



**City of Burlington  
2012 Climate Action Plan**

July 2012

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## **Introduction**

Burlington has a long history of climate change planning, beginning in 1996 when Burlington became one of the first cities to join the “Cities for Climate Protection” campaign. This led to a 1998 City Council resolution to reduce our emissions to 10% below 1990 levels and the creation of the first climate action plan. Burlington conducted its first greenhouse gas inventory (GHG) in 2000 and then again in 2007 and 2010. The 2007 GHG inventory was accompanied by a community process that researched and brainstormed action items to reduce the City’s climate footprint. Over 200 recommendations resulted. These strategies were then sorted and filtered, analyzed, and prioritized, forming the basis of the climate action plan update.

In this update, you will find information on climate action plans, Burlington’s history of climate action planning, Burlington’s plan for the future, including 2007 and 2010 inventory details and comparisons, and Burlington’s action steps.

## **What is a Climate Action Plan**

A climate action plan is a detailed and strategic framework for measuring, planning, and reducing GHG emissions and related climatic impacts. Municipalities design and utilize climate action plans as customized roadmaps for making informed decisions and understanding where and how to achieve the largest and most cost-effective emissions reductions that are in alignment with other municipal goals. Climate action plans, at a minimum, include an inventory of existing emissions, reduction goals or targets, and analyzed and prioritized reduction actions. Ideally, a climate action plan also includes an implementation strategy that identifies required resources and funding mechanisms.

## **Climate Action Planning & Equity**

Equity and inclusion are a high priority for the City of Burlington. To respond to the complex and intertwined issues of climate change and social equity the City must put forth a clear and unyielding effort to promote inclusion in all decision and policy-making processes and to apply an equity lens to implementation strategies in order to create an integrated response that goes far beyond reducing carbon emissions. Addressing social equity will, in turn, help foster strong, resilient natural systems and neighborhoods. Some areas for consideration include:

- How can the City of Burlington build a more diverse and multi-disciplinary climate action stakeholder group?
- By evaluating emissions mitigation strategies with attention to issues of equity, how might planning and implementation of infrastructure and behavioral emission reduction projects be enhanced?
- In what ways does a more inclusive set of active stakeholders create a more effective and innovative emissions reduction program?
- What are the synergies between equity and inclusion goals and climate action goals and how do these crossovers advance a community culture of sustainability?
- How can the City of Burlington help ensure the safety and health of all of its citizens in the face of changing climate?

The City of Burlington has identified five key issues, which may present pressing equity issues either presently or in the future. These issues will be explored in the future to create a more comprehensive and transparent plan of action.

1. Housing
  - Disparate concentrations of wealth in relation to floodplains and green space
  - Individuals' financial ability to adapt and respond to climatic changes
  - Access to energy efficient homes – including heating, cooling, and weatherization
2. Infrastructure and Transportation
  - Individuals' proximity to affordable, reliable public transportation
  - Distance from town center and shopping centers proportional to levels of income and wealth
3. Extreme Weather Events and Impacts
  - Flooding and tree falls
  - Effects of extreme weather on livability, comfort, and crime
4. Food Security
  - Stability and viability of long-term, local agriculture
  - Access to and affordability of fresh, local foods
  - Community garden placement and supporting resources
  - Home garden and composting education
5. Participation, outreach, and education
  - Equitable community involvement in policy and decision making process such as zoning and land use planning
  - Build on the work of the diverse stakeholders through a climate action education designed to engage and inform all members of the community

The City of Burlington, through its climate mitigation and adaption efforts, has already begun developing a comprehensive, integrated plan of action to respond and deal with the issues of climate change and equity. This plan will be completed by August 30, 2012 and shared with the public for comments.

### **History of Climate Action Planning in Burlington**

Burlington has a long history of climate change planning. In 1996, Burlington became one of the first cities to join the “Cities for Climate Protection” campaign, organized by what is now referred to as “ICLEI: Local Governments for Sustainability.” This led to a 1998 City Council resolution to reduce our emissions to 10% below 1990 levels and the formation of a Climate Protection Task Force. This group, comprised of non-profit, city, and business leaders appointed by then Mayor Peter Clavelle, guided an 18-month analysis and planning process, which ultimately led to the City’s first Climate Action Plan (CAP). This plan was adopted by the City Council in May 2000.

## CAP Update and 2007 GHG Emissions Inventory

In 2008, Burlington began its CAP update and review process with an inventory of Burlington's emissions. This inventory, conducted using ICLEI's Clean Air and Climate Protection (CACAP) software, involved input, not only from key City departments such as Burlington Electric Department (BED), Department of Public Works (DPW), and Department of Planning and Zoning (DPZ), but other organizations such as the Chittenden Solid Waste District (CSWD) and the Regional Planning Commission. The 2007 inventory revealed **the City of Burlington generated 397,272.4 tons of carbon dioxide equivalent (tCO<sub>2e</sub>)\***.

Specifically:

- The Community generated 380,762.3 tCO<sub>2e</sub>,
- The City Government emitted 14,290.7 tCO<sub>2e</sub>, and
- The Airport emitted 2,219.4 tCO<sub>2e</sub>.

For more details, please see the *GHG Emissions Inventory Results* section below.

## GHG Emissions Reduction Target

**GHG emissions reduction target:**

- **20% reduction of 2007 levels by 2020, which equals 1.5% annual reduction until 2020, and**
- **80% reductions by 2050, which equals 2% annual reduction between 2020 and 2050**

The findings and these goals were presented at a public forum in September 2008. Over 70 people attended this event, including citizens, members of the media, government officials, non-profit leaders and other stakeholders.

To achieve its 2020 goal, the City would have to reduce their emissions by nearly 80,000 tCO<sub>2e</sub>. While ambitious, these carbon reduction goals are attainable through a cooperative and collaborative City-led and community supported effort. Exploration of new technologies, new financial incentives and/or financing schemes, as well as a general willingness and commitment to the implementation of this plan will bring success. The City's GHG emissions reduction target is in line with the Kyoto Protocol and cities across the country, including Portland, Oregon, Boulder, Colorado, and Chicago, Illinois. It is important to note that the reduction goals are all slightly different, meeting the needs of each City. In addition, the Kyoto Protocol uses a baseline of 1990, whereas the City uses 2007.

## GHG Emissions Reduction Strategy Generation

Next, the City launched a lengthy community process, reflective of Burlington's participatory decision-making and community involvement history. Between September

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\* Please note that the 2007 GHG inventory was updated in 2011 to reflect consistent methodologies. Therefore, the emissions may be different than previously published.

2008 and February 2009, over 100 community volunteers and City staff gathered in eight working groups to consider the following eight key themes:

- Transportation - Community-wide & Governmental
- Local Gardens, Farms and Food Production
- Energy Efficiency in Buildings
- Renewable Energy Resources
- Urban Forestry & Carbon Sequestration
- Waste Reduction and Recycling
- Policy, Research and Education

The workgroups researched and brainstormed action items to reduce the City's climate footprint. This work resulted in over 200 community-generated recommendations. These ideas were shared and vetted with the public at the December 2008 Legacy Town Meeting. (This event, hosted annually, reviews the community's goals and successes and involves an element of community engagement around a particular issue or theme.) During the evening, about 50 people weighed in, and new ideas were added and integrated.

### **Cost-Carbon-Benefit Analysis**

In the Fall 2009, Spring Hill Solutions, a local carbon-management, clean energy, and business sustainability consulting firm, was hired with the help of American Recovery Act funds to filter, analyze and prioritize the 200 + mitigation actions developed by the workgroups. The goal of this process was to define a set of actionable GHG mitigation strategies that would: (1) form the foundation of the City's CAP; (2) provide the City with a framework to guide decisions on emissions reductions strategies; and (3) better prepare the City to reach its GHG reduction target of 20% of 2007 emission levels by 2020.

Their final report discusses the results of a cost-carbon-benefit analysis and their graphical representation in a cost-abatement curve. Through providing a detailed description and illustration of the relative "carbon bang for each investment buck" for each strategy analyzed, this report constitutes the basis for decision-making in the City's climate action planning process.

For more information, please see the *Spring Hill Solutions Cost-Carbon Benefit Analysis* section below.

### **2010 GHG Emissions Inventory**

In the spring of 2011, the City hired a Spring Hill Solution's consultant to update the City's GHG emissions inventory. The 2010 inventory revealed that **the City of Burlington generated 423,542.7 tCO<sub>2</sub>e, a 7% increase from 2007.**

Specifically:

- The Community generated 404,778.6 tCO<sub>2</sub>e, a 6% increase from 2007,
- The City Government emitted 16,476.9 tCO<sub>2</sub>e, a 15% increase from 2007, and
- The Airport emitted 2,287.2 tCO<sub>2</sub>e, a 3% increase from 2007.

For more details, please see the *GHG Emissions Inventory Results* section below.

In addition, to help facilitate the climate action planning process, an Excel-based tool for measuring, managing, and monitoring the City of Burlington's greenhouse gas (GHG) emissions was developed. This modeling tool focuses on five key areas or indicators: electricity, natural gas, transportation, solid waste, and GHG emissions; and utilizes 2007 baseline and 2010 inventory data, established goals, and trend analysis to assist the City in climate action planning and decision-making.

It is the City's intent to revisit this priority list every three years along with the update of the City's GHG emissions inventory to better track our progress towards our reduction goals.

## **GHG Emissions Inventory Results**

The City of Burlington followed the International Local Government Greenhouse Gas (GHG) Emissions Analysis Protocol developed by ICLEI to produce its 2007 and 2010 GHG Emissions Inventory. Using this protocol will allow the City to be consistent in its inventory over time, which will in turn allow better tracking of our progress towards reaching the City's reduction goals.

The Burlington GHG emissions inventories serve as a "snapshot" of the emissions generated in our community and municipal operations. It identifies the major sources and quantity of GHG emissions produced by city government operations, the airport, as well as residents, businesses, and public institutions. The summary results are captured in the table below.

**Table 1: City of Burlington - 2007 and 2010 Summary Emissions**

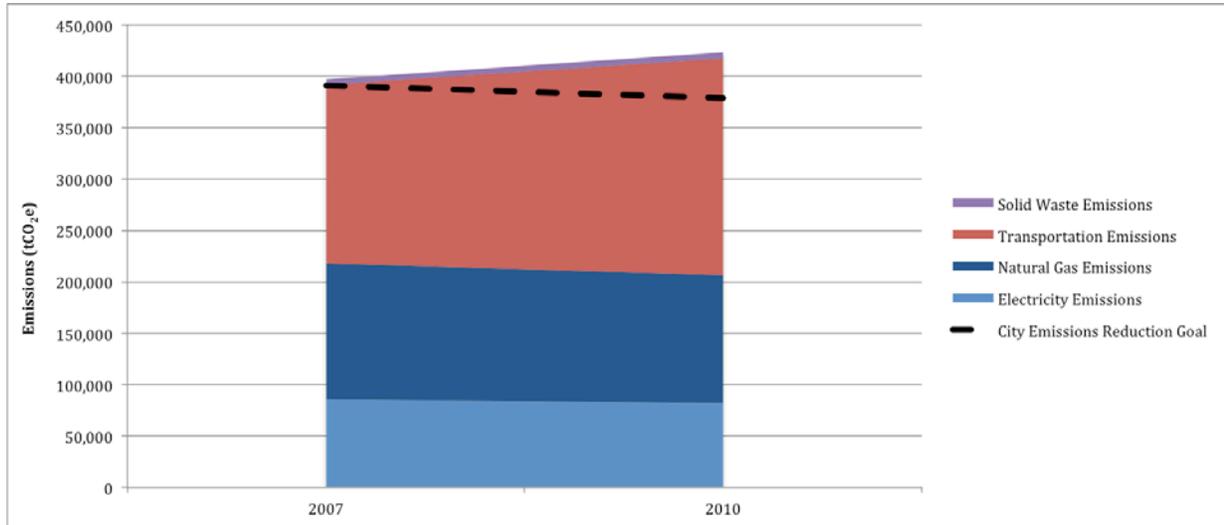
<b>Sector</b>	<b>2007 GHG Emissions (tCO<sub>2</sub>e)</b>	<b>2010 GHG Emissions (tCO<sub>2</sub>e)</b>	<b>Percent Change between 2007 and 2010</b>
<b>City Government</b>	14,290.7	16,476.9	15%
<b>Airport</b>	2,219.4	2,287.2	3%
<b>Community</b>	380,762.3	404,778.6	6%
<b>TOTAL</b>	<b>397,272.4</b>	<b>423,542.7</b>	<b>7%</b>

Specifically between 2007 and 2010:

- Electricity emissions decreased 4% from 85,428 to 82,021,
- Natural gas emissions decreased 6% from 132,565 to 124,502,
- Transportation emissions increased 22% from 173,520 to 211,165, and
- Solid Waste emissions increased 2% from 5,758 to 5,855.

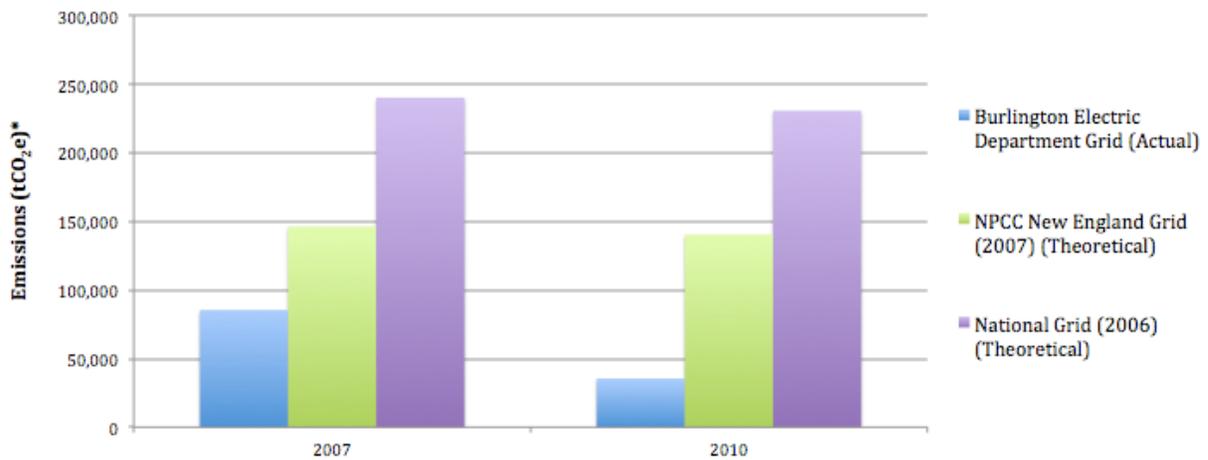
The figure below shows the City of Burlington’s emissions for 2007 and 2010, as well as the GHG emissions reduction goal line.

**Figure 1: City of Burlington - 2007 and 2010 Summary Emissions**



As a municipal department for the City of Burlington, Burlington Electric Department has a long history sourcing their electricity from clean power mixes and providing energy efficiency programs for their consumers. This is reflected in the lower emissions from the Burlington Electric Department Grid, shown in blue in the graph below. The 2007 Burlington Electric Department Grid emissions were applied to the 2007 usage and the 2010 Grid emissions were applied to the 2010 usage. For theoretical purposes, the emissions factors for the regional grid, the NPCC New England Grid (2007), shown in green below, and the National Grid (2006), shown in purple in the graph below, were applied to the 2007 and 2010 usage. The NPCC New England Grid provides cleaner electricity than the National Grid, but not as clean as the Burlington Electric Department Grid.

**Figure 2: City of Burlington - 2007 and 2010 Electricity Emissions by Grid**

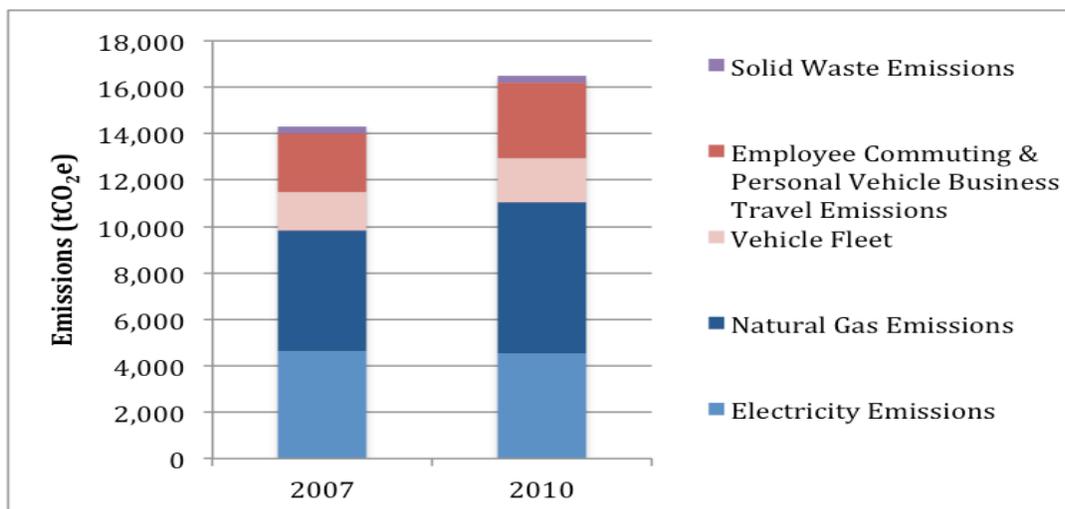


## City Government Inventory

The City of Burlington’s Government operations generated 14,290.7 tCO<sub>2</sub>e in 2007 and 16,476.9 tCO<sub>2</sub>e in 2010, a 15% increase. This cost the City Government over \$4.5 million in 2007 and around \$4.9 million in 2010, a 7% increase. For more information on contact information for data and inputs and assumptions, please see appendices A and B.

- In 2007, the City Government consumed around 21 million kWh of electricity, emitting 4,643.8 tCO<sub>2</sub>e. This decreased by 2% in 2010 to around 20 million kWh and 4,537.2 tCO<sub>2</sub>e.
- In 2007, the City Government consumed over 965,000 CCFs of natural gas, emitting 5,213.4 tCO<sub>2</sub>e. This increased by 25% in 2010 to over 1.2 million CCFs and 6,514.8 tCO<sub>2</sub>e.
- The City Government’s vehicle fleet consumed around 184,000 gallons of diesel, biodiesel, and gasoline (23,957.1 MBTU) in 2007, emitting 1,653.3 tCO<sub>2</sub>e, which increased by 14% in 2010 when over 210,000 gallons (27,323.2 MBTU) were consumed and 1,885.9 tCO<sub>2</sub>e were generated.
- With over 5.9 million miles driven for commuting purposes in 2007 and over 420,000 miles driven in personal vehicles for business travel, employee commuting & personal vehicle business travel emitted 2,521.9 tCO<sub>2</sub>e. The average commute distance was 11 miles (one way) in 2007 and 78% of employees drove alone to work. In 2010, nearly 8.0 million miles were driven for commuting purposes and around 330,000 miles were driven in personal vehicles for business travel, employee commuting & personal vehicle business travel generated 3,259.0 tCO<sub>2</sub>e, a 29% increase from 2007. The average commute distance rose to nearly 13 miles (one way) in 2010 and 75% of employees drove alone to work.
- The City Government’s disposed over 1,600 tons of landfilled waste in 2007, which generated 258.2 tCO<sub>2</sub>e. This increased to nearly 1,750 tons of landfilled waste in 2010 and 280.0 tCO<sub>2</sub>e.

The figure below shows the emissions by source of the City Government in 2007 and 2010.  
**Figure 3: City of Burlington - Government - Emissions by Source**



The table below details the usage by source for 2007 and 2010 for the City Government and the percent change between the inventory years.

**Table 2: City of Burlington - Government - 2007 and 2010 Usage by Source**

Source	Metric	2007 Usage	2010 Usage	Percent Change between 2007 and 2010
Electricity	kWh	21,022,372.0	20,539,651.0	-2%
Natural Gas	CCF	965,441.8	1,206,443.0	25%
Vehicle Fleet	MBTU	23,957.1	27,323.2	14%
Employee Commuting & Personal Vehicle Business Travel	VMT	6,364,237.2	8,310,941.9	31%
Solid Waste	Tons	1,613.8	1,749.7	8%

The City Government emitted 14,290.7 tCO<sub>2</sub>e in 2007 and 16,476.9 tCO<sub>2</sub>e in 2010, a 15% increase. The table below details the GHG emissions by source for 2007 and 2010 for the City Government and the percentage of the total emission each source represents.

**Table 3: City of Burlington - Government - 2007 and 2010 Emissions by Source**

Source	2007 GHG Emissions (tCO <sub>2</sub> e)	Percent of Total 2007 City Emissions	2010 GHG Emissions (tCO <sub>2</sub> e)	Percent of Total 2010 City Emissions
Electricity	4,643.8	34%	4,537.2	28%
Natural Gas	5,213.4	38%	6,514.8	40%
Vehicle Fleet	1,653.3	12%	1,885.9	11%
Employee Commuting & Personal Vehicle Business Travel	2,521.9	18%	3,259.0	20%
Solid Waste	258.2	2%	280.0	2%
<b>TOTAL</b>	<b>14,290.7</b>	<b>100%</b>	<b>16,476.9</b>	<b>100%</b>

Please note that percentages may not add up to 100% due to rounding.

The City of Burlington spent over \$4.5 million on energy for municipal operations in 2007 and approximately \$4.9 million in 2010, including electricity and natural gas consumption, and fuel for its vehicle fleet. The table below details the cost data by source for 2007 and 2010 for the City Government and the percent change between the inventory years.

**Table 4: City of Burlington - Government - 2007 and 2010 Cost by Source**

Source	2007 Cost	2010 Cost	Percent Change between 2007 and 2010
Electricity	\$2,886,197	\$3,192,860	11%
Natural Gas	\$1,109,492	\$1,072,197	-3%
Vehicle Fleet	\$558,795	\$609,884	9%
Employee Commuting & Personal Vehicle Business Travel	ND	ND	ND
Solid Waste	\$34,376	\$34,841	1%
<b>TOTAL</b>	<b>\$4,588,860</b>	<b>\$4,909,782</b>	<b>7%</b>

ND - No Data

These results show that by improving the energy efficiency of City-owned buildings and encouraging City workers to use alternative ways of commuting to work, the City can have a strong impact on reducing the GHG emissions it generates every year. These types of initiatives would also have a direct impact on costs/savings both for the City and for its employees themselves. The City can also promote and legislate incentives to encourage community-wide programs to reduce energy consumption and emissions. Technology provides many opportunities to increase electrical, heating, and transportation efficiency. Policies can shift energy sources towards cleaner burning fuels and renewable energy.

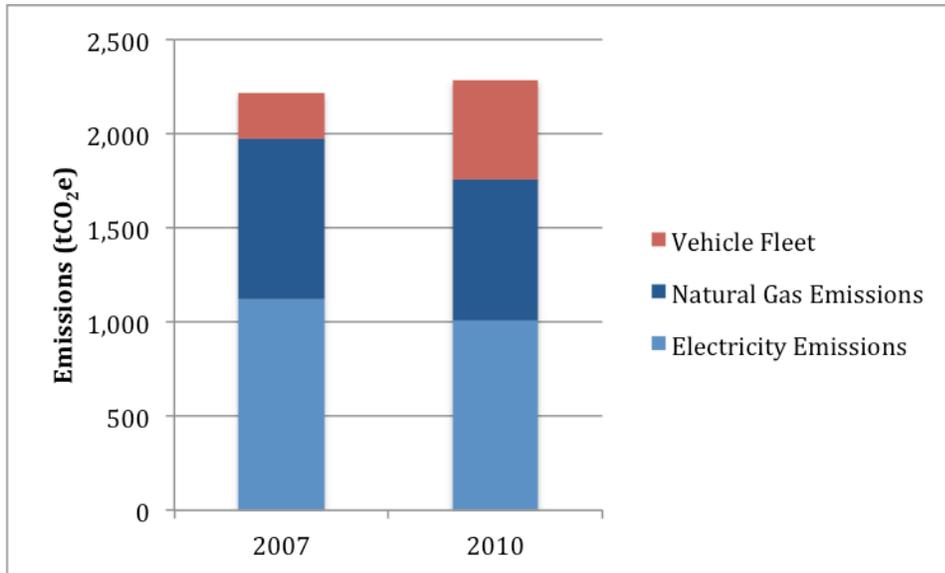
### Airport Inventory

The City of Burlington's Airport generated 2,219.4 tCO<sub>2e</sub> in 2007 and 2,287.2 tCO<sub>2e</sub> in 2010, a 3% increase. This cost the Airport \$963,300 in 2007 and \$947,339 in 2010, a 2% decrease. For more information on contact information for data and inputs and assumptions, please see appendices A and B.

- In 2007, the Airport consumed over 5.1 million kWh of electricity, emitting 1120.1 tCO<sub>2e</sub>. This decreased by 10% in 2010 to around 4.6 million kWh and 1,009.2 tCO<sub>2e</sub>.
- In 2007, the Airport consumed nearly 160,000 CCFs of natural gas, emitting 856.1 tCO<sub>2e</sub>. This decreased by 13% in 2010 to around 138,000 CCFs and 745.1 tCO<sub>2e</sub>.
- The Airport's vehicle fleet consumed around 25,000 gallons of diesel, biodiesel, and gasoline (3,493.3 MBTU) in 2007, emitting 249.2 tCO<sub>2e</sub>, which increased in 2010 to over 48,000 gallons (6,517.2 MBTU) were consumed and 543.5 tCO<sub>2e</sub> were generated.

The figure below shows the emissions by source of the Airport in 2007 and 2010.

**Figure 4: City of Burlington - Airport - Emissions by Source**



The table below details the usage by source for 2007 and 2010 for the Airport and the percent change between the inventory years.

**Table 5: City of Burlington - Airport - 2007 and 2010 Usage by Source**

Source	Metric	2007 Usage	2010 Usage	Percent Change between 2007 and 2010
Electricity	kWh	5,070,730.0	4,568,788.0	-10%
Natural Gas	CCF	158,537.0	137,977.0	-13%
Transportation	MBTU	3,493.3	6,517.2	87%

The Airport emitted 2,219.4 tCO<sub>2</sub>e in 2007 and 2,287.2 tCO<sub>2</sub>e in 2010, a 3 increase. The table below details the GHG emissions by source for 2007 and 2010 for the Airport and the percentage of the total emission each source represents.

**Table 6: City of Burlington - Airport - 2007 and 2010 Emissions by Source**

Source	2007 GHG Emissions (tCO <sub>2</sub> e)	Percent of Total 2007 City Emissions	2010 GHG Emissions (tCO <sub>2</sub> e)	Percent of Total 2010 City Emissions
Electricity	1,120.1	50%	1,009.2	44%
Natural Gas	856.1	38%	745.1	32%
Vehicle Fleet	243.2	11%	532.9	24%
<b>TOTAL</b>	<b>2,219.4</b>	<b>100%</b>	<b>2,287.2</b>	<b>100%</b>

Please note that percentages may not add up to 100% due to rounding.

The Airport spent over \$963,000 in 2007 and over \$947,000 in 2010, a 2% decrease. The table below details the cost by source for 2007 and 2010 for the Airport and the percent change between the inventory years.

**Table 7: City of Burlington - Airport - 2007 and 2010 Cost by Source**

Source	2007 Cost	2010 Cost	Percent Change between 2007 and 2010
Electricity	\$656,962	\$643,742	-2%
Natural Gas	\$217,511	\$160,327	-26%
Vehicle Fleet	\$88,827	\$143,270	61%
<b>TOTAL</b>	<b>\$963,300</b>	<b>\$947,339</b>	<b>-2%</b>

Over the past three years the airport has undertaken an aggressive energy efficiency project. Projects include: replacement of incandescent taxiway lighting with LEDs; replacement of terminal, roadway, parking lot lighting with CFL and LEDs; replacement of parking garage lighting with LEDs; replacement of aging major air conditioning and heating equipment with high efficiency units; replacement of terminal air handling units with high efficiency units; upgrading of manual equipment controls to digital.

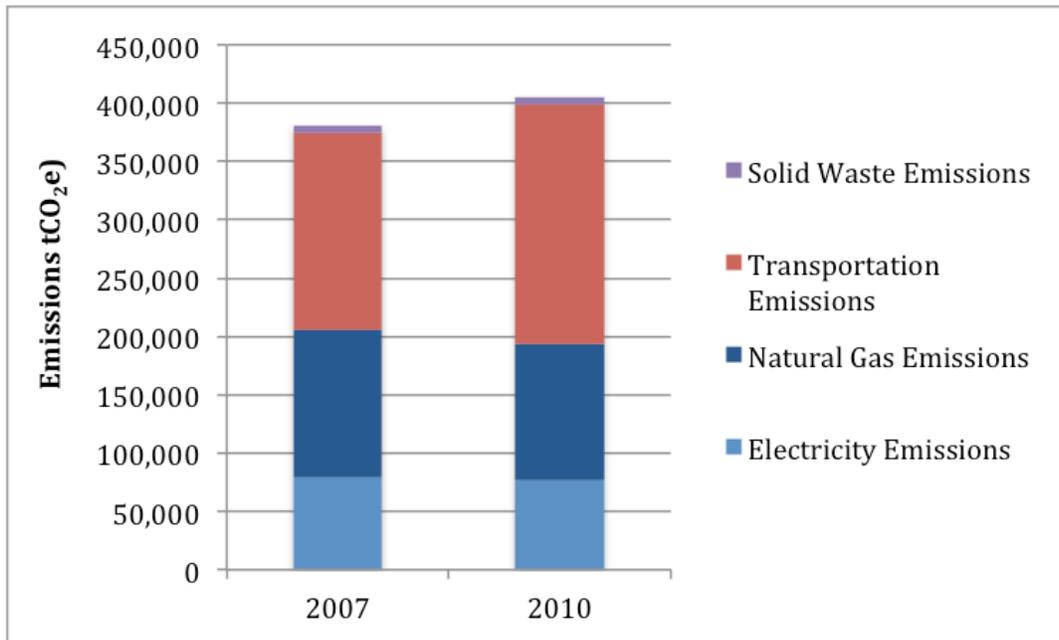
### Community Inventory

As a Community, the City of Burlington generated 380,762.3 tCO<sub>2</sub>e in 2007 and 404,778.6 tCO<sub>2</sub>e in 2010, a 6% increase. This cost the Community over \$78.9 million in 2007 and around \$76.0 million in 2010, a 4% decrease.. For more information on data sources and assumptions, please see appendices A and B.

- In 2007, the Community consumed over 360.6 million kWh of electricity, emitting 79,664.2 tCO<sub>2</sub>e. This decreased by 4% in 2010 to around 346.2 million kWh and 76,474.4 tCO<sub>2</sub>e.
- In 2007, the Community consumed nearly 23.4 million CCFs of natural gas, emitting 126,496.0 tCO<sub>2</sub>e. This decreased by 7% in 2010 to nearly 21.7 million CCFs and 117,242.6 tCO<sub>2</sub>e.
- With over 259 million vehicle miles traveled (VMT) in 2007, Community transportation emitted 169,102.0 tCO<sub>2</sub>e. This increased by 24% in 2010, when 320 million VMT were driven and 205,487.0 tCO<sub>2</sub>e were generated. Transportation is the largest source of emissions generated by the Community. With emissions increasing by almost a quarter since 2007, much work needs to be done in this sector, including changing habits and enacting policies.
- The Community disposed of nearly 34,375 tons of landfilled waste in 2007, which generated 5,500.1 tCO<sub>2</sub>e. This increased by 1% to 34,841 tons of landfilled waste in 2010 and 5,574.6 tCO<sub>2</sub>e.

The figure below shows the emissions by source of the Community in 2007 and 2010.

**Figure 5: City of Burlington - Community - Emissions by Source**



The table below details the usage by source for 2007 and 2010 for the Community and the percent change between the inventory years.

**Table 8: City of Burlington - Community - 2007 and 2010 Usage by Source**

Source	Metric	2007 Usage	2010 Usage	Percent Change between 2007 and 2010
Electricity	kWh	360,635,974.0	346,195,884.0	-4%
Natural Gas	CCF	23,425,181.2	21,711,587.0	-7%
Transportation	Million VMT	258.7	319.5	24%
Solid Waste	Tons	34,375.6	34,841.0	1%

The Community generated 385,975.7 tCO<sub>2</sub>e in 2007 and 411,293.4 tCO<sub>2</sub>e in 2010, a 7% increase. The table below details the GHG emissions by source for 2007 and 2010 for the Community and the percentage of the total emission each source represents.

**Table 9: City of Burlington - Community - 2007 and 2010 Emissions by Source**

Source	2007 GHG Emissions (tCO <sub>2</sub> e)	Percent of Total 2007 City Emissions	2010 GHG Emissions (tCO <sub>2</sub> e)	Percent of Total 2010 City Emissions
Electricity	79,664.2	21%	76,474.4	19%
Natural Gas	126,496.0	33%	117,242.6	29%
Transportation	169,102.0	44%	205,487.0	51%
Solid Waste	5,500.1	1%	5,574.6	1%
<b>TOTAL</b>	<b>380,762.3</b>	<b>100%</b>	<b>404,778.6</b>	<b>100%</b>

Please note that percentages may not add up to 100% due to rounding.

The community spent over \$78.9 million in 2007 and around \$76.0 million in 2010, a 4% decrease. The table below details the cost by source for 2007 and 2010 for the Community and the percent change between the inventory years.

**Table 10: City of Burlington - Community - 2007 and 2010 Cost by Source**

Source	2007 Cost	2010 Cost	Percent Change between 2007 and 2010
Electricity	\$45,523,850	\$48,611,777	7%
Natural Gas	\$29,984,232	\$23,665,630	-21%
Transportation	ND	ND	ND
Solid Waste	\$3,442,033	\$3,755,167	9%
<b>TOTAL</b>	<b>\$78,950,115</b>	<b>\$76,032,574</b>	<b>-4%</b>

ND - No Data

Of the total Community GHG emissions, 44% was generated by Community transportation in 2007 and 51% in 2010, indicating that a reduction in annual vehicle miles traveled (VMT) by Burlington's residents could have the biggest impact on helping the city meet its emissions reduction target for 2020 and 2050.

Behavior changes such as reducing vehicle use, material purchasing, and waste disposal can also be instituted to reach the City's emission reduction goal. Education and outreach are low cost methods to conserve energy. These are actions that Burlington can take immediately. We can seek other opportunities that are cost-effective, efficient, and reduce emissions.

## **Taking Action**

### **Action Areas**

Most climate action planning processes are broken into categories or action areas. These action areas correspond to either emission sources or to reduction strategies, and allow planners to organize and implement efforts accordingly. The City of Burlington gathered community volunteers, City staff, and climate and energy experts into eight working groups in the following action areas:

- Energy Efficiency in Buildings
- Renewable Energy Resources
- City Government Transportation
- Community Transportation
- Waste Reduction and Recycling
- Local Farms, Gardens, and Food Production
- Urban Forestry and Carbon Offsets
- Policy and Education

### **Spring Hill Solutions Cost-Carbon Benefit Analysis**

As mentioned above, in the Fall 2009, Spring Hill Solutions, a local carbon-management, clean energy, and business sustainability consulting firm, was hired with the help of American Recovery Act Funds to filter, analyze and prioritize the 200 + mitigation actions developed by the workgroups. The goal of this process was to define a set of actionable GHG mitigation strategies that will: (1) form the foundation of the City's CAP; (2) provide the City with a framework to guide decisions on emissions reductions strategies; and (3) better prepare the City to reach its GHG reduction target of 20% of 2007 emission levels by 2020.

Their final report discusses the results of a cost-carbon-benefit analysis and their graphical representation in a cost-abatement curve. Through providing a detailed description and illustration of the relative "carbon bang for each investment buck" for each strategy analyzed, this report constitutes the basis for decision-making in the City's climate action planning process.

For more information or to read the full Spring Hill Solutions report, please visit <http://www.burlingtonvt.gov/CAP/>.

The purpose Spring Hill Solutions analysis process was to analyze and describe the financial characteristics and GHG reduction potential of the strategies previously deemed suitable for analysis; and to determine which strategies reduce emissions most cost-effectively. The analysis utilized seven assessment parameters for each strategy:

- Initial capital investment
- Total capital investment
- Average annual costs/savings

- Internal rate of return
- Net present value
- Average annual avoided emissions
- Cost per ton of avoided emissions

The overall goal of the methodological approach was to gather and use high-quality, local, and regional data to the extent practicable. Local and regional experts were consulted to obtain data and provide guidance on current practices, reasonable assumptions, and potential for each of the strategies analyzed. This required extensive dialogue and follow-up with these experts. If local data did not exist, regional data was extrapolated from as appropriate. Efforts were made to ensure that the data collected and the assumptions used for each strategy were informed by the experts to ensure transparency, consistency, and accuracy.

The City of Burlington's CAP is a multi-stakeholder initiative requiring careful and non-conventional financial and GHG accounting. While most of the strategy-related costs and savings will impact all City residents, some will only affect people who participate in a given strategy such as those who change the way they commute to work, or property owners that take advantage of long term financing of energy efficiency improvements. However, the GHG reductions generated by strategy implementation will benefit all stakeholders. The methodology first determined the relevant stakeholders (e.g. taxpayers, ratepayers, City departments, and property owners), costs, savings, and GHG reductions associated with a given strategy. Then, consistent with climate action planning methodology elsewhere, the analysis aggregates all costs, savings, and GHG reductions – regardless of who would bear abatement costs or benefit from abatement savings – to reflect the society-wide net impact of implementing a given strategy.

This analysis addressed the economic, financial, and GHG emissions impacts of each strategy. It does not, however, address all critical information that should be considered when deciding whether to implement these strategies. Most importantly, the analysis does not attempt to consider or quantify the co-benefits associated with strategy implementation. Depending on the strategy, co-benefits might include increased water quality, improved soil retention, increased shading, improved human health and safety, enhanced public visibility and marketability, increased local economic support, and the creation of educational opportunities.

The results of the Cost-Carbon-Benefit Analysis are summarized in Table 2 below, sorted by annual cost or savings per ton of avoided emissions (\$/tCO<sub>2e</sub>). Following international standards, we express GHG emissions in metric tons of carbon dioxide equivalent (tCO<sub>2e</sub>). This reflects the fact that there is more than one type of GHG considered in this assessment and each has a different climate impact relative to carbon dioxide. Please note that negative numbers and costs are in red and in parenthesis.

**Table 11: Cost-Carbon-Benefit Analysis**

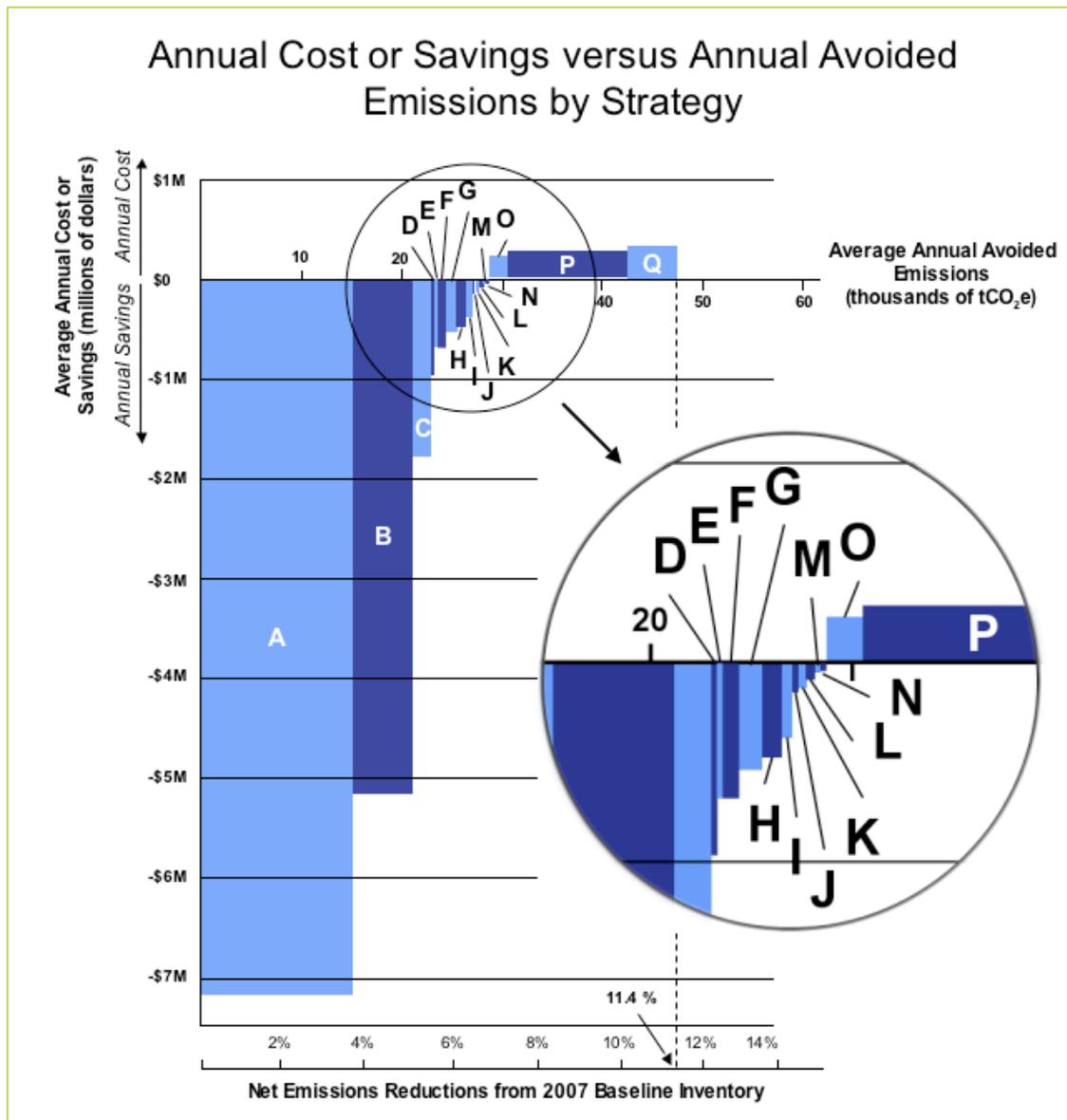
Discount Rate 9% Timeframe 25 years									
Strategy	Category	Initial Capital Investment (\$)	Total Capital Investment (\$)	Average Annual Cost / Savings (\$)	Internal Rate of Return (%)	Net Present Value (\$)	Average Annual Avoided Emissions (tCO <sub>2e</sub> )	Cost / Savings per Ton of Avoided Emissions (\$/tCO <sub>2e</sub> )	
Implement McNeil district heating project.	Renewable Energy	(\$4,200,000)	(\$23,100,000)	\$961,272	5%	(\$5,873,688)	186	4,273	Annual Cost
Reduce government VMT.	Government Transportation	\$0	\$0	\$681,485	Infinite	\$5,652,451	167	4,086	
Require new residential construction to be VESH qualified.	Energy Efficiency	(\$1,714)	(\$42,857)	\$36,924	98%	\$207,874	30	1,223	
Implement BED AMI program.	Energy Efficiency	(\$3,471,966)	(\$3,471,966)	\$676,667	15%	\$2,211,948	466	1,154	
Require new commercial construction to follow Core Performance guidelines.	Energy Efficiency	(\$582,000)	(\$14,550,000)	\$1,780,802	22%	\$7,490,927	1,947	903	
Implement PACE program.	Energy Efficiency	(\$235,175)	(\$4,525,000)	\$5,173,195	29%	\$21,832,538	6,161	838	
Implement "Solar on Schools."	Renewable Energy	(\$2,144,000)	(\$2,144,000)	\$365,427	29%	\$2,199,821	533	525	
Implement residential PAYT program.	Waste Reduction and Recycling	\$0	\$0	\$466,658	Infinite	\$4,583,789	943	495	
Reduce community VMT.	Community Transportation	\$0	\$0	\$7,200,583	Infinite	\$59,723,917	15,289	471	
Implement government vehicle retirement and replacement program.	Government Transportation	(\$125,000)	(\$625,000)	\$531,219	93%	\$4,282,645	1,177	447	
Implement government alternative-commuting program.	Government Transportation	\$0	\$0	\$139,346	Infinite	\$1,155,776	339	411	
Implement BED "Renewable Energy Resource Rider" program.	Renewable Energy	(\$857,750)	(\$4,288,750)	\$124,524	3%	(\$1,586,927)	462	195	
Replace existing streetlights with LEDs.	Energy Efficiency	(\$156,750)	(\$1,567,500)	\$42,475	5%	(\$314,437)	293	124	
Implement deep energy efficiency program in government buildings.	Energy Efficiency	(\$2,027,221)	(\$20,272,208)	\$78,690	1%	(\$8,577,448)	513	(5)	Annual Savings
Increase the UTC.	Urban Forestry	(\$132,300)	(\$3,424,500)	(\$284,568)	N/A	(\$2,468,775)	12,087	(24)	
Implement a digester for organic waste.	Renewable Energy	(\$4,950,000)	(\$4,950,000)	(\$334,707)	N/A	(\$8,237,684)	5,017	(106)	
Implement residential organics collection program.	Waste Reduction and Recycling	(\$855,000)	(\$855,000)	(\$218,313)	N/A	(\$3,126,170)	1,782	(142)	

\*Consistent with climate action planning methodology, our analysis aggregates all costs, savings, and GHG reductions - regardless of who would bear abatement costs or benefit from savings to reflect the society-wide net impact of implementing a given strategy.

### Spring Hill Solutions Cost-Carbon Abatement Curve

To most effectively support the selection of actionable carbon reduction strategies, the strategies analyzed by Spring Hill Solutions are presented in a customized cost-carbon abatement curve in Figure 3 below. This graphical format, based directly on results from the strategy analysis, illustrates the strategies that will reduce GHG emissions most cost-effectively.

Figure 6: Spring Hill Solutions Cost-Carbon Abatement Curve



\*Consistent with climate action planning methodology, our analysis aggregates all costs, savings, and GHG reductions - regardless of who would bear abatement costs or benefit from savings to reflect the society-wide net impact of implementing a given strategy.

A - Reduce community VMT.  
B - Implement PACE program.

K - Implement BED "Renewable Energy Resource Rider" program.

- |   |  |
|---|--|
| <b>C</b> - Require new commercial construction to follow Core Performance guidelines. | <b>L</b> - Implement deep energy efficiency program in government buildings. |
| <b>D</b> - Implement McNeil district heating project.                                 | <b>M</b> - Replace existing streetlights with LEDs.                          |
| <b>E</b> - Reduce government VMT.   | <b>N</b> - Require new residential construction to be VESH qualified.        |
| <b>F</b> - Implement BED AMI program.   | <b>O</b> - Implement residential organics collection program.                |
| <b>G</b> - Implement government vehicle retirement and replacement program.           | <b>P</b> - Increase the UTC.   |
| <b>H</b> - Implement residential PAYT program.  | <b>Q</b> - Implement a digester for organic waste.                           |
| <b>I</b> - Implement "Solar on Schools."  |  |
| <b>J</b> - Implement government alternative-commuting program.                        |  |

Each column on the graph above represents an analyzed strategy. The width of each column indicates the average annual avoided emissions achieved through implementing a strategy. The height of each column indicates the average annual cost or savings associated with strategy implementation. Columns below the horizontal axis (negative cost) designate strategies that will result in an annual savings or net benefit, and therefore represent the "low-hanging fruit" opportunities that will both save money and avoid emissions. Columns above the horizontal axis (positive cost) designate strategies that will result in an annual cost, and therefore may be considered lower priority. The net emissions reduction scale shows the emissions reductions as a percentage of the City of Burlington's 2007 baseline inventory.

Of the strategies analyzed, three (Reduce community VMT, Implement PACE program, and require new commercial construction to follow Core Performance guidelines) offer the greatest potential for annual cost savings. Collectively, these three strategies comprise nearly half of the estimated carbon reductions and will save the City, citizens, and other stakeholders more than \$14 million each year. If all of the strategies analyzed were implemented, 47,392 tCO<sub>2</sub>e would be avoided. This would be equivalent to a 12% reduction from the 2007 baseline inventory.

It is important to note that co-benefits (e.g., the effects of strategy implementation other than carbon emissions and cost) may exist and are not reflected in the analysis or graph, but should be considered when prioritizing the employment of these strategies. Depending on the strategy, co-benefits might include increased water quality, improved soil retention, increased shading, improved human health and safety, enhanced public visibility and marketability, increased local economic activity, and the creation of educational opportunities.

## Implementation

Implementation of the City's climate action plan will be divided into government and community efforts. The implementation of government actions will be facilitated by the Burlington Sustainability Action Team (BSAT) and the implementation of community actions will be led by the City and volunteer citizen groups.

### **Burlington Sustainability Action Team**

The Burlington Sustainability Action Team (BSAT) was formed by Mayor Kiss in the summer 2008, with the mandate of providing guidance to department leaders, the Mayor and City Council in implementing policies and initiatives included in the Climate Action Plan or any other plans that achieve the City's Climate Protection Goals. The team is also tasked with ensuring the coordination and continuity between the goals of the Climate Action Plan and other municipal plans.

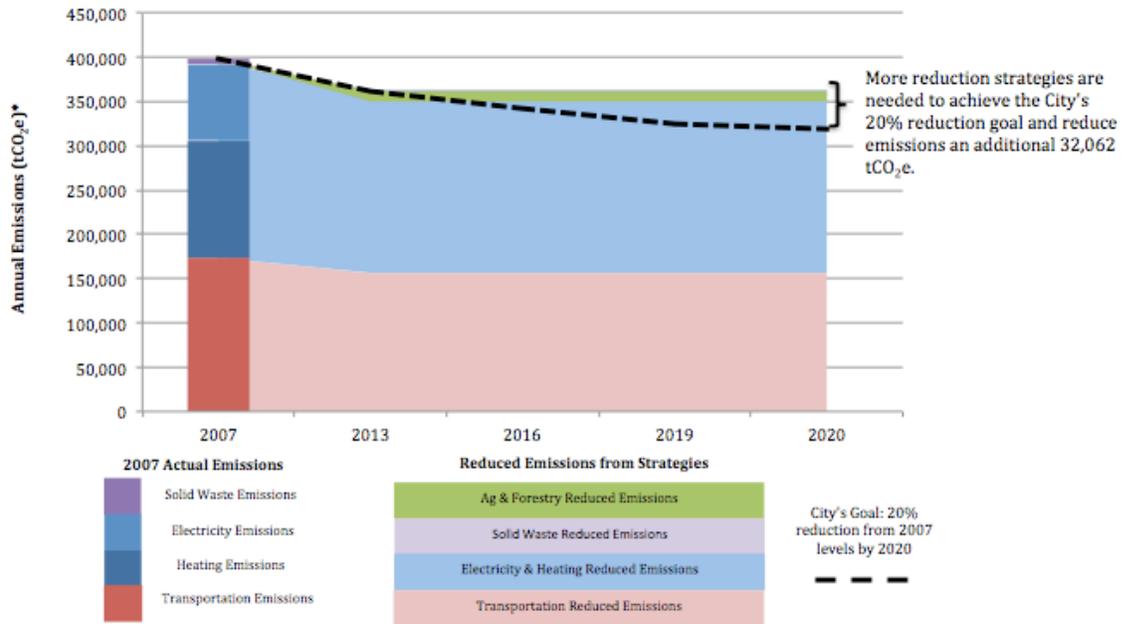
Below are the goals of the BSAT:

- Increasing exposure to the Climate Action Plan among City Departments/Divisions, the Mayor, the City Council and all related boards.
- Addressing CAP initiatives and actions at regular Municipal Team meetings.
- Tracking and celebrating successes.
- Expanding the Municipal Team presence through local media outlets, at local workshops and meetings, and by spreading the word to local businesses and residents.
- Researching potential opportunities to align the goals and objectives of municipal plans and programs to ensure continuity.

## Reduction Strategies

The figure below shows the actual 2007 and 2010 emissions for the City of Burlington by sector (solid waste, electricity and heating, and transportation), as well as the reduced emissions of 17 analyzed strategies, with the assumption that these strategies were implemented in 2007. These 17 strategies, detailed on figure 7 and discussed in table 13, will reduce the City's emissions 12%, moving the City towards their goal (20% reduction from 2007 levels by 2020), as shown as a dashed black line on the figure above. An additional 32,062 tCO<sub>2e</sub> need to be reduced by 2020 to achieve the City's goal.

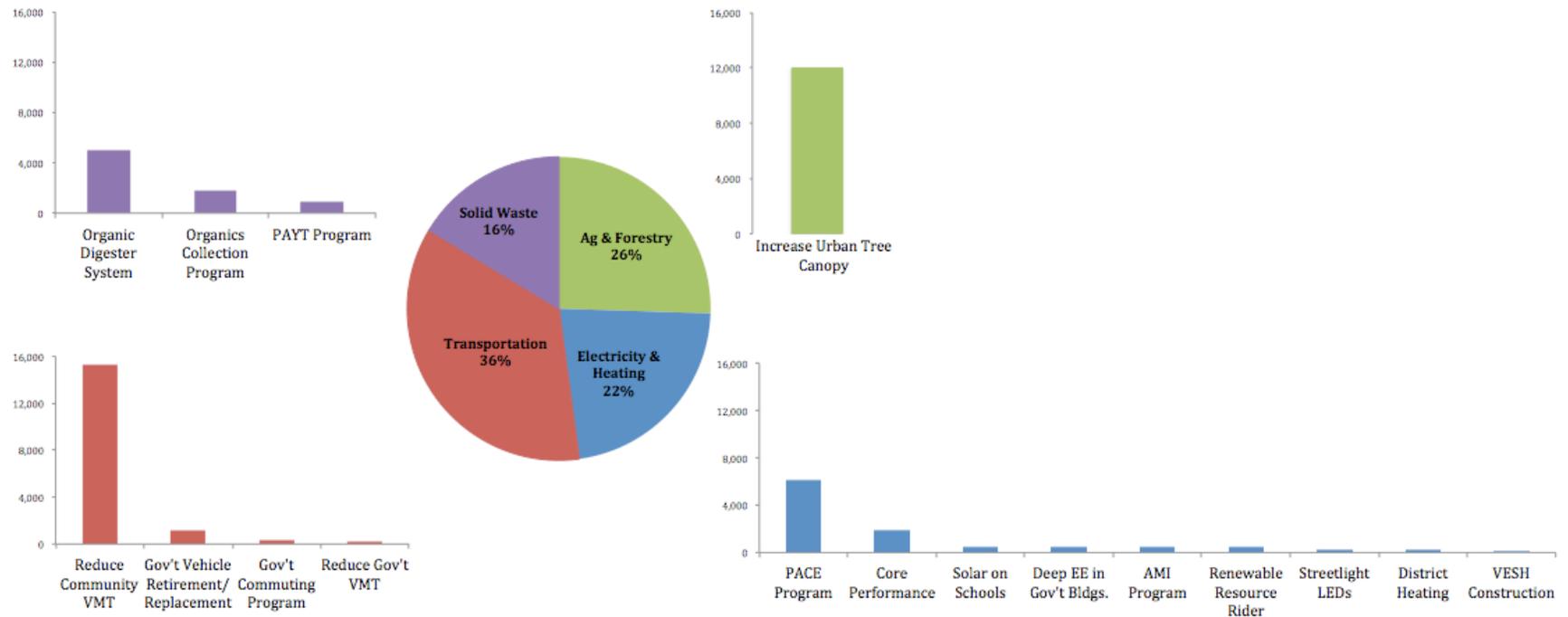
**Figure 7: City of Burlington - Actual 2007 and 2010 Emissions and Reduced Emissions from Strategies through 2020**



\*Following international standards, we express greenhouse gas emissions in metric tons of carbon dioxide equivalent (tCO<sub>2</sub>e). This reflects the fact that there is more than one type of greenhouse gas considered in this assessment and each has a different climate impact relative to carbon dioxide.

The figure below shows the reduced emissions by sector (solid waste, electricity and heating, and transportation) and by strategy within each sector. These strategies are detailed in the following table.

**Figure 8: City of Burlington - Reduction Strategies by Sector (tCO<sub>2</sub>e)**



The table below provides a description for each strategy by sector (Electricity & Heating, Ag & Forestry, Solid Waste, Transportation, and Other).

**Table 12: GHG Emissions Reduction Strategies**

Strategy Name and Description
<b>Electricity &amp; Heating</b>
<p><b>Implement "PACE" program</b> The Property Assessed Clean Energy (PACE) program allows property owners to access long term municipal financing to make eligible energy efficiency and renewable energy improvements to their buildings. By opting into a special tax assessment district, property owners pay for these improvements via property taxes over a period up to twenty years.</p>
<p><b>Require new commercial construction to follow Core Performance guidelines</b> This proposed action would require new commercial construction to follow Core Performance guidelines, a program offered by BED, Efficiency Vermont, and Vermont Gas. Core Performance is a prescriptive guide to reduce energy use in commercial buildings by 20-30%.</p>
<p><b>Implement "Solar on Schools"</b> "Solar on Schools" is a proposal to put solar PV panels on the City of Burlington schools' roofs. The panels on seven schools will be owned and operated by a private third-party development partner who can take advantage of federal and state tax credits, which the City cannot.</p>
<p><b>Implement deep energy efficiency program in government buildings</b> This action proposes to perform deep energy efficiency improvements in all municipal buildings. Deep energy retrofits are extensive renovations to existing structures that use the latest in energy-efficient materials and technologies and result in significant energy reductions.</p>
<p><b>Implement BED AMI program</b> BED is planning to install advanced meter infrastructure (AMI), commonly referred to as "smart meters." AMI would replace all existing meters, provide data to BED and its customers in 15-minute intervals, and offer two-way communication. This better data will be combined with incentive(s), probably in the form of new, voluntary electric rates, to reduce peak electricity use, cost, and emissions.</p>

**Implement BED "Renewable Resource Rider" program**

The proposed Renewable Energy Resource Rider (currently only includes solar) is a program to encourage residents and businesses to install solar PV panels. This is achieved through setting a predictable and stable rate above the retail cost of electricity, and therefore above the rate for standard net metered production.

**Replace existing streetlights with LEDs**

LED is currently a rapidly emerging technology that is still maturing. There are issues regarding LED light output for higher lumen requirement applications, high first cost and durability issues that need to be considered. This action proposes to replace all existing streetlights (approximately 4,200) in the City of Burlington with LEDs over a 10-year period at a cost estimate of \$1.49 per fixture as funding allows.

**Implement McNeil district heating project**

This proposed action is to use McNeil as a heat source for a district heating system that would improve McNeil's efficiency, make use of some of its waste heat, and provide heat to consumers at a relatively low and predictable price.

**Require new residential construction to be VESH qualified**

This proposed action would require new residential construction to be Vermont Energy Star for Homes (VESH) qualified. Energy Star Homes are designed and built using best practices to save energy by reducing air leaks and thermal bypass, and by requiring high efficiency heating systems and appliances.

**Implement a "Solar City" project on municipal buildings**

This action proposes to install solar photovoltaic panels on appropriate city-owned buildings with the goal of providing 1MW aggregate power and helping to minimize the occurrence of peak load.

**Revise and implement Time of Sale ordinance**

This action proposes to build upon the existing residential rental housing time of sale energy efficiency ordinance by applying it to all residential and commercial buildings. Furthermore, it proposes that, as a condition of sale, all buildings must receive an energy inspection and rating that is available to prospective buyers.

**Create and implement Green Roof policy and incentive program**

This proposed action would require that all new flat roofs at or under a 30 degree-pitch, both private and public, have to be vegetated. If old roofs have to be retrofitted, the building owner may be able to receive public financial support for a greenroof.

**Develop methane gas capture and CHP potential at City's wastewater treatment facilities**

This proposed action would fully develop the potential for capturing methane gas and generating electricity and/or heat from the City's decentralized waste water treatment facilities.

**Implement the Environmental Preferable Purchasing (EPP) Policy**

The proposed action builds upon the City's existing environmental purchasing policy, requiring that it be applied to all procurement decisions city-wide.

**Ag & Forestry**

**Increase the UTC**

This proposed action would increase the urban tree canopy (UTC) by planting a total of 588 trees per year and by maintaining the existing urban tree canopy. This would be achieved both on public and private property.

**Develop public-private partnerships and infrastructure for the processing, preserving, and storage of locally produced foods**

This action proposes to develop public-private partnerships and infrastructure for the processing, preserving, and storage of locally produced foods.

**Create and implement policy for raising non-domesticated animals in city neighborhoods and agricultural areas** This action proposes to create and implement a clear and consistent policy for raising non-domesticated animals, for egg, meat, and milk production, in city neighborhoods and urban agricultural areas.

**Solid Waste**

**Implement a digester for organic waste**

The proposed digester system would take community organic waste and manure from local farms to process in a strategically located CHP facility. In addition to generating electricity and heat, this project would create a bi-product to be sold as bulk compost/soil amendment. Moreover, it would reduce GHG emissions by producing cleaner electricity and heat and from avoided landfill emissions.

**Implement residential organics collection program**

This proposed action would collect residential organic food waste (no yard waste) to be composted and will be modeled after the existing City residential recycling program, thus having a similar infrastructure and cost profile.

**Implement residential PAYT program**

This proposed action would change the current residential collection payment system to a system in which residents pay per unit of trash collected. Programs like these result in a decrease in solid waste, as well as overall cost savings to participants. The current physical collection system would remain the same.

**Require recycling bins at all public facilities and events**

This proposed action would require that recycling bins are available and maintained at all public facilities and events.

**Eliminate use of plastic bags in the City of Burlington for purchases**

This proposed strategy would eliminate plastic bags by building on existing bring your own bag incentives. The action would require shoppers who don't bring their own totes to a store to pay a fee for plastic bags.

**Consolidate trash haulers by neighborhood or district**

This action proposes to consolidate trash haulers by neighborhood or district, thereby limiting the number of trucks driving through the city, reducing vehicle miles and congestion, and improving air quality.

**Require all construction and demolition projects to submit a waste management plan**

This action proposes to require construction and demolition (C&D) projects to submit a waste management plan. Such a plan would include: waste recycling, salvage or reuse goals; estimated types and quantities of materials or waste generated from the project site; proposed and intended disposal methods for these materials; and detailed instructions for subcontractors and laborers on how to safely separate or collect the materials at the job site.

## Transportation

### **Reduce community VMT**

This proposed action would reduce community VMT by 10% through a combination of travel substitutions (combining trips, telecommuting, walking and biking, ridesharing and carpooling, and using mass transit).

### **Implement government vehicle retirement and replacement program**

This proposed action will result in retiring 5% of the government's vehicle fleet and replacing 25% of the gasoline-powered vehicles with hybrids. This action would retire twelve vehicles and replace 62 gas-powered vehicles with hybrids over a five-year period.

### **Implement government alternative commuting program**

This proposed action would reduce government employee commuting miles by encouraging employees to commute through emissions-free modes (telecommuting, walking, and biking), as well as less impactful modes (car pooling, ridesharing, and mass transit). It would also include incentives such as a parking cash-out program.

### **Reduce government VMT**

This proposed action would reduce government VMT by 10% through a combination of travel substitutions (combining trips, video conferencing and conference calling, walking and biking, ridesharing and carpooling, and using mass transit).

### **Improve bicycle and pedestrian infrastructure**

The proposed action will build upon Complete Streets guidance integrating on-street bicycle and pedestrian facilities into all future infrastructure improvements to City streets.

### **Design and implement a new Citywide Bike/Ped Plan**

This proposed action would build upon the City's North/South Bike Plan by taking a more comprehensive look at the City's existing bike/ped infrastructure and designing and implementing necessary improvements.

### **Implement integrated transportation system improvements**

Building upon the City's Transportation Plan, this action proposes to implement several improvements of an integrated transportation system including the creation of a downtown transit center, Park and Ride and Auto Intercept lots to capture cars before they enter City neighborhoods, and increased frequency of transit in corridors servicing downtown and auto intercept facilities.

**Create a downtown Transportation Management Association (TMA)**

This proposed action would develop a downtown transportation management association that plans, develops, and manages all employee transportation and parking programs, infrastructure, and related facilities. The goal of the TMA would be to offer and improve cost-effective and convenient alternative transportation services while simultaneously reducing travel demand and traffic congestion and improving air quality.

**Implement government vehicle sharing/fleet management program**

This proposed fleet (vehicle) management and vehicle sharing program will include vehicle acquisition, assignment and maintenance with a focus on cost-effectiveness and emissions reduction. This program will likely also include other functions, such as vehicle financing, vehicle telematics (tracking and diagnostics), driver management, speed management, fuel management, health and safety management, regulatory compliance, and validating green initiatives.

**Develop infrastructure for fuel-efficient vehicles**

This proposed action would develop infrastructure and incentives for fuel-efficient vehicles. This might include charging stations for electric and electric-hybrid vehicles and fueling stations for CNG and other alternative fuel vehicles.

**Price on-street parking to maintain 85% on-street parking utilization**

This transportation demand management action proposes to increase on-street parking rates to market-based rates and to maintain an 85% on-street parking utilization rate. This action will better relate parking supply with demand, increase the likelihood of available spaces, reduce traffic congestion, improve air quality, and increase revenues for the City.

**Other**

**Create a FT city/staff climate action planning position**

This action proposes to create a dedicated staff position responsible for overseeing and managing the implementation of the City's climate action plan. This would include the creation of a system for measuring and managing performance and coordinating the involvement of municipal partners and community volunteers.

## Measuring Our Progress

### Monitoring and Updating

In 2009, during the public process to develop mitigation strategies, the Policy, Research and Education Group discussed the following actions that should be taken to ensure the implementation of the Climate Action Plan through constant coordination with stakeholders and regular annual assessment of the city's progress. Their action items are outlined below.

#### City Government:

1. **Dedicate a city position** responsible for the management of Burlington's Climate Action Plan. This position will involve assessing progress as well as overseeing the involvement of partner agencies such as the Burlington Sustainability Action Team (BSAT) and the Energy and Environmental Coordinating Committee (E2C2).
2. **Identify progress assessment metrics** for each Climate Action Plan item.
3. **Create an Implementation Matrix** to clarify how action items will be accomplished and how assessment metrics will be used to track progress.
4. **Develop a progress assessment structure.** We recommend:
  - a. Doing an annual progress report using the Implementation Matrix
  - b. Updating Burlington's greenhouse gas inventory every three years using the ICLEI Clean Air and Climate Action tool to measure progress on reduction targets.
  - c. Periodically revisit the action items identified for Burlington's Climate Action Plan to assess relevance.
5. **Integrate climate protection into all department levels citywide.**

#### Community Wide:

1. **Make the Climate Action Plan** and all related documents **easily accessible** and widely publicized to familiarize the community with the work that is occurring and help make it visible.
2. **Provide a community forum** that invites the participation of all stakeholders that will facilitate community engagement with and connection to the Climate Action Plan.

## Appendix A: Contact Information for Data

Table 13: City of Burlington - Contact Information for Data

Name, Department/Company	Contact Information	Input Data
John Vickery, Assessor's Office	<a href="mailto:jvickery@ci.burlington.vt.us">jvickery@ci.burlington.vt.us</a>	1. Confirm list of city-owned buildings and facilities
	(802) 865-7114	2. Determine if any facilities burn other fuel types besides natural gas
Heather Kendrew, Airport	<a href="mailto:hkendrew@btv.aero">hkendrew@btv.aero</a>	1. Annual consumption of vehicle fuel (gallons) and cost (\$). Insert into <i>Airport Vehicle Fleet Data</i> tab.
	(802) 863-2874	2. Annual electricity use (kWh) and cost (\$). Insert into <i>Airport Electricity Data</i> tab. 3. Annual combustion of natural gas (CCF) and cost (\$). Insert into <i>Airport Natural Gas Data</i> tab.
Chris Burns, Burlington Electric Department	<a href="mailto:CBurns@burlingtonelectric.com">CBurns@burlingtonelectric.com</a>	1. Annual electricity use (kWhs) and cost (\$). Insert into <i>Gov't Electricity Data</i> and <i>Community Electricity Data</i> tabs.
	(802) 865-7337	2. Determine the Burlington Electric Department's Electricity Emissions (tCO <sub>2</sub> e/kWh) for the inventory year. Insert into <i>Inputs and Assumptions</i> tab.
Scott Harrington, Vermont Gas Systems	<a href="mailto:sharrington@vermontgas.com">sharrington@vermontgas.com</a>	1. Annual combustion of natural gas (CCF) and cost (\$). Insert into <i>Gov't Natural Gas Data</i> and <i>Community Natural Gas Data</i> tabs.
	(802) 863-4511	
Karen Horne, Vermont Gas Systems	<a href="mailto:khorne@vermontgas.com">khorne@vermontgas.com</a>	2. Determine the average community natural gas cost per CCF. Insert into <i>Inputs and Assumptions</i> tab.
	(802) 863-4511	
Rob Green, Public Works	<a href="mailto:rgreen@ci.burlington.vt.us">rgreen@ci.burlington.vt.us</a>	1. Annual fuel consumption (gallons) and cost (\$) by all department (except school department) and vehicle type. Insert into <i>Gov't Vehicle Fleet</i> tab.
	(802) 864-0166	

Chris Giard, Property Services	<a href="mailto:cgiard@bsdvt.org">cgiard@bsdvt.org</a>	1. Annual consumption of vehicle fuel (gallons) and cost (\$) of school department vehicles by vehicle type. Insert into <i>Gov't Vehicle Fleet</i> tab.
	(802) 864-8453	
Joel Fitzgerald, Property Services	<a href="mailto:JFitzger@bsdvt.org">JFitzger@bsdvt.org</a>	
	(802) 864-8453	
Sandrine Thibault, Planning & Zoning	<a href="mailto:sthibault@ci.burlington.vt.us">sthibault@ci.burlington.vt.us</a>	1. Employee commuting survey. Follow instructions on <i>Gov't Employee Commuting</i> tab.
	(802) 865-7193	2. Community transportation data (annual average daily traffic, vehicle miles traveled, and emissions) using the CACP Transport Assistant Tool. Insert into <i>Community Transportation Data</i> tab.
Nancy Plunkett, Chittenden Solid Waste District	<a href="mailto:nplunkett@cswd.net">nplunkett@cswd.net</a>	1. Community landfilled solid waste (municipal solid waste and construction & demolition debris) tons and cost, CSWD population, and Burlington population. Insert into <i>Inputs and Assumptions</i> tab.
	802-872-8100 x222	
Scott Schrader, Treasurers Office	<a href="mailto:schrader@ci.burlington.vt.us">schrader@ci.burlington.vt.us</a>	1. Gov't solid waste costs. Insert into <i>Inputs and Assumptions</i> tab.
		2. If needed, account numbers for the Burlington Electric Department and Vermont Gas Systems.

## Appendix B: Inputs and Assumptions

**Table 14: City of Burlington - Workbook Inputs and Assumptions**

<b><u>Inputs and Assumptions</u></b>		
<b><u>Electricity</u></b>		
<u>Government</u> Electricity usage and cost data from the Burlington Electric Department		
<u>Community</u> Electricity usage and cost data from the Burlington Electric Department		
<b><u>Natural Gas</u></b>		
<u>Government</u> Natural gas usage and cost data from Vermont Gas		
<u>Community</u> Natural gas usage data from Vermont Gas		
National Average Cost per CCF (for residential and commercial)	<u>2007</u> \$1.28	<u>2010</u> \$1.09
<b><u>Transportation</u></b>		
<u>Government</u> <b>Vehicle Fleet</b> Vehicle fleet data from Rob Green No Parks & Rec 2007 fuel data. Therefore, the average fuel consumption percent change was applied. Average fuel consumption percent change between 2007 to 2010 14.0%		
<b>Employee Commuting</b>		

Employee Commuting data from online survey. Survey averages applied to each department.

	<u>2007</u>	<u>2010</u>
Percent of employees with commutes greater than 10 miles	39.42%	39.42%
Percent of employees with commutes less than 10 miles	55.68%	55.68%
Percent of employees driving gasoline vehicles	98.66%	98.60%
Percent of employees driving diesel vehicles	1.34%	1.40%

Community

Input miles per functional class and average annual daily traffic into CACP Transport Assistant Tool to obtain vehicle miles traveled by functional class and total emissions

Conversion Factors

Energy of Gasoline with 4.3% Ethanol (MBTU/gallon)	0.12
Energy of Diesel (MBTU/gallon)	0.14
Energy of Biodiesel (MBTU/gallon)	0.13

**Solid Waste**

Government

The calculation of the government solid waste subtracts a percentage for extra space from the total cost of solid waste and then divides by the cost per ton of trash

Cost per ton of solid waste	\$100		
Reduction for extra space	5%		
		<u>2007</u>	<u>2010</u>
Cost of Solid Waste		\$169,877.00	\$184,179.37

Community

The calculation of the community solid waste adds the total CSWD municipal solid waste and construction and demolition debris, then multiplied it by the Burlington population over the CSWD population

	<u>2007</u>	<u>2010</u>
CSWD municipal solid waste landfilled (tons)	100,785.0	92,181.0
CSWD construction & demolition debris landfilled (tons)	37,085.0	36,404.0
CSWD solid waste cost (\$/ton)	\$100.13	\$107.78
CSWD Population	153,842	156,545
Burlington Population	38,358	42,417

<b><u>Greenhouse Gas Emissions</u></b>		
<b><u>Emissions Factors</u></b>		
<b>Electricity</b>		
Electricity Emissions (tCO <sub>2</sub> e/kWh) - National average (2006)	0.0006	
Electricity Emissions (tCO <sub>2</sub> e/kWh) - NPCC New England (NEWE) (2007)	0.0004	
	<u>2007</u>	<u>2010</u>
Electricity Emissions (tCO <sub>2</sub> e/kWh) - Burlington Electric Department	0.0002	0.0001
<b>Natural Gas</b>		
Natural Gas Emissions (tCO <sub>2</sub> e/CCF) - Vermont Gas		0.0054
<b>Transportation</b>		
Diesel Emissions (tCO <sub>2</sub> e/gallon)		0.010160
Biodiesel Emissions - Heavy Truck (tCO <sub>2</sub> e/gallon)		0.000005
Biodiesel Emissions - Light Truck (tCO <sub>2</sub> e/gallon)		0.000013
Gasoline (4.3% ethanol) Emissions (tCO <sub>2</sub> e/gallon)		0.008400
Average miles per gallon		24.0
Link/Highway Bus (travelling more than 10 miles) (tCO <sub>2</sub> e/passenger mile)		0.004000
Inner-city Bus/Commuter (traveling less than 10 miles) (tCO <sub>2</sub> e/passenger mile)		0.000312
<b>Solid Waste</b>		
Solid Waste Disposal - CH <sub>4</sub> Recovery and Electricity Generation (tCO <sub>2</sub> e/short ton waste)		0.16
<b>Goals</b>		
Reduction of GHG Emissions from 2007 baseline		20%
Reduction Timeframe (years)		13

## Appendix C: Climate Action Prioritization Survey

The City of Burlington recently developed a Climate Action Prioritization Survey that included the efforts of a group of City employees in selecting actions and identifying and defining criteria for inclusion in the ranking process. Previous climate actions planning participants as well as the general public were invited to participate. This survey and its results will help guide the City in its efforts to: (1) prioritize 36 key strategies of the original 200 into three categories – high, medium, and low priority; and (2) select and implement top actions to reduce GHG emissions. The strategies were ranked according to eight criteria including GHG effectiveness, financial performance/cost effectiveness, existing implementation capacity, available funding/financing, technical feasibility, public interest/support, existing momentum/champion, and local/regional economic impact.

The strategy rankings are captured in the table below.

**Table 15: GHG Emissions Reduction Strategy Ranking**

<b>Strategy Ranking</b>	<b>Strategy Name</b>
1	Require new commercial construction to follow Core Performance guidelines
2	Improve bicycle and pedestrian infrastructure
3	Require new residential construction to be VESH qualified
4	Require recycling bins at all public facilities and events
5	Implement "PACE" program
6	Replace existing streetlights with LEDs
7	Design and implement a new Citywide Bike/Ped Plan
8	Implement BED AMI ("smart meter") program
9	Implement McNeil district heating project
10	Implement a digester for organic waste
11	Increase the urban tree canopy (UTC)
12	Implement "Solar on Schools"
13	Implement integrated transportation system improvements
14	Reduce community vehicle miles traveled (VMT)
15	Implement deep energy efficiency program in government buildings

16	Reduce government vehicle miles traveled (VMT)
17	Implement government alternative commuting program
18	Develop public-private partnerships and infrastructure for the processing, preserving, and storage of locally produced foods
19	Implement BED "Renewable Resource Rider" program
20	Develop methane gas capture and CHP potential at City's wastewater treatment facilities
21	Eliminate the use of plastic bags in the City of Burlington for purchases
22	Consolidate trash haulers by neighborhood or district
23	Implement residential organics collection program
24	Create a downtown Transportation Management Association (TMA)
25	Implement a "Solar City" project on municipal buildings
26	Create a FT city/staff climate action planning position
27	Implement the EPP Citywide
28	Implement government vehicle sharing/fleet management program
29	Require all construction and demolition projects to submit a waste management plan
30	Implement government vehicle retirement and replacement program
31	Create and implement policy for raising non-domesticated animals in city neighborhoods and agricultural areas
32	Develop infrastructure for fuel-efficient vehicles
33	Implement residential PAYT program
34	Price on-street parking to maintain 85% on-street parking utilization
35	Revise and implement Time of Sale ordinance
36	Create and implement Green Roof policy and incentive program

For strategy descriptions, please see Table 13 above.