Town of Brookline, Massachusetts Greenhouse Gas Inventory Overview

History and Purpose

In May 2000, the Town of Brookline elected to participate in the Cities for Climate Protection Campaign, a program of the International Council of Local Environmental Initiatives (ICLEI). The Cities for Climate Protection Campaign follows a 'Five Milestone' process:

- Milestone One: Conduct a Greenhouse Gas Emissions Inventory and Report
- Milestone Two: Set a Greenhouse Gas Emissions Reduction Target
- Milestone Three: Develop a Local Climate Action Plan
- Milestone Four: Implement the Local Climate Action Plan
- Milestone Five: Monitor Emissions Reductions

The Town completed the first three milestones in the ICLEI program, publishing a greenhouse gas inventory in August 2000 and a Greenhouse Gas Emissions Reduction Target and Climate Action Plan in February 2002.

The August 2000 Greenhouse Gas Inventory reported emissions for calendar years 1995 and 1998. The following summary updates those initial findings to include information for calendar years 2003 and 2008. Since the goal of the Greenhouse Gas Inventory is to guide Brookline's process of writing and implementing a plan to reduce the emissions contributing to climate change, it is recommended that the Selectmen's Climate Action Committee work with the Town to revise Brookline's Greenhouse Gas Reduction Target and Climate Action Plan based on the greenhouse gas emission trends from 1995 through 2008.

Brookline's Community Greenhouse Gas Emissions Totaled 520,000 Tons CO_2 Per Year For CY2008

Brookline's community greenhouse gas emissions (Table 1 and Figure 1) have been steady at roughly 520,000 tons of CO_2 per year for, at least, the five year period from 2003 through 2008. Community emissions comprise the residential, commercial, and government sectors.

Brookline's 2008 community greenhouse gas emissions were about eight percent below the annual emissions rate of 560,000 tons previously reported for 1995 (August 2000 Greenhouse Gas Inventory Report). Adjusting for possible inconsistencies in electricity and natural gas usage and vehicle emissions described below, Brookline's 1995 greenhouse gas emissions may have been as low as 515,000 tons per year. In either case, Brookline has done better than the United States, as a whole. Greenhouse gas emissions increased about ten percent nationally from 1995 through 2007.

Greenhouse gas emissions from Brookline's government operations (Figure 2) for 2008 are relatively unchanged from those previously reported for 1995 (August 2000 Greenhouse Gas Inventory Report). Government operations are responsible for about three percent of Brookline's total community emissions.

Emissions from MBTA trolleys and buses were not been included in this analysis. Emissions from these sources are likely about one percent of the reported total community emissions, based on the August 2000 Greenhouse Gas Inventory Report.

Brookline's Climate Action Plan Base Year Should Be Changed From 1995 to 2003

The ICLEI Local Government Protocol (September 2008) states: "It is good practice to compile an emissions inventory for the earliest year for which complete and accurate data can be gathered. The base year for the UNFCCC and subsequent Kyoto Protocol is calendar year 1990. However, required data from 1990 is often prohibitively difficult or impossible to collect. Given that the priority for a greenhouse gas management program should be on practical results, it is more important that the base year be documented with enough detail to provide a good basis for local action planning than it is that all local governments produce an inventory with the same, stipulated base year."

Graphs of electricity usage (Figure 3) and natural gas usage (Figure 4) from 1995 through 2008 indicate anomalies in trends for both utilities. Values for 1995 and 1998 were reported in the August 2000 Greenhouse Gas Inventory report based on information provided by Boston Edison and Boston Gas. Usage information for 2002 through 2008 was obtained from NSTAR and National Grid. The significant drop in usage of gas and electricity from 1998 to 2002 is inconsistent with both population growth in Brookline and national trends in residential energy consumption during that period.

CO_2 emissions from vehicles travelling in Brookline may also have been overstated, based on a November 2009 report from the United States Environmental Protection Agency. Vehicle emission factors generated for 1995 by the ICLEI software (CACP 2009) were based on projections that predated the recent EPA report.

Due to the above inconsistencies, it is recommended that 2003 be used as the base year for Brookline's Greenhouse Gas Reduction Target and Climate Action Plan.

Brookline's Residential Carbon Footprint Is Much Lower Than the U.S. Average

Brookline 2010 and Climate Change Action Brookline (CCAB) are participating in the Massachusetts Climate Action Network's Cool Mass initiative. The Cool Mass Campaign seeks to empower 25 percent of the households in Massachusetts to reduce their carbon footprints 25 percent. CCAB is working to exceed that target by engaging 85 percent of Brookline households in CO_2 reduction by the end of 2012, with an average CO_2 emissions reduction of 25 percent for each participating household.

Cool Mass households are being asked to follow the Empowerment Institute's Low Carbon Diet which begins with calculating a carbon footprint. Eleven Cool Mass towns, including Brookline, were asked to estimate their residential sector carbon footprint.

CCAB estimated Brookline's residential carbon footprint using information compiled during the process of completing Brookline's Greenhouse Gas Inventory. A few assumptions were made regarding the allocation of electricity, natural gas, and heating oil among residential and commercial users. The Greenhouse Gas Inventory followed the ICLEI protocol of using total vehicle miles travelled by residents and non-residents within Brookline's borders. The carbon footprint was based on the Low Carbon Diet approach, using an estimate of vehicle miles travelled by cars and trucks driven anywhere by Brookline residents and businesses.

In 2008, Brookline's average residential carbon footprint was about 31,000 pounds of CO_2 per year. The average US household had a carbon footprint of 46,000 pounds of CO_2 per year, according to data from the US Energy Information Agency's (EIA) 2005 Residential Energy Consumption Survey and a household vehicle use survey for 2009 published by the National Highway Transportation Survey (NHTS). In both cases, CO_2 emissions from personal air travel were not included. If CCAB achieves its goal of engaging 85 percent of Brookline households in CO_2 with an average CO_2 emissions reduction of 25 percent for each participating household, Brookline's residential carbon footprint will be reduced to 25,000 pounds of CO_2 per year.

Brookline's average commercial carbon footprint was 162,000 pounds of CO_2 per year in 2008, excluding air travel.

Alan Leviton

May 21, 2010

Table 1 **Greenhouse Gas Emissions**
CO_2e, Tons/Year

	1995	2003	2008
Electricity	140,920	130,384	137,125
Natural Gas	120,369	104,223	126,643
Heating Oil	126,267	112,366	103,678
Cars and Trucks	151,315	152,194	128,992
Solid Waste	21,129	21,129	21,264
Total	559,999	520,295	517,702

Table 2 **2008 GHG Emissions By Sector**
CO_2e, Tons/Year

	Residential	Commercial	Municipal	Total
Electricity	75,688	52,536	8,901	137,125
Natural Gas	89,812	34,474	2,357	126,643
Heating Oil	81,070	19,980	2,629	103,679
Cars and Trucks				128,992
Solid Waste	14,176	6,998	90	21,264
Total				517,702

Table 3 **Greenhouse Gas Sources**

		1995	2003	2008
Electricity	kwh	311,702,637	288,397,640	293,386,860
Natural Gas	Therms	20,445,394	17,702,807	21,511,045
Heating Oil	Gallons	11,283,499	10,041,279	9,264,891
Cars and Trucks	Miles	232,094,937	242,992,126	210,333,390
Solid Waste	Tons	21,000	21,000	21,135

Table 4 Brookline's Residential Carbon Footprint - 2008

	CO_2e, Tons/Year
Electricity	75,688
Natural Gas	89,812
Heating Oil	81,071
Gasoline/Diesel	139,156
Solid Waste	14,176
Total	399,901
Number of Households	25,573
Pounds CO_2/Household/Year	31,275

Table 5 Brookline's Commercial Carbon Footprint - 2008

	CO_2e, Tons/Year
Electricity	52,536
Natural Gas	34,474
Heating Oil	19,980
Gasoline/Diesel	7,576
Solid Waste	6,998
	121,564
Number of Businesses	1,500
Pounds CO_2/Business/Year	162,086

Table 6 Brookline's Municipal Carbon Footprint - 2008

	CO_2e, Tons/Year
Electricity	8,901
Natural Gas	2,357
Heating Oil	2,629
Gasoline/Diesel	2,305
Solid Waste	90
	16,282

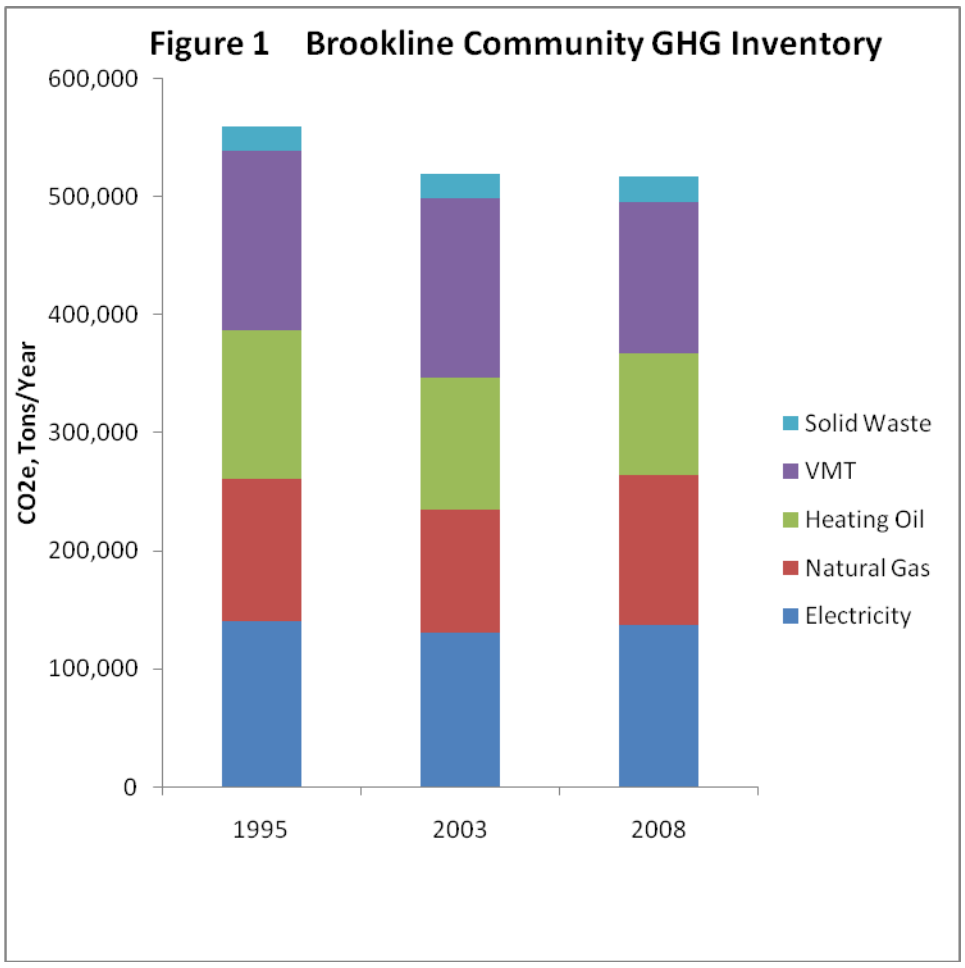
Figure 1 Brookline Community GHG Inventory
600,000
500,000
400,000
300,000
200,000
100,000
0
CO2e, Tons/Year
1995
2003
2008
Solid Waste
VMT
Heating Oil
Natural Gas
Electricity

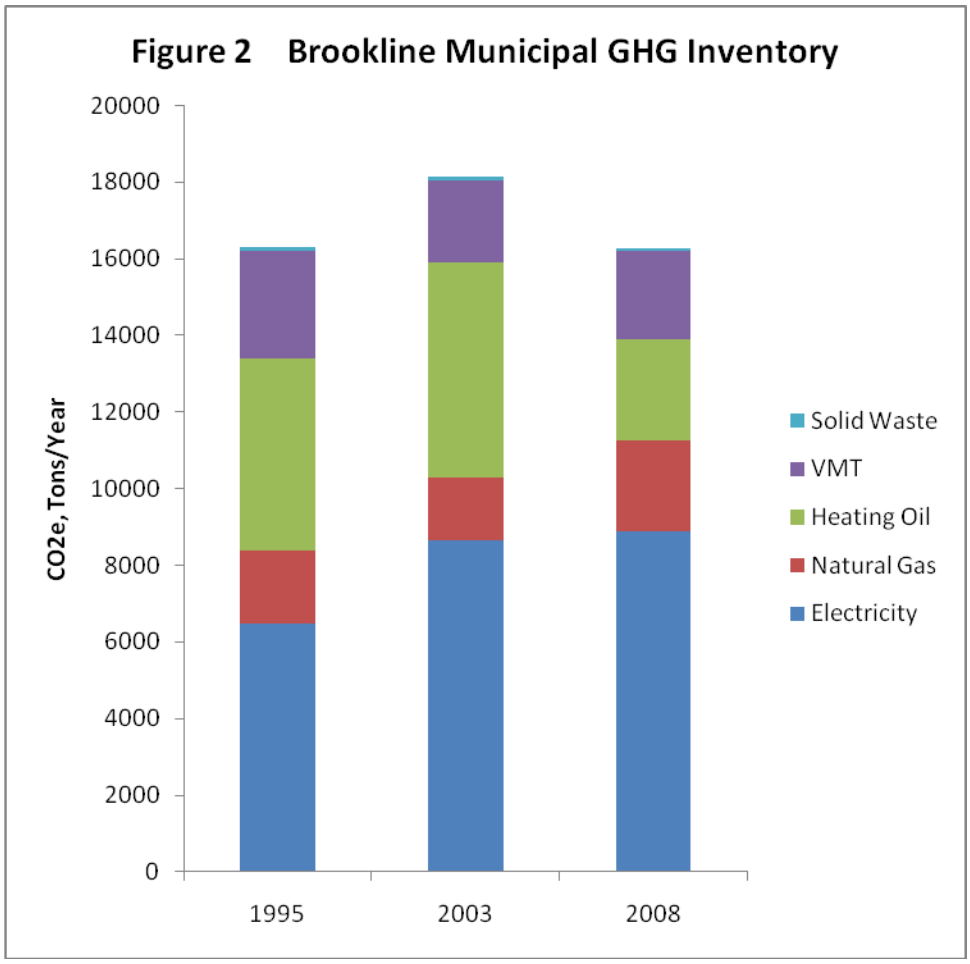
Figure 2 Brookline Municipal GHG Inventory
CO2e, Tons/Year
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
1995
2003
2008
Solid Waste
VMT
Heating Oil
Natural Gas
Electricity

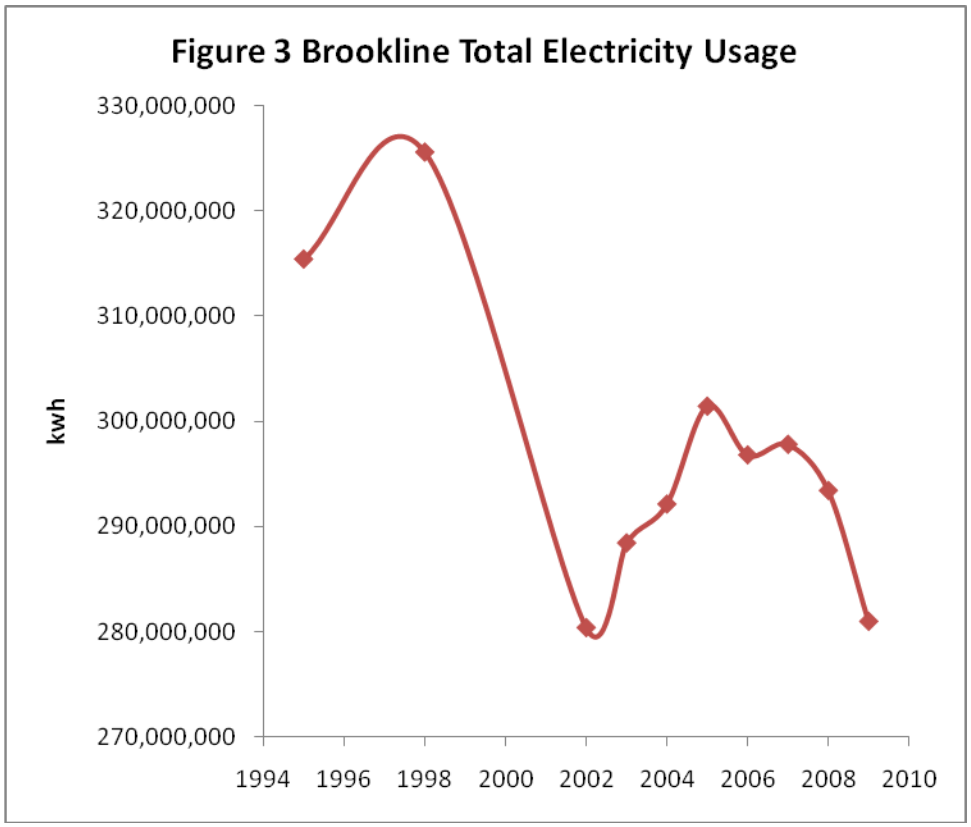
Figure 3 Brookline Total Electricity Usage
330,000,000
320,000,000
310,000,000
300,000,000
290,000,000
280,000,000
270,000,000
kwh
1994
1996
1998
2000
2002
2004
2006
2008
2010

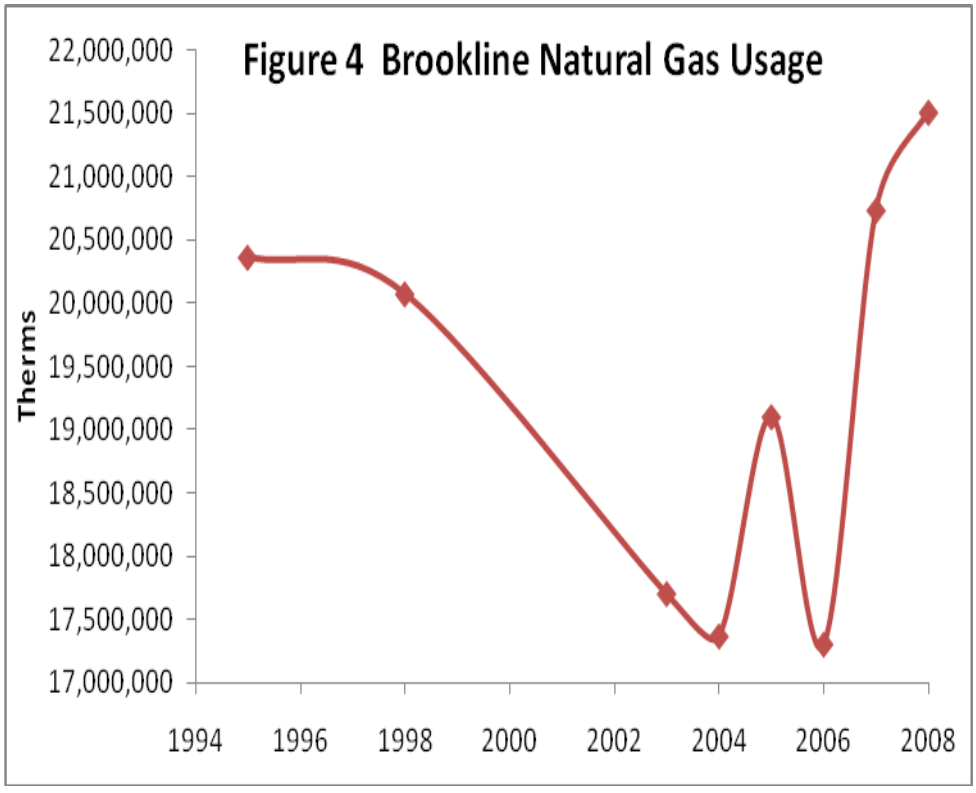
Figure 4 Brookline Natural Gas Usage
22,000,000
21,500,000
21,000,000
20,500,000
20,000,000
19,500,000
19,000,000
18,500,000
18,000,000
17,500,000
17,000,000
Therms
1994
1996
1998
2000
2002
2004
2006
2008