BELMONT COMMUNITY
GREENHOUSE GAS
INVENTORY AND REDUCTION
STRATEGIES

May 5, 2006

Prepared for Sustainable Belmont

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This report is written by a group of Tufts graduate students for Sustainable Belmont (SB), a sub-group of the Vision 21 town committee in Belmont, MA. The purpose of this report is to help SB start to formulate a climate action plan (CAP) for the Town of Belmont. A CAP is an instrument to assess greenhouse gas emissions, create emission target goals and generate policies and measures to achieve the target goals. This report is a preliminary study of the greenhouse gas emissions in Belmont during the year 2001, known as the baseline year. The report also lists some possible reduction strategies that SB can incorporate into the yet-to-be-written CAP.
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Executive Summary

This report is written by a group of Tufts graduate students for Sustainable Belmont (SB), a sub-group of the Vision 21 town committee in Belmont, MA. The purpose of this report is to help SB start to formulate a climate action plan (CAP) for the Town of Belmont. A CAP is an instrument to assess greenhouse gas (GHG) emissions, create emission target goals and generate policies and measures to achieve the target goals. This report is a preliminary study of the greenhouse gas emissions in Belmont during the year 2001, known as the baseline year. The report also lists some possible reduction strategies that SB can incorporate into the yet-to-be-written CAP. The following summary will review the data, as well as some key recommendations.

An inventory of greenhouse gas emissions for the community sector in the town of Belmont establishes a baseline for emissions reduction targets and identifies areas for potential reduction measures. In 2001, the community sector (consisting of commercial and residential usage of electricity, natural gas, oil, transportation and waste generation) used a reported 5,095,156 BTUs of energy, producing 414,852 tons of CO₂ in total—or 17.1 tons CO₂/person/year.

The following chart shows CO₂ emissions by source; 53 percent of Belmont’s emissions are due to transportation, 24 percent to heating oil usage, 13 percent to the use of natural gas, 10 percent to electricity consumption and 0.4 percent to Belmont’s waste.
Electricity

The Belmont Municipal Light Department serves as the energy purchaser and supplier to all residents, commercial businesses and municipal facilities in the Town of Belmont. The Town of Belmont does not create any electricity itself, nor does it have any industrial sources of electricity within its boundaries. All data pertaining to the creation of the baseline electricity numbers were provided by the Belmont Municipal Light Department. Combined commercial and residential electricity accounted for 41,663 tons of CO$_2$ with the residential sector accounting for 57% of all electricity.

Reduction Strategies:

- Energy Star Residential Appliance Rebate Program
- Solar electricity, water heating, space heating
- Sustainable home and commercial designs
- New York Power Authority Hydro Power Program
- Cape Wind Farm Program

Heating Oil

The greenhouse gas emissions associated with the burning of heating oil in the year 2001 were calculated for the residential section, not the commercial section of the Town of Belmont. This was done using 2000 census data and each of the Town of Arlington’s, the Town of Brookline’s and the Energy Information Administration’s numbers for the average yearly consumption of fuel oil per household. The calculation using the Town of Brookline average usage per household determined Belmont’s usage to be 306,386 million Btu in 2001, the EIA numbers calculated Belmont’s usage to be 436,126 million Btu and the computation using the Arlington numbers was 1,191,50 million Btu. The respective CO$_2$ emissions were 25,327 tons, 36,052 tons and 98,499 tons.

The following recommendations would reduce the amount of fuel oil burned:

- Increased insulation and energy efficiency
- Passive solar heating
- Active solar heating
- Geothermal heating
- LEED certified buildings
- Social marketing in order to change town behavior

As an example of quantifying the above recommendations, if 50 homes switched from 75% efficient furnaces to 95% efficient furnaces, the town would reduce CO$_2$ emissions by 236 tons.
Natural Gas

Natural gas is used as a source of energy for homes and businesses. Keyspan is the company that supplies the town, and its headquarters is located in New York City. Data from Keyspan was obtained, and the emissions due to natural gas usage are as follows: Belmont’s commercial section emitted 10,793 tons of CO₂ in 2001, and the residential section emitted 42,463 tons of CO₂, for a total of 53,256 tons of CO₂. The residential sector, therefore, accounts for 79.7% of all natural gas used in Belmont in 2001.

Reduction strategies are identical for natural gas and heating oil, because the uses are the same. Please see heating oil reduction strategies.

Transportation

The transportation sector is the source for a large amount of the carbon dioxide emissions in the town of Belmont. Belmont emits approximately 219,666 tons of CO₂ each year. Transportation accounts for 53% of all CO₂ emissions in Belmont. For the town to reduce the amount of carbon dioxide emitted, it is imperative that alternate forms of transportation and traffic calming measures are promoted. Successful implementation of these plans would reduce CO₂ emissions:

- Commuter carpooling programs should be implemented and encouraged by the town.
- Belmont should encourage residents to make more energy efficient choices when purchasing a new vehicle.
- Belmont should implement a No-Idling policy for the town and strictly enforce it.
- Traffic calming measures need to be implemented on major through streets and intersections to discourage cut-through traffic.

Waste and Recycling

The town of Belmont is responsible for collecting and disposing of residential waste, and in 1991, enforced curbside pick up of residential recyclables as well. Commercial establishments hire private companies to haul their waste and are not yet required to recycle. Residential waste only accounted for 0.4% of Belmont’s total CO₂ emissions in 2001, with 1,768 tons of CO₂ emitted. When commercial waste data are available, the tons of CO₂ emitted from the waste sector will increase.

The total amount of waste generated (and CO₂ emitted) by Belmont’s citizens decreased from the year 2001 to 2005, but it appears as if the citizens recycled less. In 2001, the recycling rate was 32%, and in 2005, it was at 25%. In order to reduce CO₂ emissions, Belmont needs a plan to
reduce overall waste, as well as increase its recycling rates. Commercial businesses need to engage in waste reduction and recycling programs. The following list includes measures for reducing waste, increasing recycling rates, and therefore, decreasing Belmont’s greenhouse gas emissions:

- Engage in a Pay-as-You-Throw-Away-Program
- Create a neighborhood composting program
- Increase awareness of purchasing choices
- Regulate commercial recycling
- Provide recycling incentives, such as RecycleBank

## Community Based Social Marketing

Community participation in Belmont’s Climate Action Plan and strategy reductions will be essential in order for Belmont to reach its target reduction goals. In many cases, this will involve a change of behavior for residents and businesses, which people may resist. Sustainable Belmont will have to execute Community Based Social Marketing approaches to encourage community members to jump onboard. Social Marketing is a practical methodology that, when implemented, has proven to have a high likelihood of affecting or changing personal behavior. The strategies, listed in detail in the Social Marketing section, outline specific ways that Belmont can attract residents and business owners to change their behavior. Several of these strategies are:

- Convey captivating information
- Gain commitments to change behavior
- Provide people with cues that can jog memory about new activities
- Make changing behavior convenient
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I. INTRODUCTION

Greenhouse Gases and Climate Change

In order to understand why any entity would want to draft a climate action plan, a short explanation of climate change is required. At all times some part of the Earth receives solar energy, known as insolation. Some of this energy is deflected when it collides with various molecules; ozone (O$_3$) is particularly adept at deflecting the energy from the sun in the upper parts of the atmosphere (such as the Stratosphere). The energy could be deflected in any direction, including back into space (Figure 1). The Sun’s energy that does make it to the Earth’s surface is either reflected or absorbed depending upon the locale’s albedo.$^1$

The energy that is finally absorbed by the Earth’s surface is eventually radiated back to space. The radiated energy is why, for example, rocks stay warm for a while after the sun sets. However, the energy is radiated back to space as a much longer wavelength than it was received. This means that different molecules will deflect the energy radiated from the Earth than the molecules that deflected the energy from the sun. Certain gases, particularly carbon dioxide (CO$_2$) and methane (CH$_4$), reflect the radiated energy from the Earth back toward the Earth and the adjacent atmosphere. This is similar to how the glass in a greenhouse doesn’t stop the Sun’s energy from entering the greenhouse, but prevents the longer wavelength heat from exiting the greenhouse. In a way, CO$_2$ and CH$_4$ act similarly to the glass in a greenhouse, but just surrounding the Earth. For this reason, CO$_2$, CH$_4$ and similar molecules are referred to as greenhouse gases. Each of the greenhouse gases deflects the radiated energy to different degrees;

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$^1$ Areas with very high albedo, such as a glacier, reflect most of the energy back toward space. On the hand, areas with low albedo, such as dark sand beaches, absorb most of the energy and reflect very little energy.
Table 1.1 shows the global warming potential\(^2\) of the two greenhouse gases\(^3\) that are most notably emitted in Belmont.

<table>
<thead>
<tr>
<th>Gas</th>
<th>Lifetime (years)</th>
<th>Global Warming Potential(^4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>20 Years</td>
</tr>
<tr>
<td>Carbon Dioxide(^5)</td>
<td>CO(_2)</td>
<td>5-200</td>
</tr>
<tr>
<td>Methane(^6)</td>
<td>CH(_4)</td>
<td>12</td>
</tr>
</tbody>
</table>


Over the past few hundred years, since the start of the industrial revolution, the concentration of greenhouse gases in the Earth’s atmosphere has increased dramatically. Carbon dioxide atmospheric concentrations have increased approximately 30 percent while methane concentrations have increased over 100 percent (U.S. Environmental Protection Agency, 2000b). While the cause of climate change may be debated\(^7\), the United States Environmental Protection Agency states that “scientists think rising levels of greenhouse gases in the atmosphere are contributing to global warming, as would be expected; but to what extent is difficult to determine at the present time” (2000b). On the other hand, the Intergovernmental Panel on Climate Change (IPCC) concluded in the Second Assessment Report (SAR) that “The balance of evidence suggests a discernible human influence on global climate” (2001). The IPCC went on to say in the Third Assessment Report (TAR) that “In the light of new evidence and taking into account the remaining uncertainties, most of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations” (2001).

\(^2\) Global warming potential is a way to measure the radiative effects of a gas both directly and indirectly (where the gas transforms other molecules into greenhouse gases) over the course of time relative to a reference gas. The reference gas is CO\(_2\) (Office of Atmospheric Programs, 2002).

\(^3\) The Intergovernmental Panel on Climate Change (IPCC) lists 93 different molecules as greenhouse gases. Three molecules occur naturally; the molecules are carbon dioxide, methane and nitrous oxide. The remaining 93 molecules are manmade and have a global warming potential ranging from 1 to 32,400. However, none of the remaining 93 molecules are know to be emitted in Belmont at this time. In addition to the greenhouse gases listed above, the Office of Atmospheric Programs (2002) lists water vapor (H\(_2\)O) as a greenhouse gas, and ozone (O\(_3\)), carbon monoxide (CO), nitrogen oxides (NO\(_x\)), nonmethane volatile organic compounds (NMVOCs) and aerosols as indirectly being greenhouse gases by chemically reacting with other molecules to increase the amount of actual greenhouse gases (pp. 5-8).

\(^4\) Global warming potential changes over the life of a molecule. Therefore, the warming potential is listed over the timeframes of 20 years, 100 years and 500 years.

\(^5\) Carbon dioxide is released to the atmosphere when solid waste, fossil fuels (oil, natural gas, and coal), and wood and wood products are burned (U.S. Environmental Protection Agency, 2005).

\(^6\) Methane is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from the decomposition of organic wastes in municipal solid waste landfills, and the raising of livestock (U.S. Environmental Protection Agency, 2005).

\(^7\) A variety of explanations exist for climate change including natural variability and climate cycles that are not completely understood.
Even though the absolute reasons for climate change are disputed, the heat trapping characteristics of greenhouse gases are largely considered to at least contribute to global warming. The effects of climate change have manifested in a variety of ways, including increased surface temperature, melting ice sheets, extreme weather variation, and rising sea levels (U.S. Environmental Protection Agency, 2000b). For more information on climate change, please consult Appendix A.

**Greenhouse Gas Emissions Reduction**

Even though a consensus has not been reached in regard to greenhouse gases’ role in climate change, nations around the world have examined the existing evidence and made a commitment to reduce greenhouse gas emissions in order to stem the rate, and perhaps the possibility, of climate change now and into the future. The commitment to reduce greenhouse gas emissions is most notably recognized in the form of the Kyoto Protocol.

According to the U.S. Environmental Protection Agency (2000a), “Key aspects of the Kyoto Protocol include emissions targets, timetables for industrialized nations, and market-based measures for meeting those targets.” The target for the United States would be an emissions reduction of seven percent below 1990 levels during the five year span of 2008-2012. During the years 2008-2012, the average yearly emissions would be calculated for comparison to the target goal. The Kyoto Protocol would also establish a worldwide system for the trading of greenhouse gas emissions allowances in addition to emissions offsets such as reforestation (U.S. Environmental Protection Agency, 2000a).

However, the United States has not ratified the Kyoto Protocol. Therefore, the United States has not made a commitment to reduce greenhouse gas emissions. This has placed the burden of emissions reduction on lower bodies of government, including states and municipalities.

**The Town of Belmont**

On April 23, 2001 the Town of Belmont created a Town Committee named Vision 21 (see Appendix B). The purpose of the committee is broad in nature, but overall it is concerned with maintaining and/or improving the beneficial qualities of the town. One of the Vision 21 stated goals in Appendix B is that “We will be an environmentally responsible community and conserve our natural habitats” (Town of Belmont, 2003).

Toward the realization of this goal, Sustainable Belmont (SB), an all-volunteer subgroup of the Vision 21 Implementation Committee, was established in early 2005 (Sustainable Belmont, n.d., p. 1).

The self-described objective of Sustainable Belmont “is to make that vision [of an environmentally responsible community] a reality by achieving important environmental objectives, including the reduction of Belmont’s share of greenhouse gas emissions and the protection of the town’s natural habitat” (Sustainable Belmont, n.d., p. 1). With the establishment of Sustainable Belmont, the Town of Belmont has shouldered their portion

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8 Ratification requires the President to send the Protocol to the Senate for approval and for the Senate to pass the Protocol.
of the burden to reduce greenhouse gas emissions with the goal of stemming the tide of climate change.

In order to reduce greenhouse gas emissions within the town, Sustainable Belmont has decided to draft a climate action plan (CAP). Since Sustainable Belmont is a volunteer group with limited resources, it recruited a group of Tufts University graduate students to help in the drafting of the climate action plan. The Tufts consulting team is the author of this working paper.

**Climate Action Plan**

A climate action plan is a way to account for and reduce greenhouse gases with the goal of stopping or limiting the effects of climate change. The first step in a climate action plan is to try and measure the amount of greenhouse gases emitted in a specific year; this year is commonly referred to as the baseline year. The baseline year serves as a reference point to which current and/or future yearly emissions can be compared.

Once the reference point is established, the climate action plan describes a strategy to reduce greenhouse gas emissions. The plan might just attempt to eliminate the increase of greenhouse gas emissions from the baseline year, but more than likely it tries to decrease emissions in regard to the baseline year. The implementation approach could take a variety of approaches including statutes, regulations, tax incentives, rebates, government-funded and voluntary programs and other measures. The limit of execution strategies is restricted only by the drafter’s imagination, realistic expectations of what is possible and what is deemed acceptable by the affected community.
II. ICLEI AS A METHODOLOGY

The group Sustainable Belmont, appointed with the task of creating the Town’s CAP became a member of ICLEI Local Governments for Sustainability (ICLEI), prompting the use and promotion of their Clean Air and Climate Protection (CACP) software that all ICLEI members gain access to. The use of the CACP software in the creation of Belmont’s community CAP has defined the methodology that was used to conduct an examination of how much GHGs the Town of Belmont has released. This procedure and final emission numbers are referred to more commonly as the “Baseline Inventory” for Belmont. Calculating the baseline inventory for the Town of Belmont is the most important, and, therefore, primary objective of this report. The baseline inventory allows the town to have a measuring stick by which they can quantify reduction strategies for the immediate and future potential to reduce the towns GHG emissions. For the calculations derived in this report to determine Belmont’s baseline inventory, we used the CACP software disseminated by ICLEI to Sustainable Belmont. The rest of this section details who ICLEI is, where Belmont fits into ICLEI and a brief summary of the CACP software. Greater methodological details pertaining to data collection and the CACP output are provided within each sectors respective section.

What is ICLEI?

ICLEI was originally founded in 1990 by more then 200 local governments from 43 countries that came together at the first World Congress of Local Governments for a Sustainable Future (ICLEI, 2005). These were local city mayors, councilors and other municipal officials from around the world that recognized a deficient answer to the climate change problems on a larger national and international level. Their conclusion was that their individual national governments were not going to try and solve this issue then they would enact change within their own local communities. This led to the creation of the International Council for Local Environmental Initiatives, what is referred to today as ICLEI.

The United States has 54 cities and towns that are members of ICLEI, from Honolulu, HI to Burlington, VT. Massachusetts itself has 26 towns with or in the process of creating a CAP, with five of those towns already ICLEI members. Some of the general advantages and benefits that come with being and ICLEI member are:

- **National and International Recognition for Work** - National and international recognition for accomplishments through participation in federal, UN and ICLEI award programs, events and activities.

- **Grant Opportunities** - Being a member of ICLEI not only provides access to grants within the organization, but also creates state and federal programs awareness of ICLEI programs and are offering grants specifically to local government members.
• **Policy Development and Technical Assistance** - ICLEI membership also provides members with access to their network, case studies of other members CAPs and assistance from their local and regional staff.

• **Tools to Create a CAP** - ICLEI membership allows towns to access their Climate Action Climate Protection software, which makes the creation of a meaningful CAP a real possibility.

ICLEI is founded on the belief that “locally designed initiatives can provide an effective and cost-efficient way to achieve local, national, and global sustainability objectives,” (ICLEI, 2006) and is focused into two distinct campaigns. Communities 21 is a methodology on how to improve ecological health and social justice within local communities, and Cities for Climate Protection (CCP) is designed to educate and empower local governments to reduce their community’s impact on the climate. Belmont is a member of ICLEI’s CCP program.

**ICLEI’s Cities for Climate Protection Campaign**

“ICLEI's Cities for Climate Protection Campaign was launched in 1993 when municipal leaders, invited by ICLEI, met at the United Nations in New York and adopted a declaration that called for the establishment of a worldwide movement of local governments to reduce greenhouse gas emissions, improve air quality and enhance urban sustainability” ([http://www.iclei.org/index.php?id=1118](http://www.iclei.org/index.php?id=1118)). The CCP Campaign achieves these results by linking climate change mitigation with actions that improve local air quality, reduce local governments' operating costs and address other existing municipal concerns.

“CCP is ICLEI's flagship campaign. The program is designed to educate and empower local governments worldwide to take action on climate change. CCP is a performance-oriented campaign that offers a framework for local governments to reduce greenhouse gas emissions and improve livability within their municipalities” (ICLEI, 2005). In becoming a CCP member, Belmont will produce a unique CAP specific to the town, through the CCP Campaign’s “5 Milestones,” a five step creation and implementation strategy referred. The “5 Milestones” assist local governments like Belmont by providing a methodology for the development and implementation of local solutions to reduce GHG and air pollution emissions. (To learn more about the five milestones see Appendix C).

**CACP Software**

*It should be noted that the CACP software is designed to be a Policy Development Tool only, that utilizes a vast quantity of built in equations and coefficients that are based upon estimations of national, regional or state wide averages. Given the nature of the CACP software and the fact that data inputted into the software can itself be an average or estimation, figures derived in this report from use of the CACP software should be considered generalizations to assist the Town of Belmont only in creating policy recommendations, and not as scientific certainty.*
The CACP software disseminated to cities and towns that are ICLEI members created in May 2003 was created in a joint effort between the State and Territorial Air Pollution Program Administrators, the Association of Local Air Pollution Control Officials (STAPPA/ALAPCO), ICLEI and Torrie Smith Associates (CACP, 2005). The CACP Software is designed to track emissions and quantify how successful reduction measures of GHGs and criteria air pollutants associated with electricity and fuel use and waste disposal. The software is specifically designed to:

- Create emissions inventories for the community as a whole or for the government's internal operations
- Quantify the effect of existing and proposed emissions reduction measures
- Predict future emissions levels
- Set reduction targets and track progress towards meeting those goals
- Track emissions on either a supply or demand side basis
- Build emissions scenarios for use in the planning process
- Create a full emissions reduction plan

For further information on ICLEI or how the CACP software works please visit their websites at [http://www.iclei.org/index.php?id=391](http://www.iclei.org/index.php?id=391) and [http://www.cacpsoftware.org](http://www.cacpsoftware.org) respectively.

**The Baseline Inventory Methodology**

The purpose of using the ICLEI baseline inventory methodology is to create a simplified process to overcome the task of calculating GHG emissions for the community sector of the Town of Belmont. This methodology consists of three parts: 1) Data collection, 2) Data inputting and 3) Data Interpretation. In the case of the Town of Belmont, data collection consisted of contacting key personnel within each individual sector to obtain the necessary data. In almost all cases Sustainable Belmont provided the Tufts consultant group with contact information for these individuals. When contacts were not available or data was not able to obtained, other data assumptions were used. The data inputting phase involved entering consumption usage numbers gathered during data collection into the ICLEI software along with other pertinent system numbers. The data interpretation phase uses the software to create reports on consumption and CO₂ creation for each sector of Belmont. The following sections will detail how these three steps were accomplished for each sector of the baseline inventory.
This section of the report details how the data was collected, interpreted and calculated to determine the baseline inventory emissions produced by the community electricity consumption for the Town of Belmont. It also provides an overview of current reduction measures along with recommendations for new community based reduction strategies. In reviewing this section, it is important to remember that GHG emissions created by Belmont’s use of electricity will never actually be seen within the town itself since the emissions are created where the supply originates. The current measures and recommendations that are made in this section can best be seen in individual electrical cost reductions, but the implementation of these strategies would dramatically reduce the overall environmental footprint that Belmont’s electrical consumption creates.

The Belmont Municipal Light Department (BMLD) serves as the energy purchaser and supplier to all residents, commercial businesses and municipal facilities in the Town of Belmont. Belmont does not create any electricity itself, nor does it have any industrial sources of electricity within its boundaries. So the town electricity supplier, Belmont Municipal Light Department, purchases 100% of commercial and municipal electricity, along with 95% of all Belmont’s electricity on the open market grid. The remaining 5% of residential electricity supply is purchased through a residential green-electricity program through New York Hydro Power. It is important to know where the electricity that the town is consuming comes from since this is where the largest reductions in GHG emissions can be made.

**Methods**

1. Data Collection

The electricity data that needed to be collected for GHG calculations were clearly defined and outlined by the data collection manuals that come with the ICLEI software. The information that was tracked down for electricity consumption was the total residential and commercial electricity in Kilowatts per Hour (kWh). Belmont was provided with spreadsheets containing total kWh hours for each electricity rate for the years 2001 and 2005, along with an explanation and a manual detailing how the different electricity rates distinguish between residential, commercial and municipal users.
2. Electrical Rate Breakdown

The electrical consumption totals that have been recorded and passed along to SB were categorized by the city electricity rates and in total kWh. The data was already broken down by the billing rates on a monthly basis for the years 2001 and 2005 and provided to use in excel spreadsheets format. The following is a summary explanation of those rate breakdowns according to the individual years (See Appendix D) for a full explanation of each rate). Through an examination of the rate breakdowns and conversations with BMLD the following rates can be categorized into Residential, Commercial and Municipal.

- Residential = Rate A
- Commercial = Rate B, E\(^9\), F & G
- Municipal = Rate TB, TE & SL

These Categories will be used in the data analysis section to explain how the residential and commercial GHG emission outputs come from different energy customers.

3. Calculating Belmont’s Community Electricity Baseline Inventory

To calculate the community baseline inventory electricity emissions, it is necessary to enter the consumption totals for residential and commercial into the ICLEI software separately, in different reporting sections. The software then calculates the emission outputs for CO\(_2\) created by the Belmont’s consumption of electricity. For commercial consumption, this creates a user-friendly approach to calculating the emissions. It is as simple as entering the commercial total for 2001, which is 43,834,996 kWh, into the software under commercial fuel type and energy use. Calculating the residential emissions is not as straightforward as the commercial emissions given that 5% of the residential energy is purchased through a green-electricity program. This reduction needs to be accounted for in order to establish Belmont’s baseline emissions inventory.

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\(^9\) (Rate E contains a few residential customers, but is predominantly comprised of commercial users. An example of a home that would fall under this category would be one that contained an indoor heated swimming pool, or a home with an indoor hockey rink. Due to privacy reasons that could potentially reveal individual customers; we are not able to ascertain how many of these residential customers exist, nor are we able to determine what their consumption amounts would total. For this reason, it has been decided to allow those users to remain within their respective rates as has been provided to the Tufts consulting team.)
4. Subtracting the New York Hydro Power Purchasing Program

An existing measure that BMLD already had in place before 2001 mandated that 5% of all residential electricity shall be purchased from the New York Power Authority (NYPA). Hydropower was determined each month based on the past months consumption rates (See Appendix D for further detail). By taking the total amount of residential electricity created for the year 2001, it is possible to subtract out the amount of GHG emissions the town of Belmont has already saved.

\[
\begin{align*}
2001 \text{ Total Residential Electricity} &= 68,882,254 \text{ kWh} \\
2001 \text{ NYPA Hydropower} &= 5\% \text{ Residential Electricity} \\
2001 \text{ Total Green Electricity Purchased} &= 3,444,113 \text{ kWh} \\
\text{Total Amount of GHG Producing Electricity} &= 65,438,141 \text{ kWh}
\end{align*}
\]

As the calculation of the baseline moves forward, only the total amount of GHG producing electricity, 65,438,141 kWh, will be used.

Data Analysis

5. Residential v. Commercial Electricity Usage

Utilizing the rate breakdowns and corresponding electricity usage, it has been determined which sectors of the Belmont community are using the greatest amount of electricity. The data in Table 1 displays the total amount of electricity consumption for each rate breakdown, revealing Belmont’s largest consumer to be their residential population, which consumes 68,882,254 kWh of electricity or 57% of all electricity the town uses.

<table>
<thead>
<tr>
<th>SUMMARY</th>
<th>% of kWh Sales</th>
<th>kWh</th>
<th>REVENUE*</th>
</tr>
</thead>
<tbody>
<tr>
<td>RATE A</td>
<td>57%</td>
<td>68,882,254</td>
<td>$7,873,877</td>
</tr>
<tr>
<td>RATE B</td>
<td>20%</td>
<td>24,307,973</td>
<td>$2,650,628</td>
</tr>
<tr>
<td>RATE E</td>
<td>14%</td>
<td>16,907,250</td>
<td>$1,438,010</td>
</tr>
<tr>
<td>RATE F</td>
<td>2%</td>
<td>2,309,549</td>
<td>$205,809</td>
</tr>
<tr>
<td>RATE G</td>
<td>0%</td>
<td>310,224</td>
<td>$30,797</td>
</tr>
<tr>
<td>TOWN RATE B</td>
<td>2%</td>
<td>2,568,632</td>
<td>$256,951</td>
</tr>
<tr>
<td>TOWN RATE E</td>
<td>3%</td>
<td>3,423,075</td>
<td>$263,772</td>
</tr>
<tr>
<td>STREET LIGHTING</td>
<td>1%</td>
<td>1,715,595</td>
<td>$179,828</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100%</td>
<td>120,424,552</td>
<td>$11,928,251</td>
</tr>
</tbody>
</table>

*Revenue for each rate was provided to us by BMLD, however the actual rate breakdown by cost for individual customers is provided in Appendix D.
The commercial and municipal sectors consume 43,834,996 kWh or 36%, and 7,707,302 kWh or 5% of all electricity respectively. The difference in electricity consumption between the residential, commercial and municipal sectors was not surprising given the residential makeup of Belmont. To check for anomalies within the baseline year of 2001, we also obtained data from BMLD for another year, 2005.

Table 3-2. 2005 Summary of kWh & Revenue for Town of Belmont, MA

<table>
<thead>
<tr>
<th>SUMMARY</th>
<th>% of kWh Sales</th>
<th>kWh</th>
<th>REVENUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>RATE A</td>
<td>58%</td>
<td>75,269,218</td>
<td>$7,873,877</td>
</tr>
<tr>
<td>RATE B</td>
<td>20%</td>
<td>25,743,395</td>
<td>$2,650,628</td>
</tr>
<tr>
<td>RATE E</td>
<td>13%</td>
<td>17,005,010</td>
<td>$1,438,010</td>
</tr>
<tr>
<td>RATE F</td>
<td>2%</td>
<td>2,349,870</td>
<td>$205,809</td>
</tr>
<tr>
<td>RATE G</td>
<td>0%</td>
<td>54,900</td>
<td>$30,797</td>
</tr>
<tr>
<td>TOWN RATE B</td>
<td>2%</td>
<td>3,182,577</td>
<td>$256,951</td>
</tr>
<tr>
<td>TOWN RATE E</td>
<td>3%</td>
<td>3,587,725</td>
<td>$263,772</td>
</tr>
<tr>
<td>STREET LIGHTING</td>
<td>1%</td>
<td>1,667,886</td>
<td>$179,828</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100%</td>
<td>128,860,581</td>
<td>$12,899,671</td>
</tr>
</tbody>
</table>

*Revenue for each rate was provided to us by BMLD, however the actual rate breakdown by cost for individual customers is provided in Appendix D

Electricity consumption for the Town of Belmont jumped from 2001 to 2005 by 8,436,029 kWh. The increase was of an almost perfect proportion to the individual rate increase within +- 1% illustrated in Table 2. This discovery adds credibility to the assessment of the 2001 electricity consumption numbers; the data appear to be consistent enough so that accurate results can be obtained during the ICLEI calculation phase.

6. Belmont’s Electrical CO₂ Inventory for 2001

Using the total amount of residential GHG producing electricity of 65,438,141 kWh, the emissions created by the electricity consumption for the Town of Belmont is equivalent to 41,663 tons of CO₂.

Existing Measures and Recommendations

7. Green Energy Purchasing Program

The Town of Belmont has already started to take part in a green energy purchasing program by buying energy from the NYPA hydropower program.
Discussions have already started at BMLD about the potential of supplementing town energy usage by taking part in the Cape Wind Farm that may come online in 2007. There are also more potential opportunities for the city to take part in:

- **Annual Green Energy Purchasing Review**: Belmont could conduct an annual review of the availability and feasibility of different options for green power purchasing. As more options become available and feasible, the BMLD should be encouraged to purchase green power to increase at least a portion of the residential electricity needs through green options.

- **Conduct a Green Option purchasing survey & program**: A survey could be administered through the electric bills to determine how many residents may be willing to pay more for their electricity power to be supplied from green sources.

For every kilowatt hour of emission-free green power that is purchased, the Town of Belmont would offset 1.53 pounds of CO\(_2\). By purchasing green power to meet even just 10% of the residential electricity usage, Belmont would reduce CO\(_2\) emissions approximately 1,100 tons each year.

8. **Residential Appliance Rebate Program**

There are over 40 different varieties of products that consumers can now choose from that meet the federal energy star criteria. As of 2006, BMLD has started taking part in a Residential Appliance rebate program. In this program, the purchaser of a certified energy star appliance can receive a rebate to offset the cost of purchase.

- Refrigerators 15.0 cubic feet or larger = $100.00
- Front-loading washing machine = $100.00
- Top-loading washing machine = $50.00
- Central air conditioners SEER certified = $100.00
- Room air conditioners = $25.00
- Dishwashers = $50.00

This reduction strategy does not need to be relegated strictly to these appliances. For more information on energy star certified appliances and other energy star rebates, visit [http://www.energystar.gov/](http://www.energystar.gov/). As a quick and easy way to get more people interested in the energy star program, there is an online test people can take to see if their home energy usage is above average. ([http://www.energystar.gov/index.cfm?fuseaction=home_energy_yardstick.showStep2](http://www.energystar.gov/index.cfm?fuseaction=home_energy_yardstick.showStep2))

9. **Solar Renewable Energy Sources**

“I’d put my money on the sun and solar energy. What a source of Power! I hope we don’t have to wait until oil and coal run out before we tackle that.” – Thomas Edison
Everyday solar energy is becoming a more viable option for residents and commercial business to be environmentally conscious. It is also an affordable opportunity to reduce their dependence on oil and grid electricity. Given the variety of solar programs and the cost reduction measures like grants, rebates, tax credits and tax exemptions available for residents and businesses, we are beginning to see more conversions to this type of green energy usage. Below is a brief list and explanation of a few of the more popular solar energy systems.

- **Solar Electricity:** Photovoltaic (PV) panels produce electricity when the sun’s rays fall on the PV cell. It increases the energy stored in the atoms of the panel, thereby allowing that increased energy to be used for electricity when conducting wires are attached (Solar Boston, pg 4). Solar electricity systems generally cost $10/watt, but with federal and state rebates usually reduce that amount by half. The biggest benefit is that residential and commercial users that are connected to the town grid have the ability to sell back the electricity they are creating during peak hours.

- **Solar Water Heating:** Solar water heating is becoming common among residential consumers because it is most applauded for its low cost and limited time needed to pay for itself. “A water heating system for a typical family of four costs between $5,000 and $6,000, and incentives may be available through your utility’s energy efficiency program” (Solar Boston, pg 6). The average cost of heating water can be reduced by more than 50%, using this system.

- **Solar Space Heating:** This can be extremely beneficial to apartment buildings and commercial users because it offsets the large heating system loads that can be a financial drain. “Active solar space heating systems use solar panels to heat recirculated fresh air, which is circulated throughout the building by fans” (Solar Boston, Pg 7). The largest benefits come in the tax credits and rebates that commercial users get for installing these types of heating systems (http://www.solarboston.org/incentives.shtml). Even if the commercial or residential user were to pay for them without the incentives, “solar space heating systems payback is generally less than five years (Solar Boston, pg 7).

To learn more about solar energy programs, cost reductions and installers in the Greater Metro Boston Area visit the Solar Boston website at www.solarboston.org, take a look at their brochure in Appendix E, or visit http://www.dsireusa.org/ to learn more about state and federal incentives and deductions for installation of renewable energy sources.

10. Compact Florescent Light bulb (CFL) Campaign

Setting up a modest campaign that would seek to convert the equivalent of one incandescent bulb per household to an energy-efficient compact florescent lighthub (CFL) within one year, could be a very simple but effective way to broaden public support for reduction of GHG. This could be started through local media, and enhanced by the local stores that sell these bulbs. This campaign could reduce residential GHG
emissions for the town of Belmont, while at the same time promoting individual adoption of a reduction strategy through simple cost effective solutions.

4. Sustainable Building Efforts

A great way to reduce GHGs, while at the same time taking strides to build more dependable fuel efficient houses, is through sustainable building practices. Sustainable building practices, not only save the environment, but they also save money on utility bills.

- Promote home insulation through energy audits: 30% of the energy consumed from heating and air conditioning can be recaptured through better insulation. Utility-sponsored rebate programs are available for many types of home insulation.
- Sustainable building ordinance: an ordinance could be developed, which requires that only LEED certified builders be used for residential and commercial land use developments. Also, requirements could be made that specific insulation be installed in homes at the time of property transfer or during major renovations. (Arlington, MA recently passed a sustainable building ordinance.)
- Collaborating with Green Round Table (www.greenroundtable.org): the Green Round Table has some great workshops, events and LEED builder connections in the metro Boston area. It also provides sustainable building consultants for municipal and commercial developers.

**Summary**

Reduction strategies for decreasing the amount of GHGs created by the Belmont community can be broken down into reductions on the supplier or user ends only. The greater impacts that the town of Belmont can make to decrease their effect on the climate resides in ability and willingness to purchase more green-electricity like NYPA hydropower. Encouraging first steps are already taking place within BMLD, where talks exist about potentially purchasing power from the Cape Wind Project once it is up and running. To affect residential behavior towards energy usage, promotion of sustainable design, solar incentives and CFL light bulbs are a great way to bring the scope of energy conservation to an individual participation level.
IV. HEATING OIL

This section is in regards to fuel oil used for general heating purposes. The primary fuel used when referring to heating oil is no. 2 fuel oil, although kerosene (for heating) and both no. 1 and no. 4 fuel oils are also included in this section.

Heating oil is an extremely important fuel for the Northeastern United States. “Of the 8.1 million households in the United States that use heating oil to heat their homes, 6.3 million households or roughly 78 percent are located in the Northeast region of the country [including New England, and the Central Atlantic States]” (Energy Information Administration, 2000). In order to accurately draft a climate action plan for the Town of Belmont, an understanding of the heating oil usage and the resulting emissions is required.

Methods

The first step to determine the resulting greenhouse gas emissions from heating oil usage is to find out the number of homes that heat with fuel oil. Since the baseline year is 2001, the most desirable data is from the same year. However, after consulting Maryanne Knorr at the Town of Belmont’s Assessors office, this data is not kept “on file” (personal communication, March 22, 2006). In a later conversation, she went on to explain that the assessor’s records are constantly updated with no record of how the assessor’s file looked in 2001; “the data is overridden” (personal communication, April 18, 2006).

The next alternative, and the option used in this paper, is to consult a different year for the numbers. The logical location to find the number of residences that heat with fuel oil was the United States 2000 census data. One of the parameters of gathered information in the census data is housing characteristics. Within housing characteristics, there is information on the “House Heating Fuel” (U.S. Census Bureau, n.d.b). Naturally, there are some differences between the 2000 census data and the 2001 baseline year. For example, the number of residences could have increased or decreased from one year to the next; and/or residences could have shifted from one heating source to another. However, there is no basis for comparison at this moment in time. In mid to late April the Belmont Assessors office will release a report that will detail the number of residences and their heating source (Maryanne Knorr, personal communication, March 22, 2006). With the use of this report, Sustainable Belmont will be able to determine with relative accuracy how the source of heating changed from 2000 to 2001. Nonetheless, until this report is released there is no comparison to extrapolate how the

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10 Later in this report, the number of natural gas meters used for heating in residences in the year 2001 is reported. However, while the number of natural gas meters is greater in 2001 then the number of
heating method dynamic changed from 2000 to 2001. Therefore, even though the
numbers from 2001 more than likely changed from the 2000 figures, the two are assumed
to be the same in this draft until data becomes available that will allow reasonable
extrapolation of how the heating source makeup changed. If the number of residences
did change from 2000 to 2001, then the data in this draft will change.

After the number of residences that heat with fuel oil has been determined using
the most accurate data possible, the next question is how much heating oil was used in
Belmont. The best way to determine this would be to actually count the gallons of fuel
oil delivered within Belmont. However, unlike electricity and natural gas, which only
have one provider in the town, heating oil is delivered by numerous undetermined
companies in the greater Boston metropolitan area, which may or may not keep accurate
or specific records from five years ago, making data collection unrealistic.

Another possibility was to take a sampling of heating oil delivery companies
within Belmont and try to determine average annual fuel oil consumption per household.
After attempts to get an average proved less than promising, Sustainable Belmont
informed the Tufts consulting team to end this pursuit.

Under the advice of Kim Lundgren, the New England Director for ICLEI North
America, and Sustainable Belmont, the Tufts consulting team was informed to try to find
average heating oil usage for the area. To this end, average heating oil usage figures per
household in New England were obtained from the U.S. Energy Information
Administration and average heating oil usage per household in neighboring Arlington and
nearby Brookline were calculated from the respective climate action plans. With three
average usage numbers, the expectation is that a rough idea of the amount of heating oil
burned and greenhouse gases released will be determined. Sustainable Belmont will need
to refine the average fuel oil usage per household as better information becomes
available; specifically, the town’s Assessor’s report.

In addition to the number of residences that use home heating oil, the Town of
Belmont Assessor’s report will also include information about businesses within the
town, including the type of heat that each business uses. At the moment, no data is
available for the commercial sector and won’t be available until the assessor’s report is
released in April. Henceforth, the following data is in regards to the residential sector
only. No estimates for greenhouse gas emissions from commercial heating oil usage are
supplied at this time.

### Data Collection

In the year 2000, 4,392 residences, or slightly more than 45 percent of all
residences in the Town of Belmont, were heated by fuel oil (Table 4.1). As stated above,
the number of residences heating with fuel oil is assumed to be the same in 2001 until
additional data becomes available in mid to late April.

residences that use natural gas for heating according to the census data, no extrapolation of how the number
of residences heating with fuel oil is possible. This is because there is no available information that would
illuminate if the rise in natural gas users is due to an increase in residences, a shift in fuel heating source, or
a simple case of the number of meters not being equivalent to the number of residences that heat with
natural gas. Simply put, more information is required to extrapolate fuel oil users from the natural gas
users.
Table 4-1. Itemized list of residential heating sources for the Town of Belmont in the year 2000

<table>
<thead>
<tr>
<th>House Heating Fuel</th>
<th>Number of Residences</th>
<th>Percentage of All Residences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utility gas</td>
<td>4,607</td>
<td>47.3</td>
</tr>
<tr>
<td>Bottled, tank, or LP gas</td>
<td>93</td>
<td>1.0</td>
</tr>
<tr>
<td>Electricity</td>
<td>596</td>
<td>6.1</td>
</tr>
<tr>
<td>Fuel oil, kerosene, etc.</td>
<td>4,392</td>
<td>45.1</td>
</tr>
<tr>
<td>Coal or coke</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Wood</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Solar energy</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Other fuel</td>
<td>29</td>
<td>0.3</td>
</tr>
<tr>
<td>No fuel used</td>
<td>15</td>
<td>0.2</td>
</tr>
</tbody>
</table>

(U.S. Census Bureau, n.d.b)

According to the Energy Information Administration (EIA), the average fuel oil usage in New England during the year 2001 is 99.3 million Btu per household (Energy Information Administration, 2004). As a matter of comparison, the average usage in 2001 across the country was 81.7 million Btu per household, and in the Middle Atlantic states, the average usage was 78.8 million Btu per household (Energy Information Administration, 2004).

Now that the regional average is known, a more specific local comparison is desirable. According to the Town of Arlington’s climate action plan, total fuel oil used by residences in 1997 was 2,327,344 million Btu\(^{11}\) (Town of Arlington, 2005, p. 3). In order to determine the average yearly usage per household, the Arlington total needs to be divided by the number of residential fuel oil users. To accomplish this, the number of households using fuel oil is obtained from the 2000 census data. The three-year difference in the data does present a problem in regards to its accuracy. However, the Arlington usage per household is meant to give a rough estimate and a point of comparison to the EIA data. According to the 2000 census, the number of households that use fuel oil is 8,579 (U.S. Census Bureau, n.d.a).

The approximate average yearly fuel oil usage per household is then calculated by dividing 2,327,344 million Btu by 8,579 households. The result is that an average household in Arlington uses 271.3 million Btu over the course of the year 1997. This number is clearly drastically different than the EIA figure of 99.3 million Btu per household. This might perhaps be due to the fact that the estimates are for completely different years (1997 v. 2001).

\(^{11}\) While the Arlington report lists the units as Btu, that would mean that the whole Arlington community used just over 2.3 million Btu, or slightly more than two percent of the average yearly consumption for one household according to the Energy Information Administration. In order to accommodate for this incredible discrepancy, the Arlington figure is assumed to be million Btu.
As another frame of reference, the Town of Brookline’s average fuel oil usage per household in the year 1998 was 501.7838 gallons. When converted to million Btu per household\(^{12}\), the average household in Brookline used 69.76 million Btu in 1998.

Naturally, the use of three different years in the calculation presents a time consistency problem that cannot be overcome in this report. There is also a spatial inconsistency to the average usage numbers; the towns of Belmont, Arlington and Brookline do not represent the same housing dynamics. However, the three usage numbers do give a general frame of reference in which Sustainable Belmont can work in order to generate a more specific number for the Town of Belmont.

At this moment in time, none of the estimates can be said to be closer to the actual usage than the others. The numbers were not averaged together because a false sense of accuracy might result. Instead, the three numbers are used as a possible range in which to work. With this in mind, pollution estimates were calculated in the ICLEI software using all of the usage approximations. Even though the usage averages are from different years, they were all used in order to estimate the baseline year of 2001. However, when the fuel oil greenhouse gas emissions are compared to the other sectors in this paper, the Arlington usage was used. Since none of the estimates can be said to be more or less accurate than the others, the largest estimate was used as a matter of comparison in order to err on the side of caution in regards to the GHG emissions.

In order to derive the total amount of heating oil used in Belmont, the three estimates are multiplied by the total number of homes that use heating oil in Belmont, which is 4,392. According to the Brookline average usage data, the Town of Belmont used 306,386 million Btu in 2001; 436,126 million Btu were used according to the EIA average; and the Arlington usage data indicates that 1,191,550 million Btu were used. The numbers were then inputted into the ICLEI software in order to determine the resulting greenhouse gas emissions; the results are listed in Table 4.2.

### Recommendations

The recommendations section of both the heating oil and the natural gas sections are very similar. Since both are used for home heating, the measures in this regard will be virtually identical.

1. **Energy Efficiency**

   Energy efficiency can reduce the amount of heating oil residencies use by maximizing the heat derived per unit of oil.

| Table 4-2. Total Amount heating oil and Pollution from Home Heating Oil using estimates from Brookline, the EIA, and Arlington for the year 2001 in Belmont, MA. |
|---------------------------------|----------------|----------------|----------------|
|                                 | Using Brookline Average Usage Per Household | Using EIA Average Usage Per Household | Using Arlington Average Usage Per Household |
| Million Btu                    | 306,386         | 436,126         | 1,191,550       |
| Tons CO\(_2\)                  | 25,327           | 36,052           | 98,499          |

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\(^{12}\) According to the Energy Information Administration, the one gallon of heating oil is equal to 139,000 Btu (n.d.). The formula for conversion is thus: \((\text{number of gallons heating oil/household}) \times (139,000 \text{ Btu/gallon heating oil}) \times (1 \text{ million Btu/1,000,000 Btu}) = \text{million Btu/household.}\)
Not only will CO$_2$ emissions be curbed, but monthly bills will also decrease, providing an incentive to install the following energy efficient items:

- **Programmable thermostat.** Use in order to only maintain comfortable ambient temperatures during hours when people are home and awake. When the residence is normally unoccupied or people are asleep, the thermostat can be programmed to reduce the heat.

- **High efficiency oil boilers and furnaces.** By increasing the annual fuel utilization efficiency (AFUE), a consumer can maximize the heat from each unit of fuel. According to Energy Star, a standard furnace has an AFUE of 75%. Energy Star approved furnaces are much more efficient with an AFUE of at least 90% (Energy Star, n.d.). Table 4.3 gives examples of the potential cost savings if a furnace is replaced with a different furnace which has a higher AFUE rating. As Table 4.3 clearly illustrates, when inefficient furnaces are replaced with more efficient furnaces, the financial gain can be substantial in addition to the reduced GHG benefits.

<table>
<thead>
<tr>
<th>AFUE of Existing System</th>
<th>75%</th>
<th>80%</th>
<th>85%</th>
<th>90%</th>
<th>95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFUE of New System</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50%</td>
<td>$33</td>
<td>$37</td>
<td>$41</td>
<td>$44</td>
<td>$47</td>
</tr>
<tr>
<td>55%</td>
<td>26</td>
<td>31</td>
<td>35</td>
<td>38</td>
<td>42</td>
</tr>
<tr>
<td>60%</td>
<td>20</td>
<td>25</td>
<td>29</td>
<td>33</td>
<td>37</td>
</tr>
<tr>
<td>65%</td>
<td>13</td>
<td>18</td>
<td>23</td>
<td>27</td>
<td>32</td>
</tr>
<tr>
<td>70%</td>
<td>6</td>
<td>12</td>
<td>17</td>
<td>22</td>
<td>26</td>
</tr>
<tr>
<td>75%</td>
<td></td>
<td>6</td>
<td>11</td>
<td>16</td>
<td>21</td>
</tr>
<tr>
<td>80%</td>
<td></td>
<td></td>
<td>5</td>
<td>11</td>
<td>16</td>
</tr>
<tr>
<td>85%</td>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>11</td>
</tr>
</tbody>
</table>

(American Council for an Energy-Efficient Economy, 2005)

- **Insulation.** When residences are properly weatherized, the amount of heat that escapes is minimized. The less heat that escapes, the less heat is needed to replace the lost heat.

2. **LEED certifications and Green Buildings**

Leadership in Energy and Environmental Design (LEED) is a voluntary standard that guarantees a certain level of energy efficiency and environmental accord. Using these standards as guidelines will help owners of buildings have a better understanding of what changes they can make. Homeowners and commercial establishments should be encouraged to refit their homes by LEED standards. The LEED Homes Program is still being developed, and when produced, it will provide homeowners with tools and techniques to make their homes energy efficient (LEED, 2006). LEED certifications should also be introduced in any new developments in Belmont. Renters and owners with LEED features will spend less money on bills and replace items in the home (such as windows) less frequently. The following are LEED recommendations (CenterPoint Energy, n.d.):

- **Install high efficiency furnaces.**
• Install energy recovery systems that recycle exhaust to heat the building.

• Insulate homes and businesses to prevent unnecessary heat loss.

• Encourage Modeling. Modeling is a principle of social marketing, which encourages homeowners and commercial businesses to follow the lead of others who have already taken energy efficient action.

• Advertise Energy Star and LEED certified buildings and businesses. Locations where the town has already made changes, such as LEED certified buildings to increase awareness about the issue. It will increase the feeling of teamwork and camaraderie to know that the town is participating in certain programs.

3. Alternative Heating Methods

One way to reduce fuel oil usage is to promote alternative forms of heating. When a residence adds and/or switches to another form of heating, naturally the emissions associated with burning heating oil are reduced.

• Passive Solar. Passive solar involves taking full advantage of the sun’s energy during the colder seasons while sheltering the building from the sun in the warmer seasons. During the winter when the sun has a lower angle of incidence, the sun’s energy is allowed to enter unobstructed through large south-facing windows. However, during the summer when the sun is higher in the sky, the overhanging roof prevents the sun from directly entering the building, thereby preventing overheating and the resulting cooling costs.

• Geothermal Heat Pumps. The ground below the frost line stays a relatively constant temperature year-round. When liquid is run through piping below the frost line, the heat can be captured, consolidated, and used for home heating. During the summer when the ground is cooler than the air, the unit can be used for cooling.

• Direct Solar Heating. This method is most commonly used for heating hot water by concentrating the sun’s rays onto water, but can also be used for space heating. However, this method is only valuable as a compliment to a traditional heating system and should not be used independently.

• Natural Gas. While switching from fuel oil to natural gas will not eliminate GHG emissions, there can be a reduction. For every million Btu, heating oil emits 185 lbs of CO\textsubscript{2} whereas natural gas emits only 124 lbs of CO\textsubscript{2}.

4. Estimated Reductions

Using the above suggestions, significant reductions in CO\textsubscript{2} output will be achieved. For example, if 50 homes in Belmont upgrade their furnaces to an Energy Star certified furnace with an AFUE of 95%, 2,855 million Btu of energy will be saved,
reducing CO₂ emissions by 236 tons\textsuperscript{13}. This assumes that all homes in Belmont currently have furnaces with a 75\% Annual Fuel Utilization Efficiency (AFUE), when in fact, furnaces over 15 years of age may have an AFUE of 65\% (American Council for an Energy Efficient Economy, 2005). If 50 homes that currently use heating oil with a furnace that has an AFUE rating of 75\% were to switch to a natural gas furnace with an AFUE rating of 95\%, the savings would amount a reduction of 460 tons of CO₂\textsuperscript{14}.

The other recommendations listed above can be extremely hard to quantify due to the various unknown characteristics of the housing community within Belmont. For example, the number of households that already have programmable thermostats, and the degree to which households are insulated, is completely unknown. Hence, this report will go only as far to say that there would be reductions. The extent of the reductions needs to be studied in further detail by Sustainable Belmont.

**Summary**

The greenhouse gas emissions associated with the burning of heating oil in the year 2001 were calculated using 2000 census data, which determined the number of homes that use fuel oil for heating, and each of the Town of Arlington’s, the Town of Brookline’s and the Energy Information Administration’s numbers for the average yearly consumption of fuel oil per household. The calculation using the Town of Brookline average usage per household determined Belmont’s usage to be 306,386 million Btu in 2001, the EIA numbers calculated Belmont’s usage to be 436,126 million Btu and the computation using the Arlington numbers was 1,191,550 million Btu. The respective CO₂ emissions were 25,327 tons, 36,052 tons and 98,499 tons.

There are currently no measures to reduce greenhouse gas emissions from fuel oil in Belmont. However, the following recommendations would reduce the amount of fuel oil burned: increased energy efficiency; passive solar heating; active solar heating; passive geothermal heating; LEED certified buildings; and social marketing in order to change town behavior.

\textsuperscript{13} These numbers were calculated using the Arlington per household usage estimates. Using the lowest estimate of Brookline, the reduction would be 873 million Btu and 72.5 tons of CO₂.

\textsuperscript{14} Once again, this calculation was based on the Arlington figures. If the Brookline figures were used, the reduction would amount to 127 tons of CO₂.
V. NATURAL GAS

Natural gas is a fossil fuel that is primarily used for home heating, water heating and gas ranges. According to the Energy Information Administration, when natural gas is burned it emits less CO₂ than other fossil fuels used for heating and electricity, 27% less than oil and 45% less than coal. Nonetheless, natural gas consumption is a significant contributor to greenhouse gas emissions at 124 pounds of CO₂ per million Btu.

Methods

Keyspan Energy, the natural gas provider of Belmont, supplied the energy consumption data in the unit Therms (Michael Bruno, Personal Communication, April 13, 2006). Data was given for total natural gas consumption for meters categorized as residential and those categorized as commercial and industrial, the latter were combined. The number of meters for both classes was supplied as well.

Data Analysis

Table 5-1 displays energy consumption and CO₂ output from natural gas usage for both the residential and commercial/industrial arenas. This data includes natural gas consumption for heating and non-heating applications.

<table>
<thead>
<tr>
<th>Customer</th>
<th># Meters</th>
<th>Million Btu</th>
<th>Million Btu/meter</th>
<th>CO₂ output (tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>7,258</td>
<td>687,295</td>
<td>95</td>
<td>42,463</td>
</tr>
<tr>
<td>Commercial/Industry</td>
<td>431</td>
<td>174,690</td>
<td>405</td>
<td>10,793</td>
</tr>
<tr>
<td>Total</td>
<td>7,689</td>
<td>861,984</td>
<td></td>
<td>53,256</td>
</tr>
</tbody>
</table>

Overall, the Commercial/Industrial customers use less energy and create less CO₂. Residential customers use 60% more natural gas than the commercial customers. However, the number of million Btu measured per commercial/industrial meter is 77% more than that measured per residential meter. Therefore commercial businesses are much more intense users of natural gas.
Recommendations

1. Energy Efficiency

Energy efficiency can reduce the amount of natural gas homes and commercial businesses use in a cost-efficient manner. Not only will CO$_2$ emissions be curbed, but monthly bills will also decrease, providing an incentive to install the following energy efficient items:

- Programmable thermostat. Buy a clock-thermostat, which allows programming of temperatures according to the time of day. For example, heat will automatically be lessened at night or when the home is vacant.

- High efficiency natural gas boilers, indirect water heaters or on-demand tankless water heaters. Energy Star certified boilers and water heaters have an Annual Fuel Utilization Efficiency (AFUE) rating of 85%, which means that for every Btu produced, 85% is used. Aquastats can be used to regulate the temperature of the water, similarly to programmable thermostats.

- Insulation. Weatherize homes and businesses (so as to not waste heat).

- Energy efficient appliances. Install energy efficient appliances that use natural gas, such as stoves and clothes dryers.

- High efficiency furnaces. According to Energy Star, a standard furnace has an AFUE of 75%. Energy Star approved furnaces are much more efficient with an AFUE of at least 90%.

- Low flow showerheads. Install low flow showerheads. Less hot water requires less natural gas to heat the hot water.

2. Energy Savings Programs

Keyspan Energy offers a number of energy saving programs for Belmont homes and small businesses. These include rebates up to $500 for high efficient boilers, furnaces and water heaters and rebates for clock thermostats and Energy Star windows. For homes built prior to January 1, 1995, a contractor hired by Keyspan Energy will weatherize homes through their Residential Weatherization Program at a portion of the cost and free of cost (up to $4500) for low income residents. This program includes attic, crawlspace and wall insulation, ductwork leakage testing and sealing and other energy efficient measures. Keyspan Energy should be encouraged to mail out rebate forms bi-annually to Belmont customers with utility bills. These rebates and
immediate cost savings from lower utility bills due to high efficiency appliances and behaviors should be marketed throughout the Belmont community.

3. LEED certifications and Green Buildings

Leadership in Energy and Environmental Design (LEED) is a voluntary standard that guarantees a certain level of energy efficiency and environmental accord. Using these standards as guidelines will help owners of buildings have a better understanding of what changes they can make. Homeowners and commercial establishments should be encouraged to refit their homes by LEED standards. The LEED Homes Program is still being developed, and when produced, will provide homeowners with tools and techniques to make their homes energy efficient (LEED, 2006). LEED certifications should also be introduced in any new developments in Belmont. Renters and owners with LEED features will spend less money on bills and replace items in the home (such as windows) less frequently.

The following are LEED recommendations for both commercial and residential sectors that are applicable to natural gas consumption reduction (CenterPoint Energy, n.d.):

- Installing high efficiency water heaters, boilers and furnaces.
- Installing energy recovery systems that recycle exhaust to heat the building.
- Insulating homes and businesses to prevent unnecessary heat loss.
- Energy Star and LEED certified buildings and businesses should be publicized to increase awareness about the issue. It will increase the feeling of teamwork and camaraderie to know that the town is participating in certain programs.

4. Alternative Heating Methods

As with fuel oil, emissions from natural gas usage can also be reduced by using alternative forms of heating.

- Passive Solar. Passive solar involves taking full advantage of the sun’s energy during the colder seasons while sheltering the building from the sun in the warmer seasons. During the winter when the sun has a lower angle of incidence, the sun’s energy is allowed to enter unobstructed through large south-facing windows. However, during the summer when the sun is higher in the sky, the overhanging roof prevents the sun from directly entering the building, thereby preventing overheating and the resulting cooling costs.

- Geothermal Heat Pumps. The ground below the frost line stays a relatively constant temperature year round. When liquid is run through piping below the frost line, the heat can be captured, consolidated and used for home heating.
During the summer when the ground is cooler than the air, the unit can be used for cooling.

- Direct Solar Heating. This method is most commonly used for heating hot water by concentrating the sun’s rays onto water, but can also be used for space heating. However, this method is only valuable as a compliment to a traditional heating system and should not be used independently.

5. Estimated Reductions

Using the above suggestions, significant reductions in CO₂ output will be achieved. For example, if 50 homes in Belmont upgrade their furnaces to an Energy Star certified furnace with an AFUE of 92%, 789 million Btu of energy will be saved, reducing CO₂ emissions by 49 tons. This assumes that all homes in Belmont currently have furnaces with a 75% Annual Fuel Utilization Efficiency, when in fact, furnaces over 15 years of age may have an AFUE of 65% (American Council for an Energy Efficient Economy, 2005). It is difficult to quantify the CO₂ reductions resulting from the other recommendations listed above because of the many variables involved. For example, installing energy efficient windows may reduce energy differently for different homes. A home that keeps a temperature of 70º Fahrenheit and has Energy Star windows will use more energy than a home that keeps a temperature of 65º Fahrenheit with the same windows. Hence, this report will go only as far to say that there would be reductions. The extent of the reductions needs to be studied in further detail by Sustainable Belmont.

Summary

As illustrated above, there are many ways that Belmont can work to reduce the use of natural gas in the community, thereby increasing energy efficiency, and at the same time, saving money through rebates and utility bills. The town of Belmont, business owners and residents alike can play a role in making critical changes. Sustainable Belmont should focus on raising awareness and marketing the rebate offers and utility savings from energy efficient appliances and other equipment.

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15 This average estimate of million Btu saved uses a combined total of natural gas consumption using the number of meters read for heat and non-heat natural gas consumption, which may be an underestimate because homes that use natural gas for heat are assumed to consume more than those who do not use natural gas for heat. To determine a more accurate reduction, the total million Btu for only natural gas consumption measured by residential heat meters should be used. The equations used are the following: (Total million Btu for residential heating meters)*(.75 AFUE)/ (.90 AFUE)= # million Btu at 90% AFUE. (# million Btu at 90% AFUE) – (# million Btu at 75% AFUE) = # million Btu reduced. # million Btu/# meters = # million Btu reduced per meter.
VI. TRANSPORTATION

With the suburbanization of America and the lack of availability of public transportation for many, Americans have become entirely dependant on their vehicles for almost all of the trips they take. Therefore, people have become complacent regarding their modal choice. The result has been that the transportation sector accounts for a large amount of the carbon dioxide emissions in the Town of Belmont. The town emits approximately 216,666 tons of CO\textsubscript{2} carbon dioxide each year. For the town to reduce the amount of carbon dioxide emitted, it is imperative that alternate forms of transportation and traffic calming measures be promoted. Successful implementation of these plans would reduce CO\textsubscript{2} emissions.

Methodology

The transportation sector has three key differences from other sectors in the software. First, as the emissions of criteria air pollutants depend on the technology used, information is needed on vehicle types as well as fuel usage. Secondly, the energy usage information can be entered in terms of actual fuel use or can be estimated based on the total number of vehicle miles traveled (VMT).\textsuperscript{16} Finally, if total fuel or VMT in a community is not broken out by vehicle type, the Transportation Assistant (explained below) can be used to help derive these numbers (ICLEI, 2005).

The most accurate measure of CO\textsubscript{2} emitted in the transportation sector would be derived by entering the total number of vehicles in a community, broken down by type, and then by entering the total quantity of fuel used by each class of vehicle. Doing this would give an exact CO\textsubscript{2} amount emitted by classification of vehicle in a community. This information is often available in terms of fuel sale records. However, there are two problems with this method. First, these records include fuel purchased in the community and used elsewhere (e.g., fuel purchased by highway traffic just “passing through”). Second, these records do not take into consideration fuel purchased outside the community and consumed within the community boundaries (e.g., if a portion of the population crosses jurisdictional lines to take advantage of cheaper gas prices) (CAPS, 2005). Therefore, it is highly recommended by ICLEI that a component of the software called the Transportation Assistant be used. The Transportation Assistant uses the most accurate accounting method available by asking for vehicle miles traveled (VMT).

\textsuperscript{16} VMT is based on average annual daily traffic counts for a given street or roadway and the total length of the road type being counted (CAPS, 2005).
The software allows the user to enter VMT data by fuel and vehicle type. However, in most cases this information is not available. Therefore, it is recommended by ICLEI that the defaults for the fuel/vehicle split be used. The defaults are based on recent census data of vehicle ownership and type of fuel being consumed. The vehicle default is a weighted mix of all size classes of automobile as well as sport utility vehicles and pickup truck. Both fuel economy (expressed in miles per gallon) and emission factors are weighted based on the following vehicle mix:

- Auto – Full-Size / SUVs / Pick-ups = 36.4%
- Auto – Midsize = 18.8%
- Auto – Compact / Sub-compact = 44.8%

(CAPS, 2005)

If VMT data is unavailable, there is an additional function of the software known as the VMT calculator, which is what was used to determine VMT. The VMT calculator can calculate annual VMT based on annual average daily traffic counts by road type and total length of each of those road types within a community. The software then multiplies the daily VMT by 365 (365 is the number of days in a year) to give an annual VMT. This number is then transferred to the transportation assistant, which will then determine pollution output numbers based off of the annual VMT.

While carbon dioxide emissions vary quite directly with the amount of fuel consumed and can therefore be specified in terms of emissions per unit of fuel burned, criteria pollutant emissions are not so directly tied to the quantity of fuel consumption. Air pollution emissions and emission standards for vehicles are more often expressed in emissions per vehicle-mile, without reference to the fuel efficiency of the vehicle. Two vehicles with very different fuel efficiencies could have similar air pollution emissions per mile traveled and conversely, two vehicles with similar pollution emission profiles could have quite different fuel efficiencies.

The software provides average transportation emissions of greenhouse gases and air pollutants that are based on actual average emissions of the entire on-road fleet of each vehicle type. However, when it comes to emissions associated with particular vehicle standards, greenhouse gas emissions are computed based on fuel efficiency and criteria pollutants are computed based on vehicle miles of travel.

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17 Traffic counts do not need to be done on all roads to determine VMT for a community. Only major roadways and streets need to be counted in order to obtain an accurate estimate of VMT. Further explanation can be found in the CAPS user manual.

18 “The quantification framework for the transportation sectors in the software is based on a simple equation for describing the impact of a particular measure or strategy” (CAPS, 2005). Emissions = Vehicle Miles traveled X Emissions per Vehicle Mile. The two terms in this equation break down even further.

VMT = Average Daily Traffic X Road Length. The second factor Emission/VMT also breaks down to separate factors describing the fuel efficiency of the vehicle and the emissions intensity of the fuel being used. Emissions per VMT = Fuel Efficiency (miles per US gallon) X Emissions per Unit of Fuel (the fuel type factor) (CAPS, 2005).
Data Collection

To determine a baseline of emissions for the transportation sector, vehicle miles traveled (VMT) data for the Town of Belmont must be entered into the software. However, the town of Belmont does not keep VMT records. Since this is a common problem for many communities, the software has a feature that enables the user to determine VMT. To determine VMT, data was collected on traffic count studies that had been done for major streets. Knowing traffic count numbers by road type and the length of the road the traffic count was done on, allows the user to determine VMT. Traffic count data for major streets has been included in Appendix F.

We were able to obtain traffic count data from the Town of Belmont for the year 2005, which allowed us to determine VMT for that year. However, we also needed traffic count data for the year 2001 (our baseline year), which was not available from the town.

To determine VMT data for 2001, a 1.0 percent per year compounded annual traffic growth rate was used. A 1.0 percent annual growth rate was used because of a traffic impact and access study conducted by Vanasse & Associates, Inc. (done in 2005 for O’Neil Properties for a proposed residential development) which determined a 1.0 traffic growth rate for the Town of Belmont.

To obtain VMT numbers for 2001, we subtracted a 1.0 percent compounded growth rate from the 2005 traffic count data to obtain 2001 traffic count data. Doing this allowed us to obtain the 2001 VMT numbers. When 2001 and 2005 VMT numbers were entered into the software, they produced the following pollution output numbers:

<table>
<thead>
<tr>
<th>Years</th>
<th>CO₂ (tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>219,666</td>
</tr>
<tr>
<td>2005</td>
<td>228,678</td>
</tr>
</tbody>
</table>

Although we did not have exact VMT data for the above-mentioned years, the pollution output numbers are assumed to be correct based off of the validity of the source, the logic behind a 1.0 percent yearly traffic growth rate, and because these numbers were compared to the Sustainable Arlington plan and the two sets of data were comparable.

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19 This study looked at historical traffic volume data compiled by the Massachusetts Highway Department from permanent count stations and historic traffic counts that were done in the town. This data was reviewed in order to determine general traffic growth trends. Vanasse & Associates determined that traffic volumes within the town of Belmont have fluctuated over the past several years, ranging from increases of approximately 8 percent to decreases of approximately 11 percent depending on the time of year. Traffic volumes for the town were projected to the year 2010, which reflects a five-year planning horizon, consistent with state traffic study guidelines. Then independent of any proposed building project in Belmont, a traffic volume growth rate was determined by using existing traffic data and projecting new traffic resulting from background traffic growth. In order to account for future traffic growth and unforeseen development within the study area, Vanasse & Associates determined that a 1.0 percent per year compounded annual traffic growth rate was appropriate when forecasting future traffic growth in the town of Belmont.
Existing Measures and Recommendations:

1. No-Idling Policy

   The idling of vehicles has an impact on our environment and is a preventable contributor of pollutants and GHGs in the atmosphere. Nationwide, 11 million tons of carbon dioxide, 200,000 tons of oxides of nitrogen and 5,000 tons of particulate matter are emitted annually (U.S. Environmental Protection Agency, 2006). The idling of vehicles at schools, the post office and even in private driveways has an impact on the amount CO\textsubscript{2} that is released into the atmosphere. Although it is impossible to measure the amount of idling that occurs in Belmont, it is assumed that idling occurs and should therefore be addressed because idling is easily preventable.

   To help combat the problem of unnecessary idling, the Commonwealth of Massachusetts has mandated a five minute maximum idling time for vehicles (EPA, 2006a). For Belmont to reduce CO\textsubscript{2} emission through unnecessary idling, the town should institute a public awareness campaign and enforcement program to promote this law. To promote public awareness, the town could post anti-idling signs in all town parking lots and public school drop off and pickup points. Signs could say things like “This is an Anti Idling Zone” or “Do you realize that one minute of idling causes more fuel to be burned than re-starting your engine.” (EPA, 2006a) The Town of Belmont should establish an idling enforcement program. This could be done through existing parking ticketing agents employed by the town. By reducing the amount of idling time of vehicles within the town of Belmont, there would be an annual reduction equal to tons of carbon dioxide.

2. Traffic Calming

   The Town of Belmont should consider the installation of traffic calming devices throughout the Town of Belmont. Traffic calming devices are physical additions to roadways that are designed to reduce traffic on a given road, such as speed bumps and raised crosswalks. Installing these devices in key intersections throughout the town would have a two-fold effect. One, installing traffic calming devices at key intersections would make it less desirable for residents of neighboring towns to use the streets of Belmont as cut-through streets while on their way to a destination outside of Belmont, thereby reducing the pollution created by cars because fewer cars would be entering Belmont. Two, installing traffic calming devices would not only reduce the overall amount of traffic in Belmont, but they would also have the effect of slowing the speed of traffic. Cars traveling at lower rates of speed burn less gasoline and this would translate in less pollution being emitted from the transportation sector. Slower traffic and less of it would also make it safer for pedestrians to walk or ride their bikes.

   Depending on the street, the Town of Belmont should consider installing the following devices in the table below to encourage the reduction of cut-through traffic, slow traffic promotes pedestrian safety:
Table 6-3. Traffic Calming Measures and Implementation Costs

<table>
<thead>
<tr>
<th>Traffic Calming Measure</th>
<th>Explanation</th>
<th>Construction Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed Hump</td>
<td>A narrow, slightly raised area crossing travel lanes.</td>
<td>$2,000-$3,000</td>
</tr>
<tr>
<td>Choker</td>
<td>A physical curbside constriction narrowing a travel lane.</td>
<td>$7,000-$10,000</td>
</tr>
<tr>
<td>Traffic Circle</td>
<td>An elevated area in the middle of an intersection; Provides counterclockwise traffic flow.</td>
<td>$3,500-$15,000</td>
</tr>
<tr>
<td>Raised Crosswalk</td>
<td>A raised hump with a 10-foot-wide flat top.</td>
<td>$2,500-$8,000</td>
</tr>
<tr>
<td>Raised Median Island</td>
<td>An elevated area in the middle of a roadway.</td>
<td>$5,000-$15,000</td>
</tr>
<tr>
<td>Crosswalk Refuge</td>
<td>A raised median in the middle of a roadway, with a cut for the crosswalk.</td>
<td>$5,000-$15,000</td>
</tr>
<tr>
<td>Chicane</td>
<td>Alternating curbside constrictions channel travel in a snake-like fashion.</td>
<td>$5,000-$15,000</td>
</tr>
</tbody>
</table>

(Arlington Sustainable Action Plan, 2005)

3. Safe Routes to School Program

The Safe Routes to School Program is a national program that encourages students to walk, bike or use other human-powered modes of transportation to travel to and from school. The benefits of this program include increased physical activity, less traffic congestion around schools, safer streets, and improved air quality.

The program has four components (Safe Routes to School Program, 2006):

- **Encouragement** - Events, contests and promotional materials are incentives that encourage children and parents to try walking and biking.

- **Education** - Classroom lessons teach children the skills necessary to navigate through busy streets and persuade them to be active participants in the program.

- **Engineering** - Examine the physical barriers that prohibit children from safely navigating the routes to schools. The program partners with engineering experts who can assist the town of Belmont in learning how to evaluate streets and provide the tools to create a safer environment.

- **Enforcement** - Partner with law enforcement to increase the police presence around schools. Driver’s education is even more effective in changing the
behavior of hurried parents and commuters who are not paying attention to the children on the roads.

Cities with existing programs have experienced reduced traffic congestion, reduced collision in and around schools, reduced idling of vehicles in and around schools and decreased speed in residential neighborhoods. National studies done on morning traffic have found that, 21-27% of morning traffic is attributed to parents driving their children to school (Safe Routes to School Program, 2006). An effective Safe Routes to Schools program would have a noticeable impact on the reduction of CO$_2$.

4. Federal Tax Incentives for Clean Fuel and Electric Vehicles

The Town of Belmont should implement a public awareness campaign to advertise the availability of tax credits for ownership of both clean fuel and electric vehicles. “Qualifying electric vehicles and clean-fuel vehicles (including gasoline/electric hybrids) purchased new are eligible for federal income tax incentives” (United States Department of Energy, 2006).

- Clean-fuel vehicles: One-time tax deduction up to $2,000
- Electric vehicles: One-time tax credit up to $4,000 per vehicle

5. Infrastructure Improvements for Bicycles

Encouraging residents to use their bicycles would help reduce traffic in Belmont and thereby reducing the total amount of CO$_2$ emissions every year. Half of all trips nationally are three miles or less, with many under one or two miles (Lib Municipal Resources Bicycling Group, 2006). This is a short travel distance for much of the population and residents should be encouraged to use their bicycles for such short trips. The best way to encourage people to use their bicycles around town is to improve the overall infrastructure for bicycles. The following measures would encourage the use of bicycles:

- Clearly marked bike lanes on major streets and through fares
- Widen roadways to accommodate both bikes and cars
- Adopt bicycle-parking ordinances that specify a minimum level of bicycle parking for different building types and land uses
- Place bike racks at public parking lots and schools
- Improve sidewalks to accommodate bicycling
6. Enforcement of Traffic Laws

Existing traffic laws should be strictly enforced. Strict enforcement of such laws as speeding, reckless driving, crosswalk violations and vehicle registration would encourage people to follow the law and reduce the amount of cut-through traffic. The reduction of cut-through traffic and improved safety would allow residents to feel safer when bicycling or walking. The reduction of cut-through traffic and increased walking or bicycling would have a two fold effect on CO\textsubscript{2} emissions.

7. Ride Share Program

The Town of Belmont should implement a ride share program that encourages residents to carpool to work. This could be done by creating a ride share link on the town’s website or by creating a ride share bulletin board that is available to the public at the town office. Either would provide information on where people are commuting to and from and if they have space for another person to commute with them. The town could also encourage ride sharing by setting aside free parking spaces at municipal parking lots for people who carpool and vanpool to work on a daily basis. Implementing a ride share program would decrease the amount of traffic congestion, which would reduce air pollution and decrease fuel consumption (Massachusetts Department of Environmental Protection, 2006b).

8. Transportation Options Center

The Town of Belmont should put together a Transportation Options Center for residents and make that information available on the town’s website. The Transportation Options Center would highlight for residents alternative modes of transportation such as available ride shares, MBTA train schedules and maps and information regarding the best and safest walking and bicycle paths (Arlington Sustainable Action Plan, 2005, p. 36).

9. Vehicle Trip Reduction Ordinance

The Town of Belmont should consider passing a Vehicle Trip Reduction Ordinance, which mandates bicycle and pedestrian programs and other measures to reduce motor vehicle travel. Although it is impossible to measure emissions benefits from such an ordinance, this would be a step in changing the modal culture of Belmont.

10. Provide a mass transit shuttle van

Consideration should be given to providing a mass transit shuttle van for the residents of Belmont. A mass transit shuttle van would provide regular service to the nearby T stops and commuter train stops, as well as between Belmont’s commercial centers. The van would have several centrally located pick-up and drop-off points in the town and provide either free or very low cost rides to. This would encourage and promote the availability and accessibility of mass transit for Belmont residents to public transportation.
Summary

The transportation sector accounts for over 50 percent of all CO₂ emissions in the Town of Belmont. For the town to effectively reduce CO₂ emissions in Belmont, it is imperative that a number of the measures listed above be implemented in some shape or form. Although specific CO₂ reduction amounts are not listed for the reduction strategies listed above, we recommend that a CO₂ reduction analysis and a cost benefits analysis be done for the next phase of this project. This will allow the Town of Belmont to determine which transportation strategies will prove most effective in reducing CO₂.
VII. WASTE AND RECYCLING

Solid Waste

The Department of Public Works manages Belmont’s residential solid waste and recycling program. Solid waste is picked up weekly and is taken to North Andover, MA, where it is incinerated to produce electricity, as opposed to placed in a landfill. Incinerators produce a large amount of CO$_2$, contributing to greenhouse gas emissions as well as other harmful pollutants. Also, CO$_2$ in Belmont is increased because of the transportation of the waste to North Andover.

Commercial businesses in Belmont are responsible for contracting their own waste haulers.

Recycling

Recyclable items from the residential sector are picked up bi-monthly and taken to an incineration facility in Charlestown, MA, which is managed by the Casella Waste Systems, Inc. According to a paper by Choate, Pederson, Scharfenberg, and Ferland (2003), recycling reduces the amount of waste that is being incinerated, uses less energy and produces less CO$_2$ than when a new product is made from raw material. However, it should be noted that as with the transportation of solid waste, CO$_2$ is emitted within Belmont when the recyclable material is transported to the incineration facility.

According to the Town of Belmont, MA, recyclable items include the following (2005)$^{20}$:

- Mixed Paper - junk mail and mixed paper, cereal boxes, pasta boxes, snack boxes, newspapers with inserts, magazines, catalogs, soft cover books, telephone books, insides of hardcover books. Does not include corrugated cardboard.

- Plastic - containers labeled #1, #2, #3, #4, #5, #6 or #7. Plastic rings and covers may stay on. Does not include motor oil or chemical containers, plastic bags, styrofoam or any unmarked plastic.

$^{20}$“Commingled” will be the term used to group together Plastic, Glass, Metal and Aluminum recyclables.
• Glass Bottles / Jars - glass bottles and jars with corks removed. Does not include broken or other glass such as light bulbs, window or auto glass, dishes, glasses, Pyrex or china.

• Metal Cans and Lids, Clean Aluminum Foil and Tins – Does not include cans containing hazardous material, paint, or aerosol.

• Yard Waste is defined as leaves, twigs, grass, weeds flowers, wood chips, plants, hedge & shrub pruning 1" or less in diameter and other easily raked yard waste.

Yard Waste is collected every other week from April to October, and weekly from November to the beginning of December. It is not collected from December to March. Residents of Belmont also have the option of bringing their yard waste to Belmont’s old incinerator site, or taking it directly to Landscape Express in Woburn, MA, where it is composted and recycled.

Currently, commercial businesses are not required by the Town of Belmont to engage in recycling programs.

**Methods**

Residential waste and recycling data was provided by Belmont’s Department of Public Works. Monthly data was collected for the years 1998 through 2005. It is reported in tonnage and divided into the following categories: solid waste, mixed paper, commingled and yard waste.

Commercial businesses in Belmont are not included in municipal collection, and therefore, are responsible for contracting their own waste haulers and disposal companies. There are many different waste companies that businesses hire in Belmont, so it would be a daunting task to find out which company to contact for each business. It would be more efficient for each commercial business to request the information of their waste collection companies. It is uncertain if they have the necessary data specific to towns or even businesses. A letter is attached in Appendix G that Sustainable Belmont can use to engage the business community in the project and introduce to them the committee and the Climate Action Plan.

Because commercial businesses are not required to participate with a recycling program, no recycling data was collected this area.

**Data Analysis**

CO₂ emissions from waste in Belmont totals 1,768 tons in 2001, which accounts for 0.4% of Belmont’s total CO₂ emissions. Although the percentage is not high, the CO₂ emissions still exist. Additionally, there are many specific strategies that Belmont can utilize to reduce emissions in this sector.

As shown in Table 7-1, total residential waste in the baseline year (2001) is 14,292 tons. 68% of the total waste is incinerated, and 32% is recycled (14% is mixed papers, 5% is commingled and 13% is yard waste).
Table 7-1: Residential waste produced by the Town of Belmont in 2001 and 2005

<table>
<thead>
<tr>
<th>Product</th>
<th>Total in Tonnage</th>
<th>Percentage of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid Waste</td>
<td>9703</td>
<td>68%</td>
</tr>
<tr>
<td>Mixed Papers</td>
<td>1951</td>
<td>14%</td>
</tr>
<tr>
<td>Commingled</td>
<td>725</td>
<td>5%</td>
</tr>
<tr>
<td>Yard Waste</td>
<td>1908</td>
<td>13%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>14287</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Product</th>
<th>Total in Tonnage</th>
<th>Percentage of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid Waste</td>
<td>8838</td>
<td>75%</td>
</tr>
<tr>
<td>Mixed Papers</td>
<td>1217</td>
<td>10%</td>
</tr>
<tr>
<td>Commingled</td>
<td>559</td>
<td>5%</td>
</tr>
<tr>
<td>Yard Waste</td>
<td>1175</td>
<td>10%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>11789</strong></td>
<td><strong>100%</strong></td>
</tr>
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</table>

In interim year of 2005, total residential waste is 11,789 tons. 75% of the total waste is incinerated and 25% is recycled (10% is mixed papers, 5% is commingled, and 10% is yard waste). Although, the total waste decreased by 2,503 tons of waste, notice that less of the total was recycled, 32% in 2001 down to 25% in 2005. This can be seen in the figure 7-1.
In order to determine the CO₂ output that Belmont generates from residential waste, the CACP software requires input of what actually comprises the solid waste. As a result, Garrett Fitzgerald, Program Officer from ICLEI, recommended estimates typical of U.S. waste streams to input into the software, because this was not provided by the Department of Public Works. These include the following percentages, 38% paper products, 13% food waste, 10% plant debris, 4% wood and textiles and 35% other waste, as shown in Table 7-2.

The Town of Belmont currently engages in a recycling program, which reduces its greenhouse gas emissions generated from the incineration process. Therefore, data was input into the software to generate two numbers for CO₂ output. The first total is the worst-case scenario for 2001, which is if Belmont did not engage in any residential recycling program. The result is emissions of 3,170 tons of CO₂. It was then determined that the current recycling program reduced the CO₂ output by 1,472 tons of CO₂ to 1,768 tons of CO₂.

According to the CACP output, the 1,908 tons of yard waste composted in 2001, generated (-) 385 tons of CO₂. In 2005, 1,175 tons of yard waste composted generated (-) 237 tons of CO₂. The reason for this is that yard debris is composted, and composting, when managed correctly, can actually store carbon.21

| Table 7-2. Carbon dioxide emissions from residential waste disposal for baseline year (2001) compared to 2005. Two scenarios are shown, With Recycling is actual data and Without Recycling is what the CO₂ output would be without Belmont’s current residential recycling program |
|---|---|---|---|---|
| | 2001 Without Recycling | 2005 Without Recycling |
| Total Waste (tons) | 14,287 | Total CO₂ (tons) | 3,170 |
| Total Waste (tons) | 11,789 | Total CO₂ (tons) | 2,616 |
| Total Waste (tons) | 9,703 | Total CO₂ (tons) | 1,768 |
| Total Waste (tons) | 8,838 | Total CO₂ (tons) | 1,961 |

Data for 2005 was also collected. However, data for solid waste for the months of August and September were unavailable. As a result, an average of the solid waste for the month August for years 2001, 2002, 2003 and 2004 was used. The same method was used to determine an estimate of solid waste for the month of September 2005.

It should be noted that the Department of Public works also provided collection and disposal costs. The tipping fee for solid waste disposal was reduced for the Town of

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21 According to the EPA, “EPA found that compost leads to long-term carbon storage in degraded soils. Compost from yard trimmings applied at various rates to depleted agricultural soil for 10 years was able to restore some of the carbon lost during cultivation. … EPA also noted that carbon dioxide emissions during decomposition "do not count" towards national inventories of greenhouse gas emissions submitted annually to the United Nations Framework Convention on Climate Change. According to internationally accepted rules, these emissions are considered part of the natural carbon cycle and are not a reflection of human activities (EPA, 2000c).
Belmont in 2005 from $138 per ton to $64 per ton. At this time, it is undetermined what effect this decrease will have on solid waste generated by Belmont.

**Recommendations**

1. **Existing Measures:**

   The Town of Belmont was awarded a Municipal Waste Reduction Grant from the Massachusetts Department of Environmental Protection. They will receive 100 kitchen scrap buckets for home composting bins and 100 wheeled recycling carts for use in schools and businesses. The grant’s monetary value is $6,533. This is a big honor for Belmont and will help in their efforts (Belmont Citizen Herald, 2006).

   Recommendations include the following:

2. **Minimize Waste**

   Belmont can use a variety of techniques to decrease its overall waste. Collaboration with Belmont’s Recycling Committee is encouraged. Town members came up with other good ideas to achieve this in community outreach meetings. Their ideas for reducing waste include:

   - Encourage the use of cloth napkins instead of paper
   - Encourage composting
   - Encourage cloth shopping bags at supermarkets
   - Buy plastic or glass reusable bottles for refilling liquids
   - Encourage the use of lunch boxes instead of paper bags
   - Use reusable plastic containers for sandwiches instead of wrapping individually with disposable materials (such as plastic wrap or foil)

3. **Pay As You Throw Away**

   Pay-As-You-Throw programs differ from standard waste pick-up in that people pay for the waste based on the amount. According to the Environmental Protection Agency, 112 towns and cities in MA have already instituted the Pay as You Throw Away program, including small towns like Gill and Savoy, and larger towns and cities like Northampton and Worcester (EPA, 2006b). On average, recycling rates are 13 percent higher, in communities with the program, than those without it (Massachusetts Department of Environmental Protection, 2006a). The way the program is most often instituted is that residents pay per bag of waste that the city hauls, as opposed to a flat
Specific guidelines vary, but typically towns charged fifty cents to two dollars a bag. This plan can help to decrease waste and increase recycling. It also increases fairness, since people only have to pay for what bags are taken; the more you waste, the more you pay, and the less you waste, the less you pay. In 2003, the town of Belmont attempted to implement this program, but residents were not in favor of it. So the program was not approved. Belmont should bring this proposal back to the community, explaining its importance. The town should make it clear that the program promotes fairness, rather than unfairness. This would be a valuable step towards waste reductions for the town of Belmont (Town of Belmont, Massachusetts, 2004). It should be used in conjunction with the following recycling incentive programs.

4. Recycling Incentives

Encourage recycling with incentive techniques, such as the MassRecycle Awards Program. In this program, businesses, individuals, institutions and municipalities can be nominated for their excellence in recycling (MassRecycle, 2005). Rewarding for achievement in behavior change is an example of social marketing. Sustainable Belmont could initiate this feedback by nominating community members and businesses that excel in recycling.

As shown in Table 7-2, recycling greatly reduces the CO₂ output. However, according to the data from the Department of Public Works, recycling rates have decreased when comparing the interim year to the baseline year. Therefore, it is important to increase recycling rates throughout the Town of Belmont. A new program, pioneered in Philadelphia by a nonprofit called RecycleBank could eventually be adopted in Belmont. RecycleBank started in Philadelphia in January 2006 (RecycleBank, 2006). The organization increases recycling rates by paying people to recycle. People participating in the program (now only a few trial neighborhoods), are given one bin to put all the recyclables, and then, based on the weight of the bin, earn “recycle bank dollars.” These dollars can add up to a total of $400 annually, are in the form of donated coupons or discounts from local businesses. In one of the trial neighborhoods, Chestnut Hill, the recycling rate has risen from 10 percent to 50 percent. There are plans to expand the program to other neighborhoods. The City of Philadelphia benefits from the reduced amount of trash, and therefore pays RecycleBank half of its savings (Environmental News Network, 2006). This program also serves as a great social marketing technique because it makes recycling easy and provides a specific incentive for individual households to participate.

5. Commercial Recycling

Require commercial businesses to develop and implement recycling plans. The City of Cambridge implemented commercial recycling regulations in 1991, at the same that they enforced residential recycling. Cambridge can be used as an example, and this bylaw can be found on the city’s website (The Cambridge Department of Public Works, 2003).

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22 The other method is billing people each month based on the weight of their weight. This method is infrequently used.
WasteCap is a Massachusetts-based nonprofit that offers a number of recycling related services, which includes site visits to individual businesses and institutions to facilitate the creation of a recycling plan. WasteCap also has a Recycling Assistance hotline, and a cell phone and ink cartridge recycling program (WasteCap, 2005).

6. Composting Program

Belmont could have a community compost that would serve as a demonstration composting for town members. Residents could bring their compost there and in turn, could receive the soil it creates. Because composting can even store carbon, it can serve as a great way for communities to reduce their waste, while recycling organic matter and contributing to the production of new plants.23

7. Purchasing Choices

Belmont can encourage community members to start thinking about items that they can buy that come with less packaging. Buying in bulk, and buying groceries that are not individually wrapped will create less waste.

Summary

Although the waste sector does not make up much of Belmont’s total CO\(_2\) emissions (with only 0.4%), the emissions of this sector will increase when commercial waste data are obtained. Additionally, this is a sector where reductions can be made through many different programs and initiatives. There are several significant changes that Belmont has the capacity to make fairly easily, such as encourage purchasing choices that reduce waste. Other programs that may take longer to implement include, the enforcement of commercial recycling, a Pay-As-You-Throw-Away Program and Recycling Incentive programs. These programs will help reduce emissions considerably, as towns that already participate in these programs have proven.

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23 To dispute the sometime proposed conjecture that composting releases methane, the EPA states that “Composting, when managed properly, does not generate methane emissions. Properly managed compost is aerated and turned to ensure aerobic decomposition (i.e., decomposition in the presence of oxygen). As long as the yard trimmings decompose aerobically, methane is not generated. Researchers noted that even if methane is generated in anaerobic pockets (i.e., oxygen-devoid pockets) in the center of the compost pile, the methane is most likely oxidized when it reaches the oxygen-rich surface of the pile” (EPA, 2000c).
VIII. COMMUNITY BASED SOCIAL MARKETING

Community participation in Belmont’s Climate Action Plan and strategy reductions will be essential in order for Belmont to reach its target reduction goals. In many cases, this will involve a change of behavior for residents and businesses, which people often do not welcome. Sustainable Belmont (SB) will have to execute Community Based Social Marketing (CBSM) approaches to encourage community members to jump onboard. CBSM is a practical methodology that, when implemented, has proven to have a high likelihood of affecting or changing personal behavior (McKenzie-Mohr, Smith, 1999).

CBSM is based on the idea that understanding why people reject new behavior and why they may want to accept it is key to influencing the behavior change. There are generally three reasons why people do not engage in an activity: people do not know about the activity or its benefits, people know about the activity but perceive barriers to engaging in it, or that people may not perceive barriers to engaging in the activity, but their present behavior is simply easier. An example of each of the three reasons are illustrated with a behavior change of walking to work: someone may not know there is a quick, safe route to their workplace; or, they may know of it, but believe they would have to deal with bringing a change of shoes, and not have breakfast with their family in the morning; or, they may know of it but just prefer the ease of driving. The CBSM approach takes into consideration these key principles and helps promoters of new behavior understand what barriers and benefits accompany various behavior changes.

As Belmont proceeds with carrying out the Climate Action Plan, numerous members of the Belmont community will have to help. Sustainable Belmont will not be able to achieve its goals without support from community members, businesses and municipal sections of the town. Little changes that everyone makes will add up to a significant change for the town. Yet, there are barriers that people may face that may disrupt their willingness to participate. Understanding what the perceived barriers are and what the benefits could be is crucial. For example, if Sustainable Belmont’s goal was that everyone replaces one bulb with an energy-saving bulb, barriers could be that people do not know where to buy them, they are too expensive, or that they have not even heard of this type of bulb. Benefits could be replacing the bulbs less frequently and saving on energy bills.

Once Sustainable Belmont understands both the barriers and benefits of the behavior change, they will be better able to persuade community members to change their light bulbs. One possible way that SB could balance these particular barriers or benefits would be to offer free energy-saving light bulbs or coupons for them, as well as provide captivating information about their longer life span and lower energy cost. This is a simple example, but it illustrates how understanding perceived barriers and benefits has the potential to more quickly facilitate behavior change.

After identifying what the perceived barriers and benefits could be, the next step is communicating the new activity to the public in a way that may influence behavior change. During this process, it is essential to keep in mind the barriers and benefits that people will be reacting to.
Communicating the New Ideas

Community Based Social Marketing operates under the notion that people are not likely to change behavior when only one of the following has occurred:

- They have received new information about an activity (such as changing a light bulb).
- Their attitudes about an activity have changed (such as realizing that energy-saving light bulbs may save them money or help the environment).
- They have been informed of financial advantages associated with a behavior change.
- These events alone will not persuade people to change behavior, but rather, when used together and in conjunction with the strategies mentioned below, behavior change is much more probable. (McKenzie-Mohr, Smith, 1999, 7-12)

There are some other significant facets to the CBSM approach that are essential to be aware of before this approach can be successful. The following elements of the approach will be explained in further detail in the following sections: captivating information, commitment, what the message is and who the messenger is, prompts, models, feedback, incentives and convenience.

1. Captivating Information

In order to get people to want to change their behavior, you first have to capture their attention. An effective way to do this is to “present information that is vivid, concrete and personalized” (McKenzie-Mohr, Smith, 1999, 84). This kind of presentation will also help people to remember the information at a later time. Some examples of presenting information vividly that Sustainable Belmont may want to use are as follows:

- To convey amounts (like tonnage of waste or recycled products), use concepts that reference something visual. For example, if Belmont recycles 10% more, the amount of waste that Belmont will divert from a landfill in 2007 would be enough to fill the local Pizza Shop.
- To convey where people are using the most resources in their homes, prepare a chart that shows people how much energy use or water use comes from each household activity. Use pictures of the items (like a stove or a sink faucet) instead of the usual bars for the chart.
2. Commitment

Obtaining commitments is a good way to get people onboard a new project or activity. Studies have found that people who have committed to an activity are more likely to partake in the activity, such as recycling. If a household has promised to recycle 10% more of their waste, they are more likely to follow through with it. A written promise has also proved more successful than verbal commitments. Public or group commitments are also useful (i.e. publicizing people’s names, under their consent, who have committed or getting entire groups to commit, like Vision 21). As with all techniques proposed by the CBSM method, it should be combined with other techniques (McKenzie-Mohr, Smith, 1999, 58).

One suggestion for Sustainable Belmont would be have a sign up sheet at an event for a commitment to a certain activity, informing people that their names will be published in a Vision 21 newsletter appreciating them for their participation in the activity.

3. The Message and the Messenger

Be sure the source asking the public to take new measures is a source that can be trusted by community members. Credible sources are much more likely to influence change than unknown or non-credible sources.

Equally important as who brings the message, is how the message is framed. Messages that clearly explain what could happen if actions are not taken (threatening messages) must be balanced with messages that explain what benefits will come if actions are taken (hopeful messages). Threatening messages that do not also empower people will have little effect on influencing change. It is when people feel they can make a difference and have some control that they will change their behavior (McKenzie-Mohr, Smith, 1999, 89-92).

Sustainable Belmont would not want to alarm people about global warming into a state of panic or (oppositely) indifference or homelessness; but rather, bring attention to the problem and then focus on ways people can make a difference. Here, using some of the aforementioned visual tools to show how much waste can be diverted from landfills if everyone recycles a little more.

4. Prompts

Messages that are easy to remember are more likely to influence change. Vivid messages play a role in this, but also, prompts can help people to remember the message daily (McKenzie-Mohr, Smith, 1999, 94).

For example, Sustainable Belmont could make magnets that can be placed on refrigerators reminding people what can be recycled. Anti-idling signs also serve as prompts to remind people to turn their cars off. Sometimes, when changing behavior, people need these kinds of cues.
5. **Models**

Modeling entails demonstrating the behavior that is wished to be adopted by a greater public. The more people see an activity happening, the more credible the activity becomes (McKenzie-Mohr, Smith, 1999, 96). People who are already engaging in an activity can also talk to other community members about this new activity. This can get people thinking about and aware of a new activity.

For example, if everyone on a given street has a blue recycling bin out next to their garbage except for one person, that person is likely to change their behavior to be more representative of the models’.

Another way that Belmont can model new behaviors is to conduct a tour of LEED certified homes, or other buildings that utilize energy-saving measures.

6. **Feedback**

Feedback has proved crucial in many studies to ensure that people continue to engage in an activity. People want to know that they are doing better than before, almost like competing with themselves. For example, households who received feedback about their daily energy usage were more likely to use less. When number of cans recycled is posted, the number recycled increases dramatically (McKenzie-Mohr, Smith, 1999, 101).

Also useful, are signs or references in newsletters about how well the community has been doing in a certain activity. For example, placing a sign in the downtown saying that residents in Belmont reduced their waste by 5% in only one year! (Or whatever good news can be reported at a given time.)

7. **Incentives**

Incentives can be helpful in motivating people to engage in new activities, or change behavior. Financial incentives, as well as incentives having to do with social approval, can be useful. Fees for garbage collection have been used frequently (McKenzie-Mohr, Smith, 1999, 103). Another option is an Award Program in Massachusetts that grants awards to those who have been the most devoted recyclers, in categories like residences and businesses. Last years nomination form can be found at [http://www.massrecycle.org/ApplicationNominationMassRecycle_2005.pdf](http://www.massrecycle.org/ApplicationNominationMassRecycle_2005.pdf).

8. **Convenience**

This is simple; make changing behavior more convenient than not changing behavior (McKenzie-Mohr, Smith, 1999, 118). For example, many states have created carpool lanes. People get to bypass traffic if they are not driving alone.

Belmont may want to create convenient parking spots in busy locations for carpoolers. Another example is to make recycling fluorescent light bulbs (due to their mercury content) more convenient by having bi-annual pick up or drop off days for those items at a known location in town.

One idea for Belmont that would incorporate many of the Community Based Social Marketing techniques is to hold a town event. This could be an opportunity for the
town of Belmont and Sustainable Belmont to show support for changes people are making and to educate about some of the issues that may be new to community members. The event should be informal and informational. Handouts should be given out if possible. The event could be called “Climate Day,” or “Energy Day,” or something that reminds people every time they hear it that the event is for this purpose.
IX. NEXT STEPS

While an extensive compilation of data has been done for this paper, the data is not entirely complete. The heating oil, natural gas, transportation and waste data can all be refined and/or completed for the baseline year. For instance, the heating oil and waste sections do not include any commercial numbers. In addition to the baseline year, other years should also be studied including an interim year (2005) and future years in order to help evaluate trends and the progress that the town is or isn’t making in achieving the to-be-determined goal of the yet-to-be drafted climate action plan.

A. Electricity

The electricity baseline inventory numbers have been collected, reviewed and processed, however research into potential reduction strategies should remain ongoing.

- Sustainable Belmont should meet with BMLD to learn more about green-electricity purchasing programs and to see if the opportunity to conduct a green-purchasing survey is possible.
- Conduct a cost-benefit analysis on different green electricity purchasing measures.
- Get public feedback on different reduction strategies at public meetings and other forums.

B. Heating Oil

In order for the Town of Belmont to draft a climate action plan that includes accurate data about heating oil, more complete data is required. To acquire this data, perhaps a survey of residents and businesses within the town is appropriate. The survey could also be used to obtain more complete information about natural gas usage. For instance, the survey could be used to determine the following information:

- What is your heating source?
- If you have a furnace, how old is that furnace?
- If you know, what is the efficiency rating of the furnace?
- If you have installed your furnace within the past five years:
- When was it installed?
- Did you use the same fuel source before installing the new furnace? If no, what fuel source did you previously use?
• Was the efficiency rating of the new furnace a consideration when determining which furnace to buy? If yes, on a scale of 1 to 5, how important was the consideration?

• Approximately how much fuel do you use during the course of one year?

While the town’s Assessor’s office may have some of the aforementioned information, the mailing could be used as a valuable social marketing tool. At the moment, the survey would be especially helpful in determining the commercial sector’s use of fuel oil; at the moment, no data is available that would help determine the number of businesses that use fuel oil. Once again, this could change with the release of the Assessor’s report.

C. Natural Gas

The next steps for the natural gas section will be critical in evaluating the recommendations and determining future reduction targets:

• Gather natural gas consumption data (Therms or millin Btu) for each of the following for the year 2001: Residential – Heat, Residential Non-Heat, Commercial/Industry – Heat, Commercial/Industrial Non-Heat. Existing data includes total consumption (therms) for the residential sector and the total consumption for the commercial sector, as well as the number of meters for heat and non-heat within each. This data will allow the Town of Belmont to know the difference between natural gas consumption for those who use it for heat, and those who do not use it for heat.

• Collect interim year data for the year 2005. This will include the total energy consumption due to natural gas (therms or million Btu) as well as the number of meters for the following: Residential – Heat, Residential Non-Heat, Commercial/Industry – Heat, Commercial/Industrial Non-Heat.

D. Transportation

Several additional steps need to be taken to complete the transportation analysis and provide Sustainable Belmont with an effective implementation plan.

• The town government should be encouraged to do additional traffic count studies on all of the major streets in Belmont. Additional traffic count data would provide an even more accurate pollution output number for the transportation sector.

• A reduction analysis and a cost benefits analysis should be done for the proposed transportation reduction strategies. This will allow Sustainable Belmont to determine which proposed measures would be most effective for the town.
• Additional community forums should be held to consider the proposed reduction measures and to solicit new ones.

### E. Waste

There are several steps that Belmont can take to continue the efforts to minimize the town’s waste. The following steps will help Belmont proceed:

• Follow up with Ken Siskind, Belmont Solid Waste and Recycling Committee Chairman in 2003. (Or contact relevant current position)

• Ask him:
  
  • Why Belmont didn’t approve Pay-As-you-Throw-Away Program in 2003 when it was proposed?

  • How could the program be adjusted to gain town approval?

  • What is the feasibility of regulating a commercial recycling program?

  • Look into recycling incentive programs, especially RecycleBank, and find out feasibility with implementing similar programs in Belmont.

• Proceed with social marketing strategies to influence behavior changes in the community.

### F. Climate Change Adaptation Measures

Belmont will make a contribution to reducing global greenhouse gas emissions with a Climate Action Plan, but the effects of climate change can be seen now. It is recommended that the Town of Belmont research methods to adapt to these outcomes. Belmont, MA is and will experience the following effects of climate change: increased temperatures, evaporation, precipitation events and periods of drought (Wolfson and Schneider, 2002). For example, 2005 was the warmest year in over a century of recorded data; the next warmest years also are recent: 1998, 2002, 2003 and 2004 (Gutro, 2006). Therefore, it is imperative that the city of Belmont considers an approach to adapt these effects, while at the same time, reducing greenhouse gas emissions. These adaptation measures include the following: increase heat advisory awareness, promote efficient water use and utilize low impact development techniques.

1. Increase Heat Advisory Awareness

   The elderly and young children and babies are most susceptible to increased temperatures because of a decreased inefficiency in cooling body temperatures (American Red Cross, 2005). However, heat-related illnesses and deaths can be avoided with awareness. This includes identifying symptoms of heat exhaustion, heat stroke, and heat cramps and sharing safety tips such as staying inside air conditioned buildings,
keeping pets cool and wearing light clothing (American Red Cross, 2005). It is recommended that Sustainable Belmont partner with the Belmont Housing Authority, the Belmont Public Library, and the public schools, to communicate these adaptation methods. A program should be developed in conjunction with the Belmont Neighbors Network to encourage citizens to check on vulnerable neighbors during heat advisory days.

2. Promote Efficient Water Use

Additional heat will lead to increased evaporation (United States Climate Action Network, 1995). Despite expected intensified precipitation events, increased evaporation could reduce reservoir yields (United States Environmental Protection Agency, 2001). Belmont, as well as many other cities in the Boston regional area, receives its water from the Quabbin Reservoir. Because of climate change impacts on Quabbin reservoir yields as well as increased populations using water from this resource, it is recommended that Sustainable Belmont promote efficient water use within the community. Methods include using less water in the home, moderating sprinkler use, and installing cisterns or rain barrels to catch rooftop runoff water for landscaping and other non-potable uses (Horsley Witten Group, 2005). The latter will serve to increase groundwater recharge of the Quabbin Reservoir and the Mystic River Watershed.

3. Use Low Impact Development Techniques

Low Impact Development methods can be included in new and altered developments. These techniques will also increase groundwater recharge, while at the same time mitigating the effects of flooding from the variable hydrologic events (i.e. precipitation and increased drought periods). Examples include using pervious pavement in new developments and bioretention techniques such as rain gardens and storm water infiltration systems and installing cisterns or rain barrels as mentioned above. (Horsley Witten Group, 2005).
X. CONCLUSION

A. Belmont’s Community Baseline Inventory

Community analysis for each sector of the baseline inventory were compiled to determine a preliminary CO₂ production total for the town of Belmont. The town of Belmont in 2001 used 5,095,156 million Btu of energy that created 414,852 tons of CO₂. Each sector’s contribution to the total amount of emissions is provided below in chart

**Chart 14-1. Community sector flow chart for total CO₂ emissions**

Transportation was the greatest single producing sector of CO₂ emissions at 219,666 tons of CO₂, this sector more then doubled the output of any of the other sector production totals.

**Graph 14-1. Percent CO₂ breakdown by Sector**

- Residential: 53.0%
- Commercial: 6.6%
- Waste: 0.4%
- Transportation: 40.0%
The following table illustrates all of the community consumption and CO₂ creation outputs for each of the sectors for the town of Belmont.

<table>
<thead>
<tr>
<th>Table 14-1. Belmont Community Baseline Inventory by Sector</th>
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<tr>
<td><strong>Sector</strong></td>
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<td>Residential</td>
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<td>Commercial</td>
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<tr>
<td>Waste</td>
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<td>Transportation</td>
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**B. Local Baseline Inventory Comparisons**

The uniqueness of every town or city’s baseline inventory prohibits a widespread model for solving the problem of GHG emissions. This section details how similar emission numbers may not indicate that reduction strategies are universally compatible. This gives more credence to the idea that local towns are more readily able to solve this problem than larger state and federal governments.

<table>
<thead>
<tr>
<th>Table 14-2. Local CO₂ Output Comparisons</th>
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<tbody>
<tr>
<td><strong>Belmont</strong></td>
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<tr>
<td>Total CO₂ (Tons)</td>
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<td>Population</td>
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<td>CO₂ (Tons/person/year)</td>
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<th>Table 14-3. Belmont – Cambridge Sector Comparisons</th>
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<tr>
<td><strong>Sector</strong></td>
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<td>Residential</td>
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<td>Commercial</td>
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<td>Waste</td>
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<tr>
<td>Transportation</td>
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<tr>
<td>Total CO₂</td>
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</table>
Changing Climate

Global mean surface temperatures have increased 0.5-1.0°F since the late 19th century. The 20th century’s 10 warmest years all occurred in the last 15 years of the century. Of these, 1998 was the warmest year on record. The snow cover in the Northern Hemisphere and floating ice in the Arctic Ocean have decreased. Globally, sea level has risen 4-8 inches over the past century. Worldwide precipitation over land has increased by about one percent. The frequency of extreme rainfall events has increased throughout much of the United States.

Increasing concentrations of greenhouse gases are likely to accelerate the rate of climate change. Scientists expect that the average global surface temperature could rise 1-4.5°F (0.6-2.5°C) in the next fifty years, and 2.2-10°F (1.4-5.8°C) in the next century, with significant regional variation. Evaporation will increase as the climate warms, which will increase average global precipitation. Soil moisture is likely to decline in many regions, and intense rainstorms are likely to become more frequent. Sea level is likely to rise two feet along most of the U.S. coast.

Calculations of climate change for specific areas are much less reliable than global ones, and it is unclear whether regional climate will become more variable.

(U.S. Environmental Protection Agency, 2000b).
Belmont is a desirable and welcoming community that retains a small-town atmosphere within a larger metropolitan area. Our town provides excellent educational opportunities and high quality town services. We protect the beauty and character of our natural settings and historic buildings. Thriving business centers contribute economic stability while offering places for residents to dine, shop, and socialize. The town government responds to the concerns of the residents, practices sound fiscal management and plans for future generations. We make a commitment to preserving and enhancing our strengths as a community while respecting our differences as individuals.

Our Principles

To preserve and enhance the qualities that we value, we, the Belmont community, make a commitment to:

* foster and maintain an open and inclusive decision-making process.
* develop and use our human and financial resources wisely.
* engage in comprehensive and integrated local and regional planning.

Our Common Goals

Quality Of Life

* We will ensure an excellent school system as a cornerstone of our community, providing for the learning needs of all our children and all residents.
* We will manage traffic through and around town to ensure the tranquility of our neighborhoods and the safety of pedestrians and bicyclists.
* We will be an environmentally responsible community and conserve our natural habitats.

Character Of Our Town

* We will maintain our libraries, public buildings, infrastructure and recreational facilities as investments in our future and our historic buildings as witnesses to our past.
* We will work with neighborhoods and residents to identify and support retail needs and opportunities.
* We will value cultural enrichment and encourage local talent and creativity.

Sense Of Community

* We will welcome newcomers and value diversity, while caring for our neighbors and for the needs of children, youth and seniors.
* We will promote the involvement of all residents in the life of our community, support citizen involvement in our town affairs, and rely on an effective, representative local government.
* We will preserve our small-town community atmosphere.
Appendix – C

The 5 Milestones

The methodology underlying the 5 Milestones of the CCP Campaign provides a simple, standardized means of calculating greenhouse gas emissions, of establishing targets to lower emissions, of reducing greenhouse gas emissions and of monitoring, measuring and reporting performance. ICLEI has developed a software tool that helps cities comply with the methodology. The 5 milestones are:

1. Conduct a baseline emissions inventory and forecast. Based on energy and waste data, the city calculates greenhouse gas emissions for a base year (e.g., 2000) and for a forecast year (e.g., 2015). The inventory and the forecast capture emissions from all municipal operations (e.g., city owned and/or operated buildings, streetlights, transit systems, wastewater treatment facilities) and from all community-related activities (e.g., residential and commercial buildings, motor vehicles, waste streams, industry). The inventory and forecast provide a benchmark against which the city can measure progress.

2. Adopt an emissions reduction target for the forecast year. The city passes a council resolution establishing an emission reduction target for the city. The target is essential both to foster political will and to create a framework to guide the planning and implementation of measures.

3. Develop a Local Action Plan. The local government develops a Local Action Plan that describes or lists the policies and measures that the local government will take to reduce greenhouse gas emissions and achieve its emissions reduction target. Most plans include a timeline, a description of financing mechanisms, and an assignment of responsibility to departments and staff. In addition to direct greenhouse gas reduction measures, most plans also incorporate public awareness and education efforts. The development of the Local Action Plan should include strong public input and involvement in order to build the consensus among stakeholders required to implement measures.

4. Implement policies and measures. The city implements the policies and measures contained in their Local Action Plan. Typical policies and measures implemented by CCP participants include energy efficiency improvements to municipal buildings and water treatment facilities, streetlight retrofits, public transit improvements, installation of renewable power applications, and methane recovery from waste management.

5. Monitor and verify results. Monitoring and verifying progress on the implementation of measures to reduce or avoid greenhouse gas emissions is an ongoing process. Monitoring begins once measures are implemented and continues for the life of the measures, providing important feedback that can be use to improve the measures over time. ICLEI's software provides a uniform methodology for cities to report on measures.

(Unedited version from ICLEI’s website http://www.iclei.org/index.php?id=1118)
RESIDENTIAL RATE A

Effective July 1, 2002

MDTE No. 92
Cancels MDTE No. 85

AVAILABILITY
Service under this rate is available for all single-phase, 120/140 volt, domestic purposes in an individual private dwelling or an individual apartment and is subject to our Terms and Conditions as amended from time to time.

MONTHLY RATE

CUSTOMER CHARGE: $6.25 per month
ENERGY CHARGE: $0.0962 per kWh
MINIMUM CHARGE: The Customer Charge

BILLING
When the billing period is for more than one month, the Customer Charge will be multiplied by the number of months.

Any bill for which valid payment has not been received within 45 days from the date rendered shall be considered past due and bear interest on any unpaid balance, including any outstanding interest charges, as a rate of 1 1/2% per month from the date that the bill was considered past due.

NYP A HYDRO POWER ADJUSTMENT CLAUSE
Residential customers will receive a credit applied to the first 500 kilowatt-hours billed in each month as provided in the Department's Hydro Power Adjustment Clause, MDTE No. 89.

TERMS
Until terminated on seventy-two hours written notice.
COMMERCIAL RATE B

Effective July 1, 2002

MDTE No. 93
Cancels MDTE No. 86

AVAILABILITY
Service under this rate is available for commercial purposes including stores, banks, offices, churches, schools, halls, and similar places that are used for purposes other than as private residences.

MONTHLY RATE
CUSTOMER CHARGE: $8.25 per month
ENERGY CHARGE: $0.1008 per kWh
MINIMUM CHARGE: The Customer Charge

BILLING
When the billing period is for more than one month, the Customer Charge will be multiplied by the number of months.

Any bill for which valid payment has not been received within 45 days from the date rendered shall be considered past due and bear interest on any unpaid balance, including any outstanding interest charges, as a rate of 1 1/2% per month from the date that the bill was considered past due.

PRIMARY SERVICE ADJUSTMENT
If, at locations where primary distribution voltage is available, the customer desires to furnish, install and maintain transformers and protective devices, a 10% discount will be allowed. All metering will be on the primary side of the transformers.

TERMS
Until terminated on seventy-two hours written notice.
POWER RATE E

Effective July 1, 2002

MDTE No. 94
Cancels MDTE No. 87

AVAILABILITY
This service is available for customers whose demand exceeds 75 kW and is applicable to all purposes except resale. Service will be supplied, if requested at 2,300 or 4,160 volts or higher, where lines for such delivery are available and the customer furnishes any necessary transformers.

MONTHLY RATE

CUSTOMER CHARGE: $114.75 per month
DEMAND CHARGE: $11.36 per kilowatt of Monthly Demand
ENERGY CHARGE: $0.0592 per kWh
MINIMUM CHARGE: The Customer Charge, plus Demand Charge, but not less than $800.00 per month.

DEMAND
The demand for each month under ordinary load conditions shall be the number of kilowatts equal to the greatest 15 minute peak occurring during such month but not less than 80% of the greatest 15 minute peak occurring during the preceding 11 months nor less than 75 kilowatts. The 15 minute peak shall be determined as either the average rate at which electricity is delivered in any 15 minute period as measured in kilowatts or 80% of the said average as measured in kilovolt-amperes, whichever is the greatest.

BILLING
Any bill for which valid payment has not been received within 45 days from the date rendered shall be considered past due and bear interest on any unpaid balance, including any outstanding interest charges, as a rate of 1½% per month from the date that the bill was considered past due.

DISCOUNTS
If the Department, at its option, meters the electricity furnished at 2,300 volts or higher, a discount of 2¼% will be allowed from the amount determined under the preceding provisions. In addition, if the customer receives service at high-tension voltage so that the Department is not required to furnish any transformers, there will be credited an amount of $0.31 for each kilowatt of billing demand.

TERMS
The Department's "Terms and Conditions" in effect from time to time, where not inconsistent with any specific provisions hereof, are part of this rate.
COMMERCIAL HEATING RATE F

Effective July 1, 2002

MDTE No. 95
Cancels MDTE No. 88

AVAILABILITY
To commercial or industrial customers where permanently installed, department approved electric space heating is used exclusively for comfort heating and is metered separately. Air conditioning and non-process water heating may also be included, if electricity is used exclusively for these purposes. All other electrical energy shall be metered separately under the appropriate rate. This rate is not available for resale.

MONTHLY RATE

CUSTOMER CHARGE: $21.00 per month
DEMAND CHARGE: $10.32 per kilowatt of Monthly Demand
ENERGY CHARGE: $0.0595 per kWh
MINIMUM CHARGE: The Customer Charge, plus Demand Charge.

HEATING REQUIREMENTS
All space heating equipment and water heating equipment, the size and installation thereof, shall conform to the requirements of the Town of Belmont Electric Light Department including the designation of the voltage for the service requirements.

DEMAND
The demand for each month under ordinary load conditions shall be a number of kilowatts equal to the greatest 15-minute peak during such month.

BILLING
Any bill for which valid payment has not been received within 45 days from the date rendered shall be considered past due and bear interest on any unpaid balance, including any outstanding interest charges, as a rate of 1½% per month from the date that the bill was considered past due.
PRIVATE AREA LIGHTING RATE G

Effective July 1, 2002

MDTE No. 96
Cancels MDTE No. 90

AVAILABILITY
This service is available to any customer exclusive of the Town of Belmont for purposes of lighting outdoor areas or exterior of building surfaces by means of equipment furnished and maintained by the Department.

MONTHLY RATE
For lights installed on existing Light Department poles:

175-watt mercury vapor unit - $11.21 per unit per month.

400-watt mercury vapor unit - $22.49 per unit per month.

For lights installed on wood poles furnished and installed by the Light Department and additional monthly charge of $1.41 shall be added for each pole furnished.

EQUIPMENT & SERVICE SUPPLIED BY
The Department will furnish, own and maintain all poles, wires, fixtures and controls. Burned out lamps will be replaced upon notification by the customer. No reduction in billing will be allowed for lamp outages. Lighting will be provided from 1/2 hour after sunset until 1/2 hour before sunrise daily.

BILLING
Monthly – All rates net.

TERMS AND CONDITIONS
The above rates do not include underground supply, metal poles, and guy with anchor or manual control switches. These items, if required, are to be paid for by the customer. The Department’s “Terms and Conditions” in effect from time to time, where not inconsistent with any specific provisions hereof, are a part of this rate.
STREET AREA LIGHTING RATE SL

Effective July 1, 2002

AVAILABILITY
Service under this rate schedule is available monthly for all municipal street lighting purposes.

RATE
For all kWh used per month, $0.1059 per kWh.
NYPA HYDROPOWER CREDIT

Effective May 1, 2000

MDTE No. 89

AVAILABILITY
Residential customers will receive a credit equal to the number of kilowatt-hours billed during the month, up to a maximum of 500 kilowatt-hours, multiplied by the New York Power Authority (NYPA) Hydropower Credit Rate determined each month as follows:

\[ \text{NYPA} = \frac{(\text{NC} - \text{PC}) \times \text{NK}}{\text{RK}} \]

Where:

1. \( \text{NYPA} \) = NYPA Hydropower Credit Rate for the month;
2. \( \text{PC} \) = average cost of energy purchased for the month excluding purchases from NYPA;
3. \( \text{NC} \) = average cost of hydropower from the NYPA for the month;
4. \( \text{NK} \) = total kilowatt-hours of power purchased from the NYPA for the month;
5. \( \text{RK} \) = estimated number of residential kilowatt-hours to which the NYPA Hydropower Credit will be applied for the month.
Solar Energy

Benefits of Solar Energy

Table of Contents

Solar Boston Partners
1. Tax incentives in Massachusetts
2. Frequently Asked Questions
3. Passively Solar and Sustainable Design
4. Solar Pool Heating
5. Solar Water Heating
6. Solar Electricity
7. The Benefits of Solar Energy
8. What is Solar Boston?
DRAFT OF GHG EMISSIONS INVENTORY FOR THE TOWN OF BELMONT

Frequently Asked Questions

Does solar make sense for my home or business?

Solar makes the most sense if:

- You have a location (a roof or ground space) that has southern exposure and that receives full, unobstructed sunlight for most of the day.
- You have already maximized your building's use of sites and systems, such as using energy-efficient lighting and appliances.
- Your roof (for roof-mounted systems) is relatively new, or you can replace your roof as part of your solar installation.

How do I get started on a solar project?

Factors such as the availability of space, energy use, and the amount of available space are important to consider when choosing a solar technology. The Solar Solutions staff can help you decide which technology best fits your needs and provide information about incentive programs.

How do I find a solar contractor to install my system?

After you have determined which type of solar technology is right for you, contact Solar Solutions to find a contractor who is eligible for the incentives and will install your system according to the requirements.

Is the company or contractor properly licensed?

Contact the company or contractor directly to verify their licensing status.

It is also a good practice to ask for references and view their previous work prior to selecting a contractor to work on your project. When you ask for bids, make sure that they are asked for in the same criterion.
Tax Incentives in Massachusetts

Federal business energy tax credit – a commercial property tax credit in order to offset the cost of the installation of energy efficient improvements and renewable energy systems. For more information on these credits and rebates, please contact your local energy auditor or visit the Commonwealth of Massachusetts website for detailed information.
Appendix F
2005 Existing ATR Volumes
Trapelo Road
Belmont, MA
Dear Belmont Business Owner,

I am writing on behalf of Sustainable Belmont, a subdivision of our local Vision 21 Implementation Committee. The goal of Sustainable Belmont is to help the town of Belmont become “environmentally responsible.” We can achieve this goal with the help of everyone in the town, so I am writing to request a small favor that would support our efforts immensely.

Sustainable Belmont is working to create a Climate Action Plan for our town. A Climate Action Plan is a strategy to reduce CO$_2$ emissions, which are known to contribute to global warming. In order for us to know how much Belmont can reduce these emissions, we must first know where are emissions are, as a town. One way that we calculate CO$_2$ emissions is to determine how much waste we, the entire town of Belmont, are producing.

I would like to ask you to let Sustainable Belmont know of your total waste in tons in 2001 and 2005 (or any other obtainable year). To get hold of this information, you would simply need to call your waste removal company. They generally have all this information in their records.

These figures will aid in our endeavor to keep Belmont a clean and environmentally friendly community. With your help, we have a better chance of creating accurate goals. We will follow up with you in a month’s time to see if you need any assistance with this. Additionally, please feel free to contact me with any questions or concerns. Thank you in advance for your assistance.

Respectfully,

Deborah Lockett
## Contact information

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<tr>
<th>Organization</th>
<th>Person</th>
<th>Phone</th>
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<td>617-993-2815</td>
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<td>Belmont Department of Public Works</td>
<td>Judy Kiernan</td>
<td>617-993-2680</td>
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<td>Charles Kalauskas VP</td>
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<tr>
<td>ICLEI</td>
<td>Garrett Fitzgerald</td>
<td>510-844-0699 x306</td>
<td><a href="mailto:garrett.fitzgerald@iclei.org">garrett.fitzgerald@iclei.org</a></td>
<td>436 14th Street, Suite 1520 Oakland, CA 94612</td>
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<td>781-466-5316</td>
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# Draft of GHG Emissions Inventory for the Town of Belmont

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<td>Belmont Light Department</td>
<td>Ed has been very informative and helpful in the process of gathering the appropriate data needed, as well as putting me in contact with individuals that run CAP reductions already in place and soon to be.</td>
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<td>Belmont Department of Public Works</td>
<td>Data includes monthly data from 1998-2005. Categories include Solid Waste, Mixed Paper (except for Corrugated Cardboard = Solid Waste), Comingled Recyclables (plastic, glass, aluminum), and Yard Waste. The Waste is taken to North Andover, MA to an incinerator. She said that she would get back to me early next week concerning costs.</td>
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<td>Belmont Department of Public Works</td>
<td>Judi emailed more information concerning where the waste goes. Solid goes to North Andover to be incinerated. Yard goes to Woburn, MA to Landscape Express, comimgled and mixed paper goes to FCR in Charleston. She also gave us collection and disposal costs from 1996.</td>
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<td>Belmont Department of Public Works</td>
<td>Judi emailed more information about the incinerator site. Belmont closed the incinerator site operations in 1973, the site itself closed in 1995. Also North Andover's tipping fee decreased in 2005.</td>
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<td>Judi emailed updated collection and disposal costs.</td>
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<td>Left Voice Mail - Had follow-up traffic conversation.</td>
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<td>Belmont Police Dept.</td>
<td>Visited the Belmont Police station and obtained traffic data.</td>
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<tr>
<td>BSC Group</td>
<td>Left Voice Mail - He never returned any of my calls</td>
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<td>ICLEI</td>
<td>Garrett gave us typical U.S. waste stream percentages: Paper Products 38%, Food Waste 13%, Plant Debris 10%, Wood and Textiles 4%, All Other Waste 35%</td>
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<td>Amery gave us data from 2004 and 2005. 2005 is our interim year, but the data he gave us was missing January 2005. Also the data did not separate residential from commercial</td>
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<tr>
<td>Keyspan</td>
<td>Amery Pore</td>
<td>781-466-5316</td>
<td><a href="mailto:apore@keyspanenergy.com">apore@keyspanenergy.com</a></td>
<td>email or phone</td>
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</tr>
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<td>781-466-5316</td>
<td><a href="mailto:apore@keyspanenergy.com">apore@keyspanenergy.com</a></td>
<td>email or phone</td>
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<td><a href="mailto:apore@keyspanenergy.com">apore@keyspanenergy.com</a></td>
<td>email or phone</td>
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<tr>
<td>Mahoney Oil/ Belmont Energy Corp</td>
<td></td>
<td>617-489-0888</td>
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<td>88 Grove St, Belmont, MA</td>
<td></td>
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<tr>
<td>Massachusetts Highway Department</td>
<td>Paul Chen</td>
<td>617-973-7376</td>
<td></td>
<td></td>
<td>11 Park Plaza, Suite 3170 Boston, MA 02116</td>
<td></td>
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<td>Massachusetts Highway Department</td>
<td>Paul Chen</td>
<td>617-973-7376</td>
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<td>11 Park Plaza, Suite 3170 Boston, MA 02116</td>
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<tr>
<td>Massachusetts Highway Department</td>
<td>Steve Green - Supervisor</td>
<td>617-973-7327</td>
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<td>10 Park Plaza, Suite 3170 Boston, MA 02116</td>
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<tr>
<td>Town of Belmont</td>
<td>Jeff Conti</td>
<td>617-993-2610</td>
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<td>Jeff Conti</td>
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<td>Glenn Clancy</td>
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<td>Town of Belmont Traffic Com.</td>
<td>Mary Joe Frisolle</td>
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<td>Maryanne Knorr</td>
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## Draft of GHG Emissions Inventory for the Town of Belmont

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- X indicates responsibility for data collection.
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<td>Keyspan</td>
<td>Alex contacted Amery and asked him for 2001 data to be used for our baseline</td>
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<tr>
<td>Keyspan</td>
<td>Amery told us that he would contact us on Tuesday, Feb. 28 2005 with more information.</td>
</tr>
<tr>
<td>Keyspan</td>
<td>Amery explained that he was forwarding our request to the headquarters in New York. At this time, Deb Lockett continued with the requests, until Paul Solomon phoned the company. We then received the data on 4/18/2006 from Michael Bruno at Keyspan Energy.</td>
</tr>
<tr>
<td>Mahoney Oil/Belmont Energy Corp</td>
<td>No data obtained.</td>
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<tr>
<td>Massachusetts Highway Department</td>
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<tr>
<td>Massachusetts Highway Department</td>
<td>Paul was very helpful. He directed me to two websites. <a href="http://www.fhwa.dot.gov/policy/ohpi/">http://www.fhwa.dot.gov/policy/ohpi/</a> and <a href="http://www.eot.state.ma.us//default.asp?pgid=content/plan01&amp;sid=about">http://www.eot.state.ma.us//default.asp?pgid=content/plan01&amp;sid=about</a></td>
</tr>
<tr>
<td>Massachusetts Highway Department</td>
<td>Steve Green Gave me information on where to find annual average daily traffic counts on the MHD website. He also told me that the traffic counts listed are for a 24 hour period.</td>
</tr>
<tr>
<td>Town of Belmont</td>
<td>Left Voice Mail</td>
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<tr>
<td>Town of Belmont</td>
<td>Spoke with. The town does not have any data on VMT or highway traffic counts. Jeff told me that the chair of the traffic committee may have this type of information (Mary Joe Frisoli) or the Director of Community Development (Glenn Clancy). Jeff is e-mailing both of these people for me and asking them to contact me.</td>
</tr>
<tr>
<td>Town of Belmont Building Dept.</td>
<td>Obtained traffic count data.</td>
</tr>
<tr>
<td>Town of Belmont Traffic Com.</td>
<td>Had Deb contact her - Mary Joe never responded to Deb's repeated phone calls.</td>
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<tr>
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<td>No data is available until the release of the Assessor's report.</td>
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### Appendix – J

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<th>Month</th>
<th>Day</th>
<th>Event</th>
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<td>January</td>
<td>23</td>
<td>First day of Class; meet with client for the first time</td>
</tr>
<tr>
<td>February</td>
<td>1</td>
<td>Sustainable Belmont town meeting</td>
</tr>
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<td></td>
<td>22</td>
<td>Training on the ICLEI software in Downtown Boston</td>
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<td>28</td>
<td>Belmont public meeting on climate change; guest speaker was Prof. Moomaw</td>
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<td>March</td>
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<td>Sustainable Belmont town meeting</td>
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<td>April</td>
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<td>Community outreach with Sustainable Belmont; present research</td>
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<td>Sustainable Belmont town meeting</td>
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<td>6</td>
<td>Community outreach with Sustainable Belmont; present research</td>
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<td>12</td>
<td>Community outreach with Sustainable Belmont; present research</td>
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<td>24</td>
<td>Presentation to Field Projects class and four Sustainable Belmont members</td>
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<tr>
<td>May</td>
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<td>Presentation of project to the Town of Belmont</td>
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### Acronyms used in this report

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<th>Description</th>
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<tr>
<td>AFUE-</td>
<td>annual fuel utilization efficiency</td>
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<tr>
<td>ALAPCO</td>
<td>Association of Local Air Pollution Control Officials</td>
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<tr>
<td>BMLD</td>
<td>Belmont Municipal Light Department</td>
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<tr>
<td>Btu-</td>
<td>British thermal unit</td>
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<tr>
<td>CAP-</td>
<td>climate action plan</td>
</tr>
<tr>
<td>CH₄-</td>
<td>methane</td>
</tr>
<tr>
<td>CACP</td>
<td>Clean Air and Climate Protection</td>
</tr>
<tr>
<td>CBSM</td>
<td>Community Based Social Marketing</td>
</tr>
<tr>
<td>CCP</td>
<td>Cities for Climate Protection</td>
</tr>
<tr>
<td>CFL</td>
<td>Compact Florescent Light</td>
</tr>
<tr>
<td>CO₂-</td>
<td>Carbon Dioxide</td>
</tr>
<tr>
<td>DOE-</td>
<td>United States Department of Energy</td>
</tr>
<tr>
<td>EIA-</td>
<td>Energy Information Administration</td>
</tr>
<tr>
<td>EPA-</td>
<td>United States Environmental Protection Agency</td>
</tr>
<tr>
<td>GHG-</td>
<td>greenhouse gas</td>
</tr>
<tr>
<td>ICLEI</td>
<td>Local Governments for Sustainability</td>
</tr>
<tr>
<td>IPCC-</td>
<td>Intergovernmental Panel on Climate Change</td>
</tr>
<tr>
<td>kWh</td>
<td>Kilowatts per Hour</td>
</tr>
<tr>
<td>LEED-</td>
<td>Leadership in Energy and Environmental Design</td>
</tr>
<tr>
<td>NYPA</td>
<td>New York Power Authority</td>
</tr>
<tr>
<td>PV</td>
<td>photovoltaic</td>
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<tr>
<td>SAR-</td>
<td>Second Assessment Report (from the IPCC)</td>
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<tr>
<td>SB-</td>
<td>Sustainable Belmont</td>
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<tr>
<td>STAPPA</td>
<td>State and Territorial Air Pollution Program Administrators</td>
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<tr>
<td>TAR-</td>
<td>Third Assessment Report (From the IPCC)</td>
</tr>
<tr>
<td>VMT</td>
<td>vehicle miles traveled</td>
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XII. WORKS CITED


