



*Town of Brookline
Cities for Climate Protection Campaign*

Greenhouse Gas Inventory & Forecast Report
With Recommendations for the Emissions Reduction Action Plan

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Brookline Greenhouse Gas Emissions Inventory and Forecast Report

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Executive Summary

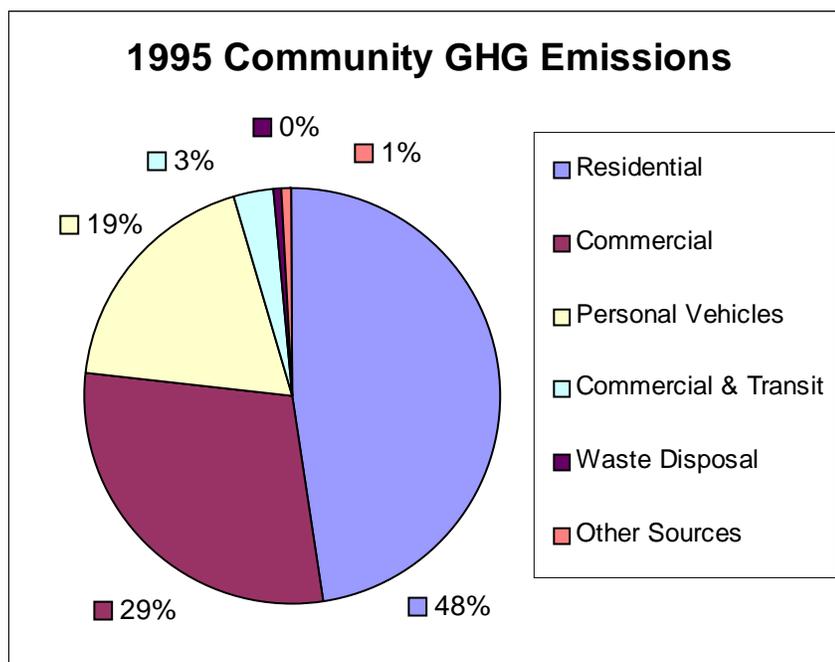
Introduction

There is a scientific consensus that human emissions of "greenhouse gases," primarily carbon dioxide and methane, are having a measurable effect on the Earth's climate. While the exact effects of elevated levels of greenhouse gases are difficult to predict, it is recognized in the international scientific and political community that we will face alterations in weather patterns, ocean behavior, and biological processes if action is not taken. The effects on residents of Brookline may include: increased severe weather events, rising sea levels, elevated summer temperatures, spread of diseases, loss of urban forest habitats, threats to water quality, and changes to many of New England's natural resources.

This emissions inventory is the first step in the Town of Brookline's efforts to address global warming pollution at the local level. In May of 2000, Brookline chose to participate in the Cities for Climate Protection Campaign, a program of the International Council of Local Environmental Initiatives (ICLEI). The inventory is the first of five milestones in this program. The goal of the inventory is to guide Brookline's process of writing and implementing a plan of actions to reduce the emissions contributing to climate change. By first knowing the relative sources of greenhouse gas emissions, Brookline will be better equipped to strategically and cost-effectively reduce emissions. The political energy and fiscal costs required to reduce greenhouse gas emissions today are less severe those costs and efforts that would be required in the 21st century to adapt to climate change.

Inventory Results

The greenhouse gas (GHG) inventory measured emissions based in two separate studies. The first was an measure of all emissions from the Brookline residential and commercial community. The second level of the inventory investigated just the emissions from municipal government operations. The emission levels of greenhouse gases are commonly measured in equivalent CO₂ levels. The baseline year for the inventory was 1995. An interim inventory was taken for 1998 and forecasts were made for 2010.

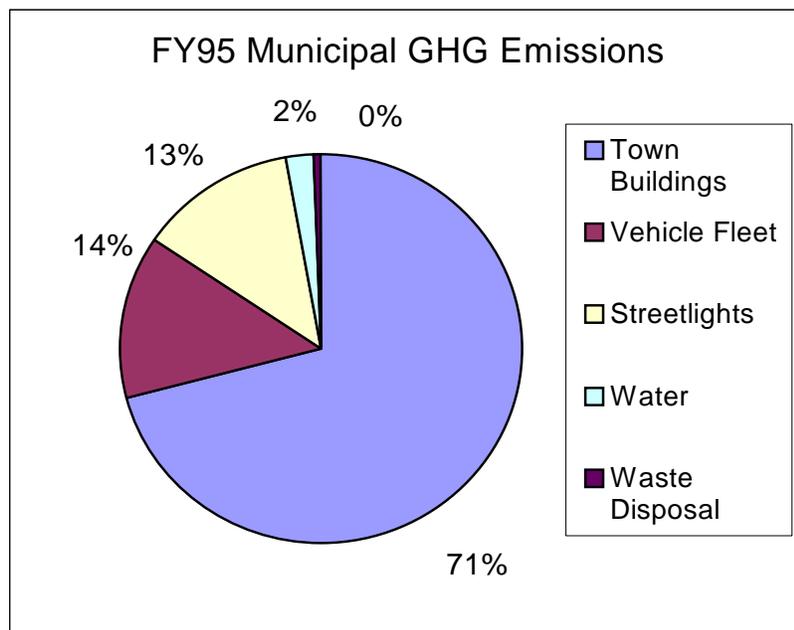


In 1995 the community's greenhouse gas emissions totaled 626,512 tons of eCO₂. Residential household energy use accounted for 48% of these emissions and commercial energy use resulted in 29% of the communities emissions. The other large contribution came from the transportation sector which provides 22% of the town's emissions. Electricity use was the largest overall sources of eCO₂. It should be noted that although these emissions are considered the responsibility of the Town of Brookline, the electricity is generated elsewhere in the Northeast. Natural gas and heating oil produced almost equal quantities of eCO₂.

The inventory in 1998 produced similar results with a net emission level of 631,426 tons of eCO₂. The 4,914 ton increase in emissions can be attributed to two factors. There was a steady increase in commercial electricity use and the vehicle traffic in Brookline continued to rise. These trends are predicted to continue through the year 2010, along with slight increases in household energy use. It is forecasted that if no action is taken to address emissions, the Brookline community will be responsible for 664,700 tons of emissions in 2010.

According to this inventory, Brookline has a per capita GHG emission rate of 11.4 tons of eCO₂. Relative to other communities in the United States, Brookline's emissions are lower. Other communities of a similar size in New England have had similar results. Because Brookline is a mostly developed, older community with access to the MBTA, emissions from transportation are a smaller portion of total emissions than elsewhere. In contrast, energy use in residential and commercial buildings is by far the largest source and suggests Brookline look into actions that address these contributions.

The Town government's emissions results were based on the fiscal years 1995 and 1998. In FY95 the Town generated 20,662 tons of eCO₂, 71% of which came from building energy use. The municipal' vehicle fleet and street lighting system accounted for 14% and 13% respectively, of the remaining emissions. In FY98 the town's emissions grew to 26,000 tons of eCO₂ with most of the growth occurring from building electricity use. This elevated energy costs from \$1.5 million in FY95 to just over \$2 million dollars in FY98.



Emission Reduction Action Plan

The next step for the Town of Brookline is to draft a Climate Protection Action Plan. The Action Plan is a proposal for how the Town can take a leadership role in the community towards reducing energy use and greenhouse gas emissions in Brookline. This document will be written with the input of multiple departments within Town Hall and community members. A goal has been set to reduce annual emissions to 20% below the 1995 levels by the year 2010. Both existing and potential programs to reduce emissions in every sector of the community and town operations are described in this report. Most of these measures have been successfully implemented in other communities across the country.

The municipal operations currently account for just under 4% of the community's total CO₂ emissions. Measure taken to increase energy efficiency within Town buildings will have a measurable impact of these emissions and a clear cost savings benefit. At the same time, the Town can also promote community wide programs to reduce energy consumption and emissions. This includes both energy efficiency and changes in energy sources. Technology provides many opportunities to increase electrical, heating, and transportation efficiency. Policies can shift energy sources towards cleaner burning fuels and renewable energy. Finally some changes in behavior such as vehicle use, energy conservation, material purchasing and waste disposal will also be needed to reach the Town's emission reduction goal. A sample list of emission reduction measures, both existing and proposed, can be found below.

Existing Emission Reduction Measures

Police Units on Bicycle
Support for Urban Ring Transit Project
Traffic Calming
Curbside Compost and Recycling Pick Up
Street Tree Planting
Town Building Lighting Retrofit
Town Building Heating & Cooling Efficiency
LED Traffic Signals
Recycling in Town Hall and Schools
Purchase of Recycled Paper Products

Proposed Emission Reduction Measures

Home Energy Conservation Program
Develop Energy Efficient Building Code
Block Purchasing of Green Electricity
T Pass Payroll Purchase for Employees
Designated Bike Lanes and Bike Routes
Town Sponsored Transit Service
Required Recycling by Permitted Haulers
Sustainable Business Awards
Energy Efficient Office Equipment Purchase
Municipal Buildings Efficiency Goals
LED Exit Signs
Alternative Fuel Vehicles for Town Fleet

Brookline CCP Goals and Objectives

Overall Goal:

To reduce the emissions of gases and air pollutants that contribute to global climate change and local air quality degradation.

Brookline Specific Objectives:

- 1) Improve and protect, Brookline's quality of life in the future.
- 2) Raise awareness of global climate change and the sources of climate changing gases.
- 3) Implement public programs to increase energy and transportation efficiency as well as solid waste reduction in order to reduce the contribution of the Brookline community to the global problem of climate change.
- 4) To develop practices to reduce the emissions of greenhouse gases and increase operational cost efficiency in municipal operations.

Introduction:

Scientists have been researching the phenomenon commonly referred to as the greenhouse effect for decades. There has been growing scientific consensus that although the exact effects are difficult to predict, the increased level of CO₂ and other greenhouse gases in the atmosphere will cause changes in the Earth climate systems. Human industrial activity has contributed to a 30% increase in global CO₂ level through the combustion of fossil fuels for energy. Other anthropogenic contributions of greenhouse gases include the production of methane in waste disposal, the emissions of nitrous oxides, and the manufacturing of chloroflorocarbons.

An increase in greenhouse gases can have a dramatic effect on the Earth's atmospheric behavior. The term global climate change is used to refer to the diverse array of potential alterations in the planet's physical and biosphere conditions. An slight overall warming of the Earth surface may be accompanied with an increase in severe weather events such as storms and droughts, geographic shifts or losses of ecosystems, changing ocean patterns, reduced polar ice caps, and alterations in regional agricultural productivity.

In Massachusetts the average temperature has increased by 2% over the past century and precipitation levels have risen by up to 20% in many regions of the Commonwealth. This trend is expected to continue through the next century with an expected four degrees Fahrenheit increase in winter and spring temperatures and 5 degree F in the summer and fall. Increased heat waves will elevate heat-related deaths particularly in urban areas such as Boston. Ground level ozone level will rise, reducing air quality in the Boston area. The Massachusetts human population will likely face a combination of elevated populations of disease carrying insects such as mosquitos and ticks, with growing range of infectious diseases usually found in tropic areas, such as encephalitis and malaria.

Sea levels in Boston have risen 11 inches in the last century and this trend is expected to accelerate. More frequent heavy storm events are expected to bring an increase in rain and snowfall.. Changes in weather patterns will effect our water resources including increased flooding in spring, water scarcity in summer and greater threats to water quality. Natural habitats and resources such as forest, fisheries, and agricultural lands will faced increased stresses.

Global climate change is an issue that needs to be addressed at every level of government and society. International treaties are in negotiation, federal and state studies have been conducted, and local governments have begun taking actions. The objective of Local Agenda 21 of the Kyoto Protocol asks municipal governments to work on local emission reduction plans. Energy consumption and waste disposal policies can often be most effective at the local government level and action can be taken most quickly. It is the hope of this campaign that the collective efforts of many communities can have a significant impact on this global problem.

ICLEI and Cities for Climate Protection

The International Council on Local Environmental Initiatives (ICLEI) is an international non-profit working to address global environmental concerns through local sustainability programs. ICLEI began its work 10 years ago to coordinate efforts by communities and to provide technical assistance for local environmental planning. In 1993, ICLEI began the Cities for Climate Change Campaign to assist local governments addressing rising emissions of greenhouse gases. Currently 350 cities, towns, and county governments are members of ICLEI worldwide and 75 municipalities are participating in the CCP Campaign within the United States. It is estimated that these communities represent 8% of the emissions from this country.

The Cities for Climate Protection Campaign involves a 5-Milestone process to inventory greenhouse gas emissions and develop emission reduction goals and implement programs to reduce local carbon dioxide and methane emissions.

- **Milestone One:** Conduct a baseline emissions inventory for the entire community as well as municipal operations. From this baseline data we projected the emissions growth or decline by the year 2010 assuming no actions are taken to address greenhouse gases. The primary emission sources examined in the Milestone One Inventory are:
 - Energy Use** - Electricity and heat for residential, commercial, and municipal facilities
 - Transportation** - Emissions from personal & commercial vehicles, transit vehicles
 - Solid Waste** - methane and CO₂ contribution of waste disposal operations
- **Milestone Two** - Set an Emission Reduction Target. Many local and international targets have been set at 20% of the base year emissions level, and use their projection year as the goal for obtaining these emission reductions. The Brookline Climate Protection and Energy Conservation Committee has agreed on a target of bringing greenhouse gas emissions 20% below 1995 emissions levels by the year 2010.
- **Milestone Three** - Develop an Action Plan - a collection of initiatives to reach the emission reduction target. These initiatives will include finding efficiency and technological improvements available to the town operations as well as programs to encourage emissions reductions within the Brookline community.
- **Milestone Four** - Implement Actions. Various initiatives may require decisions and efforts by municipal program departments and operators, the Board of Selectmen, the Town Meeting legislative body, local businesses, and community residents.
- **Milestone Five** - Monitor Emissions Reductions. Set annual goals for policy implementation and calculate emission reductions from policies put into place.

At the time of this report, Brookline has completed Milestones 1 & 2, and has begun developing an Action Plan. Implementation efforts for some emission reduction measures are expected to begin by the end of 2000.

There are five other municipalities in the Boston area that have joined the Cities for Climate Protection Campaign (Arlington, Boston, Cambridge, Medford, and Newton) and seven other New England cities and towns.

Emissions Inventory and Forecast Methods

Overall Inventory Methods:

The baseline year for the Brookline greenhouse gas inventory was 1995. This was the earliest year for which reliable data could be generated. 1998 was chosen to be an interim research year to process more recent data and observe any energy use changes. Trends and data from throughout the 1990's were collected and used occasionally in this report. The year 2010 was chosen to project future emissions forecasts and emissions reduction targets.

The emission inventory and forecast, as well as most of the reduction measures, are separated into two distinct areas. The first is a community wide assessment of all energy and waste related activities that occur in the Town of Brookline. The emissions data includes emissions from within the Town's borders such as vehicle tail pipes and heating broilers, as well as upstream emissions from activities within Town including electricity generation and waste disposal. The second section of the inventory is an evaluation of emissions coming from Town government operations. This includes building energy use, vehicle fleet emissions, Town generated solid waste, and other energy use such as outdoor/street lighting and water works operations.

A separate Town government-based inventory is conducted because the Town ultimately has greater control over its own emissions than private activities in the community. The Town can contribute directly to emission reductions through its own practices while setting an example for responsible energy and fuel use for residents and institutions within the community. For the most part, government operations that are not directly controlled by Town government as well as energy use by contractors working for the Town of Brookline are not included in this inventory.

The inventory required data and technical information to be collected from a wide range of sources including:

- Town of Brookline Offices: Department of Public Works, Buildings Department, Planning and Community Development, Health Department, Recreation Department, Purchasing Office, Assessor's Office, Fire, Police, Schools and Libraries;
- State Agencies and Offices: Massachusetts Bay Transportation Authority, Metropolitan Area Planning Commission, Central Transportation Planning Staff, Massachusetts Water Resources Authority, Executive Office of Environmental Affairs, Department of Environmental Protection, Division of Energy Resources;
- Federal Agencies: Environmental Protection Agency, Department of Transportation, Bureau of the Census, Department of Energy;
- Local Utilities: Boston Gas, Boston Edison, private waste haulers;
- Non-Profit Organizations: Boston Oil Consumers Alliance, Northeast Sustainable Energy Association, Massachusetts Recycling Coalition.

(A list of contacts for the offices providing direct data for this inventory can be found in Appendix A)

The data gathered from these offices was entered into specialized software designed by ICLEI and Torrie Smith Associates. The CCP software calculates equivalent carbon dioxide emissions (eCO₂) from energy use and other inputs. It also translates all energy units into British Thermal Units (BTU's) for comparison between energy sources. For the Municipal inventory, operational costs were included in the data and inventory reports.

Community Emissions Inventory Methods and Data Sources

Residential Homes

To measure residential emissions contributions within Brookline, the consumption of electricity and heating fuels by customers was calculated. Electricity and natural gas data was collected from local utilities. Heating oil use was estimated using a methodology described below. Jeff Niro, the Brookline Account Executive at Boston Edison provided residential electrical consumption for each year of the past decade. The population growth rate was used to project forward to 2010. The KWH consumption was multiplied by a Massachusetts based CO₂ coefficient provided by ICLEI according to the Commonwealth's electricity generation profile. Patrick Reily in the Gas Resources Office of Boston Gas, gathered natural gas consumption from 1996 through 1999 with gas use projections through the year 2010. Records for 1995 were not available.

Between the two utilities there exists some discrepancy between what is listed as a residential consumer. For natural gas this was determined by the size of the heating broiler and how many units it served. Buildings with less than 4 units are generally residential accounts by Boston Gas. Boston Edison had a larger number of residential accounts because electricity is easier to meter for individual apartments in large buildings. The Boston Edison accounts are divided according to rate classes; residential, commercial, and streetlights.

Heating oil is not provided by one utility but by any number of the over 300 heating oil distributors in the Boston area. Thus heating oil consumption was estimated using information from the Department of Energy, data from the Assessor's Office and GIS analysis. A 1997 study found that in New England, households using oil heat consumed an average of 716 gallons of oil that year. The average household size was 1914 square feet, making the average consumption rate 0.374 gallons per square foot. This was multiplied by the total square footage of residences in Brookline using oil heat. This figure was created by joining parcel information data on the Brookviewer GIS system with assessor's office data that listed parcels and fuel type. The parcels were organized by parcel code and the square footage of each housing type (single family, two family, three family, apartment) was summed.

Projections for 2010 are based on a 20% decline in residential heating oil use since 1980 according to the Energy Information Administration of the Department of Energy. Propane fuel heat was not considered to be a factor worth measuring due to the low numbers of homes listed as using propane heat in the 1990 US Census data.

Commercial and Industrial Operations

The process for calculating emissions for commercial and industrial establishments was similar to that of residential housing. Jeff Niro of Boston Edison provided commercial / industrial electrical consumption for each year of the past decade and the growth rate over the past ten years was used to project forward to 2010. Street lighting electricity use is billed a different rate than other accounts and was listed separately from commercial use. The municipal street lighting account was added to the commercial electricity use data. All other town government electricity use is embedded within the commercial account data. Patrick Reily of Boston Gas gathered natural gas consumption from 1996 through 1999 with gas use projections through the year 2010. The data from 1996 was used for 1995 base year data, as earlier data was not available. The municipal natural gas use is tallied within the Boston Gas commercial account data.

The calculation for heating oil use by commercial and industrial establishments was estimated in a similar manner as residential. The Energy Information Administration of the DOE, conducted a study of commercial operations in 1995 that found that the average oil heating rate was 0.36 per square foot. The assessor's data base does not list fuel type on commercial properties. However, Jon Snodgrass of the Information Service Office was able to provide a list of all commercial properties that pay an \$11 fire services fee for the use of an oil storage tank.. The number of commercial properties was multiplied by the average commercial property size determined from Assessor's Office data. This was then used with the average oil heating rate determined by the Energy Information Administration. This estimate was used for both 1995 and 1998.

Transportation Methods

Emissions from personal vehicles was calculated using daily Vehicle Mile Travel (VMT) data generated by Scott Peterson of the Central Transportation Planning Staff (CTPS) Mr. Peterson used a transportation system model based on regional mobility studies for the years 1990, 2000, and 2020. The VMT was assumed to be growing at a constant rate in order to develop VMT figures for 1995 and 2010. The daily VMT was multiplied by 295 to account for traffic volume changes on weekends and holidays. Vijay Mahal, of the CTPS, broke the VMT data down according to vehicle size and fuel type. It was assumed that light vehicles and light trucks (excluding diesel light trucks) were personal vehicles and that all medium and heavy trucks were commercial vehicles for data entry into the CCP emissions software. The national average data for vehicle fuel efficiency provided by the software was used to calculate fuel use.

For comparison, an alternative VMT number was calculated for the miles driven by Brookline residents. This was estimated in two ways. The average annual miles driven by Massachusetts licensed drivers was multiplied by the number of vehicles registered in Brookline as well as the number of registered voters in Brookline. The vehicle mileage data was taken from the CTPS annual booklet Massachusetts Transportation Facts. The vehicle registration numbers and the count of registered voters was provided by Jen Lutke in the Planning Office. This data was not entered into the software for emissions results but was used to generate discussion over vehicle use in Brookline.

MBTA bus and trolley line VMT was calculated with data from Scott Peterson of CTPS and Conrad Misek of the MBTA. Conrad Misek also provided MBTA vehicle fuel and electrical efficiency information. The MBTA VMT data was calculated using current bus and trolley schedules. Bus fuel efficiency was based on factory performance efficiency results when built not current vehicle performance. The national average electric train energy efficiency rate, provided by ICLEI, was used in this inventory because the data from the MBTA gave voltage load ranges that could not be translated in kilowatt per mile efficiency.

Solid Waste Disposal

In 1989 the Town of Brookline discontinued providing free garbage removal for all residents and commercial centers. A Town Trash Fee was initiated and private contractors were allowed to operate in town after applying for a hauling permit. Data from the 40 private haulers was difficult to obtain. Many of the current licensed haulers did not operate in 1995 or 1998 and few of them kept historical tonnage figures or records separated by municipality. Thus an estimate was used to determine a total solid waste disposal figure.

In 1989 the Town estimated that it picked up 25,000 tons of solid waste. This figure was compared to the annual tonnage data recorded for trash service 1990 when the trash fee and private contractor programs were initiated. This left an estimated 7000 tons of trash collected by private companies. This quantity was assumed to remain at this level in 1995 and 1998, as the town trash service has collected a consistent quantity of trash over the same period. The tonnage from town trash service pick-up was available from the annual Town of Brookline Financial Plan provided by Eleanor Clancy in the DPW, and for recent years, the Municipal Recycling Report completed by Alyssa Cook in the Conservation Office.

All the solid waste collected by the town is taken to a municipally run transfer station. This waste is hauled by a contractor to an incinerator facility in Orno, Maine. Research is ongoing regarding waste related greenhouse gas emissions. Currently the ICLEI software considered incineration to be a no-net gain in greenhouse gas emissions. However, the EPA recently came out with a study that generated a coefficient of 0.10 tons of eCO₂ emissions for incineration of one ton of municipal solid waste. This figure was used in the 1995 and 1998 inventory and 2010 forecast assuming waste is still sent to Maine. The emissions from waste hauling were also calculated based on a 250 mile round trip to the incinerator and an average of 2 truck loads a day. It was assumed that private haulers were also incinerating their garbage. This is based on a number of discussions with company representatives and the State's ban on landfill expansion.

Other Sources:

Sewage Treatment - All sewage in the Boston area is pumped to the Deer Island Treatment Facility. The treatment plant has been under construction during both of the study years, therefore data is a bit inconsistent. Approximately two thirds of the sewage reaches Deer Island by gravity flow. The other third is currently transported first to Nut Island then pumped into the Deer Island facility. The overall energy use of Deer Island was provided by Kenneth Shilinsky of the MWRA along with the flow percentage that Brookline represents. From this information, Brookline's share of the energy use for waste water treatment was calculated. Methane emissions from sewage treatment were not included in the inventory.

Newton Street Landfills - Brookline's old landfill site began accepting waste in 1936. Waste was dumped there until 1975. Most of this was unburnable solid waste from the Town's incinerators. The initial site analysis conducted by the Engineering Dept. reported that 141,744 tons of non-burnable waste was dumped on the 12.75 acres site. The methane released by the old landfill was estimated by the CCP Software. Research is ongoing into waste related greenhouse gas emissions and calculations are subject to change in future revisions of the CCP software.

Municipal Emissions Inventory Methods

Summary

The Municipal GHG Inventory was conducted using fiscal year data for 1995 and 1998 rather than the calendar year . Almost all of the data needed for the Municipal GHG Emissions inventory was available within Town Hall. A great deal of energy use information for the late 1990's was already being aggregated by Mark Sacco in the Building Department and Sean Cronin in the Selectmen's Office. Changes occurred in how energy bills and vehicle fuel use are processed and recorded between the inventory years. The current system of energy reporting to Sean Cronin for building utility bills facilitates future data collection.

Buildings

All departments are required to complete energy reports that record their monthly consumption and expenditures for electricity, heating oil, and natural gas. For FY98 most of the buildings' energy use had been summarized by Sean Cronin in the Selectmen's Office. Individual department records were consulted to complete the building emissions inventory as well as confirming aggregated data. For FY95 the energy reports or utility billing information was provided by individual departments:

Patricia Norling- Health Department
Bob Lynch - Director of Recreation
Mark Sacco - Building Department

Eleanor Clancy - DPW
Sean Cronin - Selectman's Office
Kathy Flanagan - Police Department

The fire department did not have records of individual building energy use for FY95, however Sean Cronin had overall energy consumption data for the department as a whole. After 1998 the DPW relocated its maintenance operations to a single building called the Municipal Service Center, thus future comparisons for energy efficiency of parks, water, and highway buildings should take this into account.

Initially the energy use of public housing facilities were included in the municipal inventory data. However the Brookline Housing Authority is independent of Town Hall, therefore the data was removed from this inventory. The information is still relevant for discussion of community emission sources and is discussed briefly in this report.

Forecasts for building energy use were assumed to be constant except when building expansions were planned. This assumes no dramatic changes in winter heating or summer cooling needs. Additionally increases in electricity use due to continued expansion of information or office technology are not considered. The square footage of building additions approved in the Capital Improvement Program FY 2001 - 2006, was used to project energy use increases. The Council on Aging will open a new building in the year 2000 which was included in the forecast, based on the proportional energy use of the newest school. FY2000 energy use of the Municipal Service Center was used for the forecast as well.

Vehicle Fleet

Vehicle fleet fuel consumption was calculated on a department by department inventory of fuel purchases. All fuel is purchased in the DPW yard with two regular exceptions. The fire department has their own diesel fueling station for fire trucks and the water division has a separate unleaded gas tank for their gasoline vehicles. The DPW changed their fuel system in

1997 as well as the interdepartmental fuel purchase/billed process. For FY95, all vehicle fuel data was summarized in DPW records. Fueling data for 1998 was provided by:

Eleanor Clancy - DPW	Patricia Norling- Health Department
Bob Lynch - Recreation Department	Mark Sacco - Building Department
Kathy Flanagan - Police	Chief Robert English - Fire Department
Bob Laurie - School Department	Linda MacDonald - Assessor's Office

A list of all vehicles in the municipal fleet in 2000 was provided by Fred Davies in the Highway Division. Golf carts used at the Putterham Golf Course were not listed in the vehicle inventory, however their fuel consumption was added to the recreation Department's unleaded gasoline purchases. All DPW divisions except for the Water and Sewer Division are contained within the DPW fuel data. This fuel use includes non-vehicle gasoline use for lawn mowers, generators, and other light machinery.

The school department contracts with a private company for student transportation services thus school bus fuel use is not included. The recreation department leases a bus for their summer programs that fuels at the DPW yard. Additionally the Elder Bus leased by the Council on Aging also uses fuel from the DPW yard. These accounts are both included in the inventory. Fuel use by employees reimbursed when using personal vehicles for town business is not included in this inventory. The forecast for FY2010 assumed no change in vehicle use or fuel consumption by the town. Therefore the FY2010 forecast data is unchanged from FY1998. Vehicle emissions from Town operations that are contracted out to private contractor for work such as construction projects are not incorporated in this study.

Street Lights

There are over 4000 street lights and other outdoor lights in the Town of Brookline. Almost all of the street lights are rented from Boston Edison. This includes actual street lights, parking lot lights, and area lights within parks. Boston Edison also operates lights that sit above fire alarms. The Town owns 212 street lights in the three commercial districts of Coolidge Corner, Brookline Village, and Washington Square. The Town also owns the traffic lights, pedestrian signals, and other traffic control lighting systems. Lighting outside schools is assumed to be included in the school building energy use. The data for electrical use of these different street lighting accounts was provided by Eleanor Clancy in the DPW with technical interpretation provided by Tom Condin in the Engineering Division. The costs for Boston Edison owned lights included the rental fees along with the electricity use billing.

Solid Waste

The dumpsters outside all town buildings are collected by the same truck on regularly scheduled pick ups. This truck schedule was used to segregate out town facility trash from the other town trash deliveries to the transfer station. Each truck load arriving at the transfer station is weighted and classified according to its content (rubbish, yard waste, litter). This detailed data was only available for FY 2000, therefore the current waste figures were used for FY95 and FY98 solid waste calculations.

All trash from the Town's buildings is transported to the transfer station and then shipped to an incinerator in Maine. Solid waste tonnage was multiplied times a CO₂ coefficient for greenhouse gas emissions from municipal trash incinerators. This coefficient is 0.10 tons of CO₂ per ton of municipal solid waste as determined by the EPA.

Water and Sewer

The Town of Brookline is serviced by the MWRA for both drinking water and sewage disposal. The MWRA serves over 40 communities in the Boston area. The drinking water flows from the Quabbin Reservoir and is treated at a series of intermediate reservoirs along the way to Brookline. The electricity use for water delivery is calculated only for the pumping of water at the Chestnut Hill Pumping Station for Brookline customers by the MWRA. This pumping operation delivers high pressure water flow that accounts for just over half of the Town water consumption. The other water reaches users by gravity flow. It is acknowledged that this is not the only energy cost in water treatment and delivery but the most direct energy use to Brookline consumers.

The energy use of sewage treatment at the MWRA Deer Island facility was determined to be beyond the control of the municipal government. Thus these emissions were removed from the municipal inventory and included with the community inventory.

Community Emissions Results

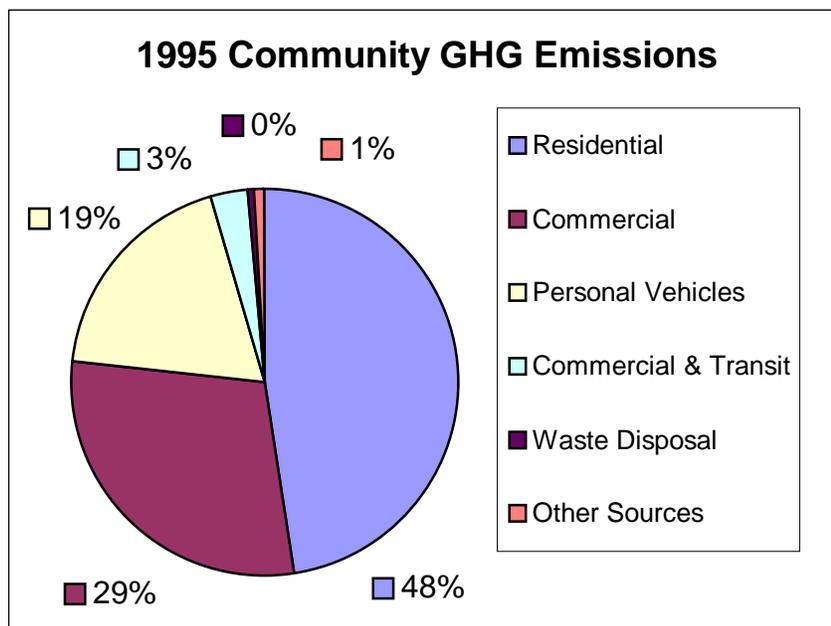
Summary

The Town of Brookline produced 626,512 tons of eCO₂ in the year 1995. Total residential household energy use (includes electricity, natural gas, and heating oil use) accounted for 48% of these emissions and commercial energy use resulted in 29% of the communities emissions. The other major contribution came from the transportation sector, which provides 22% of the town's emissions. The four largest single sources of greenhouse gas emissions were commercial electricity use, personal vehicle gasoline consumption, residential electricity use, and the burning of residential home heating oil, in that order. Natural gas and heating oil produced almost equal quantities of eCO₂.

Total Greenhouse Gas Emissions

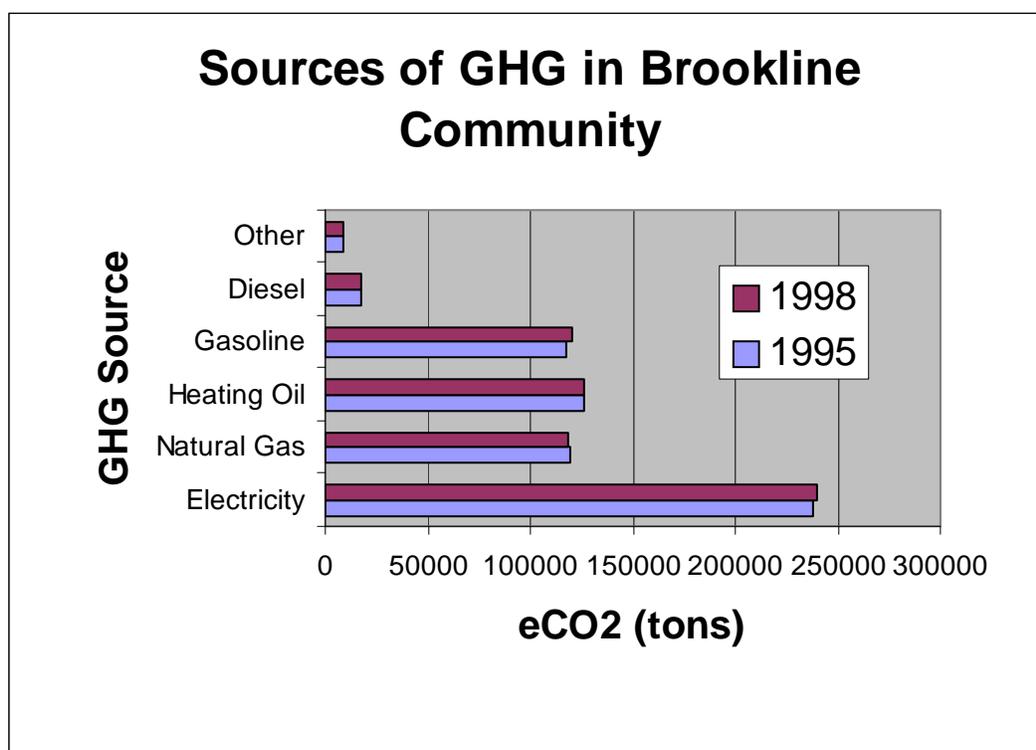
Year	Total eCO ₂ (Tons)	Energy Use (BTU's)	Per Capita Emissions
1995	626,512	6,364,125	11.4 tons / person
1998	631,426	6,416,285	11.64 tons / person
2010 (forecast)	669,460	6,686,333	11.68 tons / person

In the interim year of 1998 the community's emissions were 631,426 tons. The 1998 data saw an increase in both commercial electricity use and vehicle emissions. There was a slight decrease in home energy use in 1998, presumably due to a warmer winter and cooler summer than the baseline year. It is forecasted that without any action to reduce greenhouse gas emissions, Brookline will be responsible for 669,460 tons of eCO₂ production in the year 2010, an increase of 6% over the baseline emissions.



Brookline Community Emissions by Source

eCO ₂ Source	eCO ₂ (tons)		Energy (mil BTUs)	
	1995	1998	1995	1998
Electricity	237387	240031	1076510	1111254
Natural Gas	119888	118186	2032000	2003154
Heating Oil	126268	126268	1558861	1558861
Gasoline	117054	120466	1481694	1524890
Diesel	17420	17668	215059	218126
Other	8496	8806	0	0
Total	626513	631425	6364124	6416285



According to the US Census, the Town of Brookline had a population of 54,718 in 1990 which is projected by the Metropolitan Area Planning Council to grow to 57,284 persons in the year 2010. In the base line year, Brookline's per capita eCO₂ emissions equaled 11.6 tons of eCO₂ per person. Compared to other municipalities of its size that have conducted a similar greenhouse gas emissions inventory, Brookline's emissions are in the middle of other cities and towns in northern climates. Brookline is an older community that is mostly built out and should not expect significant growth in population. Therefore eCO₂ emissions should not rise drastically unless there is an increase in per capita energy consumption or accelerated personal vehicle use. The Town of Brookline should be able to take action to reduce its total eCO₂ emissions below the 1995 baseline level by the year 2010.

CCP Community Comparison

Community	Population	Total eCO ₂ Emissions (tons)	Per Capita (tons per person)	Year of Inventory
Brookline, MA	54,718	626,512	11.4	1995
Burlington, VT	39,127	438,931	11.2	1990
Fort Collins, CO	87,758	1,673,861	19.1	1990
Santa Fe, NM	55,859	1,418,819	25.4	1990
Santa Cruz, CA	54,575	747,679	13.7	1990
Medford, MA	57,400	696,112	12.1	1995
Arlington, MA	43,835	335,063	7.6	1997
Newton, MA	82,585	1,973,540	23.9	1990

Residential Energy Use Results

The residential energy sector use was the largest contributor to greenhouse gas emissions. About 35% of these emissions came from electricity use and another 35% from oil heating. Not illustrated in the study years is that home electrical use peaked in 1997 at 143 million KWH. Natural gas use declined by 0.4% over the second half of the 1990's most due to milder winters and new boiler installations. Boston Gas projects a minimal annual increase in natural gas use of 0.2% over the next ten years despite an expected 0.9% increase in natural gas customers. Oil use experienced a 20% decline over the past 20 years and the Department of Energy expects this trend to continue. The main cause of this appears to be improved heating efficiency as old boilers are replaced with some transition to natural gas. Both oil and natural gas use are obviously affected by greater heating efficiency and insulation in homes.

Weather is also a significant factor when comparing annual home energy use. According to the National Weather Service data., in 1995 the Boston area had a total of 5639 heating degree-days, and 846 cooling degree-days. (A degree-day is a unit used to measure building energy needs. It is calculated with the summation of degrees Fahrenheit each day the average temperature is below or above 65. For example one day 90 degree day equals 25 degree-days.) 1998 had the third warmest winter seasons of the century with only 4999 heating degree days. The summer was also cooler with 752 cooling degree days. Thus overall heating and cooling energy use in 1998 can be expected to be lower, and the decline in eCO₂ emissions in 1998 from residents may be related to temperature changes.

Greenhouse Gas Emissions by Sector

Year	Residential (Tons eCO ₂)	Commercial (Tons eCO ₂)	Transportation (Tons eCO ₂)	Waste & Sewage (Tons eCO ₂)
1995	282,095	182,258	137,336	8,495
1998	279,308	186,045	140,938	8,806
2010 (forecast)	299,706	204,970	152,207	7,890

Commercial

The commercial sector was the next largest contributor to greenhouse gases in Brookline. Electricity use of commercial accounts was the highest single source of eCO₂ and resulted in 21% of all Town emissions. Commercial natural gas use is less than two thirds that of residential accounts and heating oil use is estimated to be less than 7 percent of residential oil use. This comparison is significant because the number of designated commercial electricity accounts is

less than half the number of natural gas commercial accounts. Electricity accounts are more easily designated as residential in apartment buildings as units are more easily billed separately than heating. Therefore the numbers for natural gas are more likely to be inflated with apartment buildings.

The Town of Brookline accounts fall under commercial use and the municipal operation contribute nearly 14,000 tons of eCO₂, or 7.6% of the commercial emissions. Another large contributor are the buildings of the Brookline Public Housing Authority that collectively generate 8328 tons of eCO₂ in 1995. These buildings were not included in the Town inventory.

The high levels of emissions from electricity use in the community, both residential and commercial, point to two opportunities for the Town's emissions reduction action plan. The first is aggressive energy conservation and efficiency efforts in institutional buildings and homes. The second is developing a block electricity purchasing account in order to transfer a large portion of the Town's electricity demand to cleaner energy sources.

Transportation Results

Brookline's automobile traffic continues to grow annually. Personal vehicles are the second largest single contributor to eCO₂ emissions in Brookline and the fastest growing factor. The combination of gas and diesel powered personal vehicles released 117,700 tons of eCO₂ into the air annually. This increased to 121,000 tons in 1998 and 130,848 tons by 2010, assuming there is not a dramatic increase in net vehicle efficiency. Despite technological advanced in automobile fuel efficiency, the collective fuel efficiency of personal cars on the road has not improved due in part to consumer preference for larger vehicles such as sport utility vehicles.

The emissions data above is based on the total vehicle miles traveled of cars within Brookline, not the miles driven by Brookline residents. However, the number of vehicles registered in Brookline is growing as is the ratio of vehicles to drivers. The VMT of vehicles registered in Brookline would be 55% greater than the vehicle miles driven within town borders if all of these cars and trucks were driving the state's average 11,500 miles a year. Despite the growth of economic development along the Route 128 corridor, it is unlikely that Brookline residents travel that same distances as the state average. Still residents of Brookline are responsible for a growing number of cars and conceivably increasing greenhouse gas emissions emitted outside of Town.

Brookline is not a highly industrialized urban area thus commercial truck traffic amounts to 9% of the Town's total VMT. This sector of the transportation CO₂ is also not growing as rapidly as personal vehicles. On average commercial vehicles are less efficient than personal cars but at the same time tend to run mostly on diesel fuel. Diesel fuel delivers greater miles per gallon efficiency than unleaded gas, however each gallon emits a greater quantity of pollutants such as CO₂ and particulate matter. The total emissions from commercial vehicles were 14,600 tons of eCO₂, 11,000 tons of which are attributed to diesel engines.

Transit vehicles were determined to be contributing almost 5,000 tons of eCO₂ within Brookline. Local routes and service schedule have not changed significantly in the past five years, therefore current schedules were used for both the 1995 and the 1998 emissions inventories. The forecast assumed no change in MBTA routes or the transit vehicle fleet. Newer fleet vehicles could address this emissions area. There is great room for variation in vehicle efficiency in the current

rolling stock as the current green line trolleys were built between 1976 and 1997, and the buses were built between 1985 and 1995.

Solid Waste and Sewage

In 1995 the 21,000 tons of waste incinerated in Maine contributed an estimated 2,117 tons of eCO₂. Most of these emissions are determined to be releases from burning plastics. Organic materials, including paper are not considered to be contributors to greenhouse gases when combusted as their carbon content would have been released by aerobic decomposition. The emissions from hauling waste to Maine was estimated to equal 471 tons of eCO₂. In 1998 these combined emission sources from waste disposal contributed 2,473 tons of eCO₂, due to a decline in waste volume.

The other greenhouse gas source from waste in Brookline is the Newton Street landfill site which closed in 1975. This site is generating a declining quantity of methane from solid waste dump at the two landfills since the 1930's. These landfills released 129 tons of methane in 1995 which converts to 2701 tons of eCO₂. By 2010 this eCO₂ contribution is expected to decline to 1276 tons.

The sewage waste of the town is handled by the Massachusetts Water Resources Authority that treats waste from 43 communities in the Boston area. The MWRA is completely a new waste water treatment facility on Deer Island to handle this large volume of sewage. In 1998 this facility used 20.7 megawatts a day of electricity. Brookline contributed 3% of the sewage treated at Deer Island and thus proportionately was responsible for 3207 tons of eCO₂ released annually from the plant's electricity use. As the facility expands its treatment process, Brookline's proportional contribution will increase to 4613 tons of eCO₂ annually by 2010.

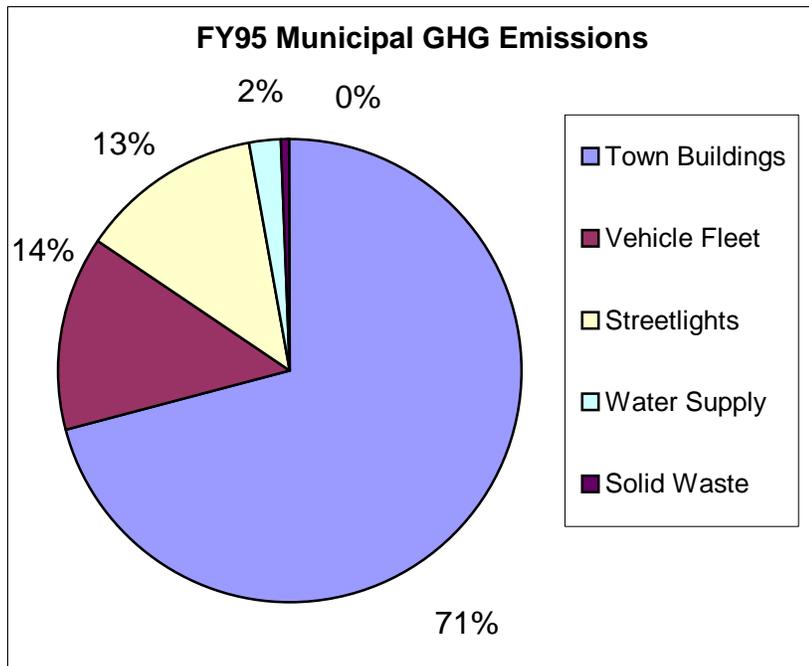
Municipal Results

Summary

The results of the municipal inventory are based on the fiscal year which runs from July 1st to June 30th. The Town of Brookline generated 20,662 tons of eCO₂ in the fiscal year 1995 and 25,294 ton of eCO₂ in FY98. Buildings accounted for approximately two thirds of the town's emissions. Street lights and the vehicle fleet were the next two largest contributors. The energy source responsible for the greatest percentage of emissions is electricity use. Heating oil was the second greatest contributor. Building energy use represented most of the 22% growth in municipal eCO₂ emissions. The Town operations represent 3.3% of the community's net eCO₂ emissions. The forecast for 2010 expects this contribution to grow to 25,552 tons of eCO₂, with most of the change coming in the form of expanding facilities.

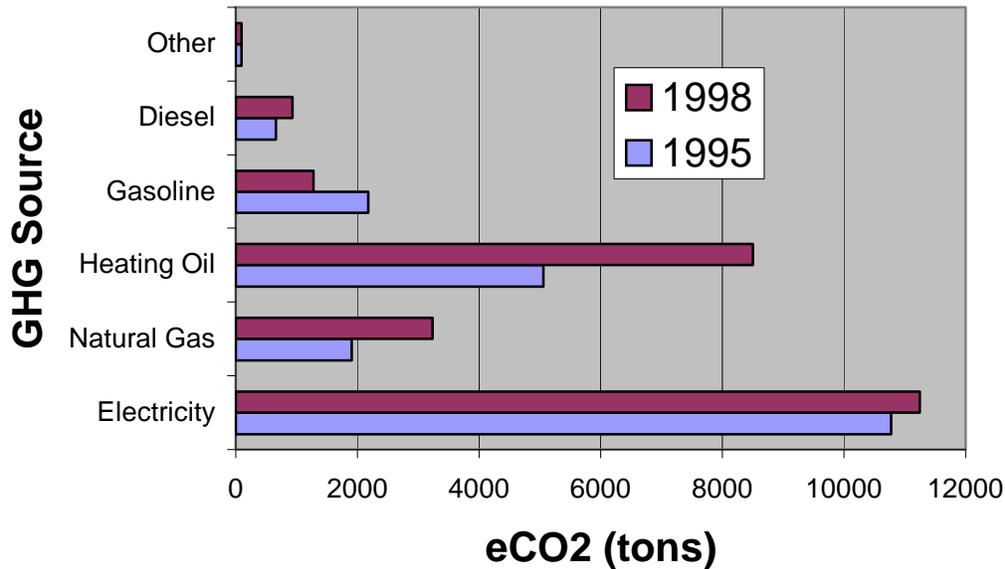
FY95 Municipal Greenhouse Gas Emissions by Sector

Sector	Buildings	Vehicle Fleet	Streetlights	Water Supply	Solid Waste
Tons of eCO ₂	13,936	2,831	2,645	476	98



Many department and division leaders have already begun work towards energy efficiency or fuel emission reductions. The building department is actively researching energy use and conservation technologies, and installing energy efficiency lighting, windows, and HVAC units in town buildings. Peter Sellers of the Highway and Sanitation Division had begun research into alternative vehicles for the town's fleet before the CCP inventory was initiated. The Public Works Department has actively promoted solid waste recycling and has shifted its waste disposal method to incineration which is believed to create less GHG emissions than landfills.

Sources of GHG in Town Operations



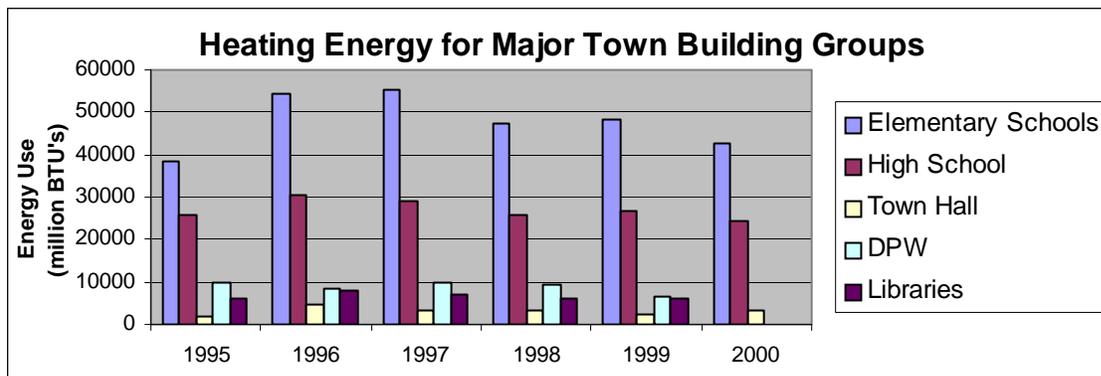
eCO2 Source	eCO2 (tons)		Energy (mil. BTUs)	
	FY95	FY98	FY95	FY98
Electricity	10772	11248	48847	52074
Natural Gas	1903	3238	32257	54874
Heating Oil	5058	8504	62445	104983
Gasoline	2176	1274	27541	16129
Diesel	655	932	8088	11510
Other	98	98	0	0
Total	20662	25294	170838	239570

Buildings

The Town's buildings are both the largest and fastest growing contributor to greenhouse gases within the municipal inventory. Collectively buildings contributed 14,612 tons of eCO₂ in 1995 and 19,926 tons of eCO₂ in 1998. The costs for energy use in all town buildings was \$1,583,000 in 1995 and rose to \$2,033,000 in 1998. This 36% increase came largely within the school buildings. The factors most likely contributing to this change are school building expansions and an increase use of electronics, particularly computers, in schools. Comparison between just two years is highly dependant on weather conditions. This trend of increased energy use in schools is demonstrated over the past 6 fiscal years in the graphs below.

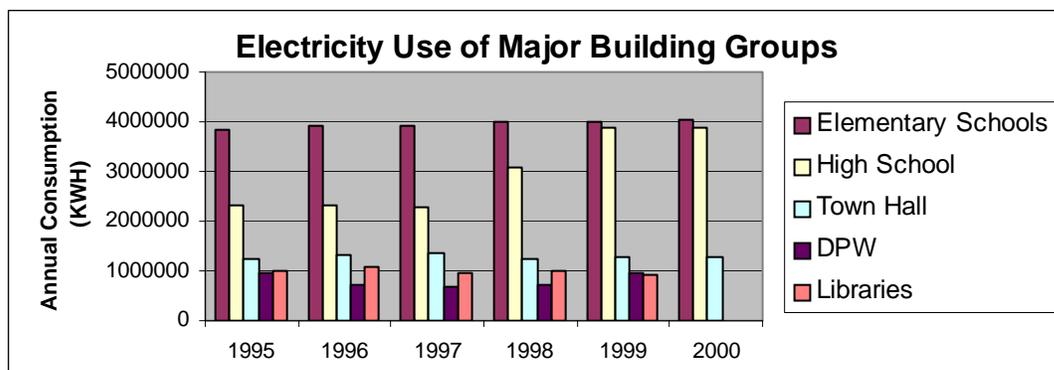
The main high school building was the largest single contributor to greenhouse emissions in both years. Town Hall was the second highest contributor to emissions in 1995, but was surpassed by the Unified Arts Building/Gym in 1998. The two high school buildings are the fastest growing energy users in the Town system. The Pierce, Devotion, and New Lincoln elementary schools

are all large contributors to the emissions inventory. Electricity use was the largest source of greenhouse gas emissions in the Town buildings.



Note: Data was not available from the DPW or Libraries for FY2000

Many changes to the building stock of the town created alterations for the fiscal year 2010 forecast. The town is building a new Senior Center as well as expanding the Main Library. The DPW combined three of its buildings into a Municipal Service Center in 1999 and the main police station is merging with Fire Station #2 to create a larger Public Safety Center, next to Town Hall.



Note: Data was not available from the DPW or Libraries for FY2000

Vehicle Fleet

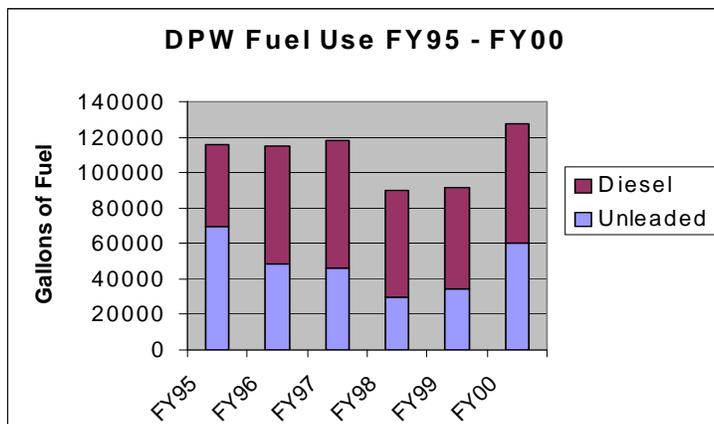
The Town's vehicles consumed 214,842 gallons of unleaded fuel and 63,671 gallons of diesel fuel in FY95 resulting in the production of 2,831 tons of CO₂. The unleaded fuel use dropped to 131,638 gallons in FY98 but diesel fuel use increased to 82,303 gallons. The fleet emitted 624 less tons of CO₂ in FY98. Fuel costs went down 45% from \$326,488 in FY95 to \$178,164 in FY98.

The decrease in total fuel use and carbon dioxide emissions come from three main factors. The first is an increased use of diesel fuel vehicles replacing unleaded vehicles. Diesel vehicles get better mileage per gallon and diesel fuel is cheaper than unleaded gas. Diesel fuel does produce higher levels of pollutants per gallon than gasoline including carbon dioxide and particulates. The purchase of 'clean' diesel fuel may reduce some of these emissions. The second factor is the purchase of more efficient vehicles and equipment. The two largest consuming departments, DPW and Police, have bought newer vehicles with more efficient engines.

Fuel Use by Department (BTU - Unit for combination of diesel and unleaded fuels)

Department	FY95 BTU's	Fuel Cost (\$)	CO2 (tons)	FY98 BTU's	Fuel Cost (\$)	CO2 (tons)
DPW	15,061	\$ 94,013	1203	12,110	\$ 73,814	974
Police	10,405	\$ 66,557	822	7,934	\$ 56,725	627
Water	5,458	\$ 35,808	432	2,741	\$ 17,780	219
Fire	1,746	\$ 10,586	140	1,247	\$ 7,026	101
Recreation	1,032	\$ 6,773	82	1,568	\$ 7,858	125
Building	825	\$ 5,557	65	855	\$ 6,100	68
Elder Bus	686	\$ 4,418	54	300	\$ 1,688	24
Health	109	\$ 732	9	91	\$ 747	7
Assessor's	33	\$ 223	3	58	\$ 523	5
Total	35,629	\$ 326,488	2,831	27,639	\$ 178,164	2,207

The final factor that could affect municipal fuel use is DPW vehicle use for weather and repairs. Heavy snow fall and icy road conditions require increased DPW use of vehicles to clear roadways. Snowfall in FY95 was, however, particularly light, actually the fourth lowest snow season since 1920 according to the National Weather Service. Other repairs or emergency maintenance needs are not well documented. To research the decrease in fleet emissions from the DPW between the two inventory years, the fuel use of the DPW (combined with Water Division) was tracked from FY95 to FY2000. Unfortunately no clear pattern could be seen nor could DPW staff figure out why the fuel use dipped in FY98 and FY99 only to increase dramatically in FY2000.



Street Lights

There are over 4000 street lights and other outdoor lights in the Town of Brookline. Almost all of the street lights are rented from Boston Edison. This includes actual street lights, parking lot lights, and area lights within parks. Boston Edison also rents Brookline lights that sit above fire alarms. The Town owns 212 street lights in the three commercial districts of Coolidge Corner, Brookline Village, and Washington Square. The Town also owns the traffic lights, pedestrian signals, and other traffic control lighting systems.

Lighting Account	FY95 KWH Use	FY95 eCO2 (tons)	Costs
Street Lights - B.E.	2,477,939	1864	759,650

Park Area Lights	92,688	70	126,011
Fire Alarms	130,880	98	22,261
Town Street Lights	182,884	138	17,798
Traffic Control	631,233	475	65,819
Total	3,515,624	2645	991,539

Solid Waste

All trash from the Town's buildings is transported to the transfer station and then shipped to an incinerator in Maine. Solid waste tonnage was multiplied times a CO₂ coefficient for greenhouse gas emissions from municipal trash incinerators. These emissions are mostly the result of plastic incineration as organic materials from plant products result in a 'zero net gain' of atmospheric carbon. In the base year the solid waste from town buildings resulted in 98 tons of eCO₂ emissions.

Greenhouse Gas Emission Reduction Measures

Summary

Listed below are a collection of options for consideration to reduce greenhouse gas emissions in Brookline. The summary list below is followed by brief program descriptions. An effort has been made to quantify CO₂ or eCO₂ (equivalent CO₂) reductions when possible, using either preliminary inventory results or examples from programs in other municipalities. More research may be needed to accurately estimate the results of each particular measure in terms of both emissions and finances.

Existing or Pending Measures

Current initiatives or capital improvement plans are included to measure efforts already underway to conserve energy or reduce waste. This list also recognize programs with other goals or priorities other than energy savings or waste reduction but have greenhouse gas reduction benefits. Pending programs that are under discussion or develop have been included even if they are not yet implemented measures. Thus research and support of these programs may still be necessary to gain their expected greenhouse gas emission reductions. Some existing measures have the potential for **extensions** that would increase the programs effectiveness at reducing greenhouse gases.

Community Programs	Department Responsible
<i>Energy</i>	
<i>No existing Town programs for residential or commercial energy use</i>	
<i>Transportation</i>	
Pedestrian Friendliness of Intersection & Squares	Transportation
Traffic Calming	Transportation
Police Units on Bicycle	Police
Support for Urban Ring Transit Project	Transportation
<i>Waste</i>	
Curbside Compost and Recycling Pick Up	Sanitation / Conservation
<i>Other</i>	
Street Tree Planting / Open Space Preservation	Parks and Open Space
Municipal Programs	Department Responsible
<i>Buildings</i>	
Town Building Lighting Efficiency	Building
Town Building Heating and Cooling Efficiency	Building
Replace Windows in Public Buildings	Building
Energy Efficiency at Recreation Facilities	Recreation
Transfer Station Retrofit	DPW / Sanitation
<i>Vehicle Fleet</i>	
Increase Fleet Vehicle and Equipment Efficiency	Highway Division
<i>Street Lights</i>	
LED Traffic Signals	Highway
Town Owned Street Lights Retrofit	Highway / Engineering
<i>Waste</i>	
Recycling in Town Hall and Schools	Conservation
Purchase of Recycled Paper Products	Purchasing
<i>Other</i>	
Reduction of Unaccounted Water	Water and Sewer

New Proposals

Below is a wide range of initiatives to be considered for the implementation in order to reach Brookline's greenhouse gas emission reduction goal by the year 2010. Many of the ideas listed below follow the example of other local government efforts to reduce emissions. Some are ideas unique to the energy or transportation needs and opportunities in Brookline. Measures marked with a "1" indicate recommended programs that can potentially be implemented within one year.

Community Programs	Department Responsible
Energy	
<input type="checkbox"/> Home Energy Conservation/Efficiency Program	Conservation
<input type="checkbox"/> Develop Energy Efficient Building Code	Building / Engineering
<input type="checkbox"/> Climate Change Outreach and Education	Education / Conservation
<input type="checkbox"/> Block Purchasing of Green Energy	Selectmen
Encourage Participation in Solar Boston	Building
Transportation	
<input type="checkbox"/> T pass payroll purchase/discounts for Town employees	Personnel
<input type="checkbox"/> Designated Bike Lanes and Bike Routes	Transportation
<input type="checkbox"/> Transportation Efficient Development Zoning	Planning
<input type="checkbox"/> Support for Car Sharing Program	Planning
Lobby for increased federal CAFE standards	Selectmen
Increase Bike Facilities	Transportation
Parking Cash Out	Planning / Transportation
Tele-Commuting Option for Town Hall Employees	All departments
Pressure for Increase T Quality of Service	Transportation/Selectmen
Town Sponsored Transit Service	Transportation
Waste	
<input type="checkbox"/> By-Law / Permit Requiring Recycling	Environmental Health
Methane Energy Recovery at Landfill Sites	DPW / Engineering
Other	
<input type="checkbox"/> Sustainable Business Awards	Economic Development
Municipal Programs	Department Responsible
Buildings	
<input type="checkbox"/> Energy Efficient Office Equipment Procurement	Purchasing
<input type="checkbox"/> Municipal Buildings Energy Efficiency Standards and Goals	Building
<input type="checkbox"/> LED Exit Signs	Building
Town Purchase of Clean/Green Energy	Selectman's Office
Solar Hot Water and/or PV on public buildings	Building
Town Owned Demonstration House	Building
Energy Impact Report of all Improvements Plans	Selectmen/Building
Vehicle Fleet	
Downsize municipal fleet vehicles	All departments
Alternative Fuel Vehicle replacement of Town fleet	All departments / DPW
Street Lights (all require town ownership or negotiation with Boston Edison)	
Replace Fire Alarm lights w/ LED or Compact Florescents	Engineering
Retrofit remaining Mercury streetlights	Engineering
Evaluate and retrofit park area lights	Parks and Engineering
Waste	
Expand Town Building Recycling Facilities	Conservation

Existing or Pending Programs

Community

Transportation

Increase Pedestrian Friendly Town Centers & Intersections / Traffic Calming

Brookline like other communities in the Boston Area benefits from the walkability of its commercial centers. The Town continues to promote this with well marked crosswalks, wide sidewalks, traffic signals prioritizing pedestrians, cross guards, and vehicle signage. Vehicular traffic is however on the rise and other measures are being investigated to promote traffic calming such as raised cross walks or intersections. Traffic calming that reduces vehicular speed also reduces gasoline use and emissions. Pedestrian friendly areas promotes transit use, combined vehicular trips, bicycle travel, and walking as a form of transportation.

Police Units on Bicycle

Many communities have found that police on bicycles provide a higher level of protection in certain areas. Moving police out of their cars and onto bikes reduces municipal fuel usage as well as provides visible evidence that bicycling is a legitimate option for transportation. Bicycle police can lead the town in establishing safe roads for cyclists. The city of Berkeley, above twice the size of Brookline, estimated an 8 ton reduction in eCO₂ from their police bike patrols.

Extensions: The police bicycle program can be expanded to include more patrols.

Support for Urban Ring Project

In January of 1999 the Joint Committee on Transportation of the Board of Selectman sent a letter to our state representatives endorsing the MBTA Urban Ring transit route and signed the Urban Ring compact with Boston, Cambridge, Everett, Chelsea, and Somerville. This transit route will provide vital transportation and economic links between these Boston area communities. Studies and work groups are underway discussing 3 different proposals for the transit route design. Brookline will only host a small portion of the transit line however it will increase the efficiency for riders of other transit lines in the Town. Currently the plan expects to use a mixture of rail and dedicated busways to complete the route.

Waste

Curbside Compost and Recycling Pick Up

The Town's municipal curbside recycling program collected 3200 tons of paper, 810 tons of containers, and over 3400 tons of yard waste in 1999. Collectively this resulted in a 36% reduction of solid waste disposal and the savings of 17,819 tons of eCO₂ emissions. Emissions reduction from recycling not only include saving from disposal methods that contribute to greenhouse gases but also accounts for the energy savings of resource recovery.

Other

Street Tree Planting / Open Space Preservation

The town has granted funding to perform restoration work for the forests within the four conservation properties. There is also an ongoing effort to protect the health of and expand the stock of 11,000 street trees in Brookline.

Municipal Programs

Buildings

Town Building Lighting Efficiency

Within Town Hall and the High School older florescent lights are to be replaced with newer ballasts and tubes. In 1998, Town Hall and the High School use 1,235,000 kWh and 1,794,000 kWh of electricity respectively and are two of the Town's greatest energy consuming building. In many areas occupancy sensors will be installed to cut down on lighting of vacant spaces.

Town Building Heating and Cooling Efficiency

Town Hall, the New Library, two recreation centers, and four schools are slated to receive new heating or HVAC systems within the next six years. The town is installing many double boilers with the capacity to use oil or natural gas. This allows operators to choose the cheapest available fuel each season. **Extension:** A commitment could be made by the Town to use natural gas in dual broiler systems if natural gas prices are within 10% of heating oil prices.

Replace Windows in Public Buildings

New glass technology can drastically cut energy loss from windows in buildings. Windows that can be opened by occupants can also reduce ventilation system use while improving indoor air quality. Many town buildings are slated for window upgrades including the Coolidge Corner Library, Fire Station #5, two recreation centers and Driscoll School.

Energy Efficiency at Recreation Facilities

Both the Anderson Ice Skating Rink and the pool at the high school have plans for upgrades in the coming years. The pool will retrofit shower facilities to reduce water and energy use. The skating rink will invest in a new refrigeration unit.

Transfer Station Retrofit

The existing transfer station will be redesigned to become a more energy and time efficient operation. Currently compactors designed for small trucks are used in combination with a tractor top loading trailers to capacity. The new design will make waste transfer a one step process resulting in less energy use. A proposal listed below encourages researching the possibility of using methane recovery from the landfill to power the new transfer station.

Vehicle Fleet

Increase Fleet Vehicle and Equipment Efficiency

Over the past 5 years the Town budget has provided funding for the DPW to upgrade many fleet vehicles and maintenance equipment. This allowed the retirement of many old inefficient engines. In general new engines contribute less CO₂ to the atmosphere than those in older vehicles. **Extension:** The DPW has shifted a large number of its vehicles from gasoline to diesel. Diesel fuel is less expensive and provides better mileage. While this may contribute a small amount of CO₂ emission reductions it should not be considered a measure by itself as diesel emissions contribute other hazards to air quality. Diesel engines do provide the opportunity to convert these vehicles to alternative fuel sources more easily than gasoline engines. Additionally diesel engines tend to last longer than high temperature gasoline motors.

Street Lights

LED Traffic Signals

The DPW recently installed LED lights for the Green and Red signals at most of the traffic signals in Brooklyn. LED lights use 80-90% less energy than the original bulbs. In 1998, traffic signals used 635,000 kWh of electricity at a total cost of \$70,000 to operate. A study in Sacramento, CA found 87% energy savings at one intersection where red, green, and pedestrian lights were converted to LED. LED lights also require 1/6 the maintenance of incandescent bulbs, often needing replacement only every 8-10 years. The energy savings from the installation in Brookline is estimated at a 75% reduction in energy use at each signal. This will result in an energy savings of 450,000 KWH of electricity, a CO2 reduction of 332 tons, and a savings of \$53,000 to \$75,000 annually. This project was funded with a grant from Boston Edison. **Extension:** Many other signal lights such as flashing red lights, school crossing lights, yellow signal lamps, and pedestrian crosswalk signals could be switched to LED. The Highway Division is currently looking into the feasibility of these changes.

Town Owned Street Lighting Retrofit

The town currently owns less than 1/10 of the street lights. The town owned lights are in the commercial squares. These are scheduled to be upgraded over the next four years. **Extension:** The other 3000 plus street lights are rented from Boston Edison. Boston Edison also provides the area lights within town parks and lights above fire alarms. Some of these lights are mercury lamps and could be retrofitted to more efficiency high pressure sodium bulbs. The town is currently considering the purchase of all of the Boston Edison lights to gain more control over their service and to save long term costs. The purchase should pay for itself within four years. The town could use some of this savings to change the older lamps to more efficient technology which will further decrease lighting costs. (see Proposed Measures)

Waste

Recycling in Town Hall and Schools

Recycling has many environmental benefits. Specific to climate change and greenhouse gas concerns, waste diverted from landfills results in reductions of methane production. Recycling also results in energy savings in the manufacturing process. One ton of recycled paper saves 4077 KWH of energy. Town Hall recycles approximately 25 tons of paper annually resulting in a reduction of 155 tons of eCO2 emissions.

Purchase of Recycled Paper Products

The key to promoting the growth recycling of the recycling industry is the purchase of recycled products. Recycled paper results in 74% less air pollution and 64% less energy use to manufacture than paper from wood. The Selectman have committed the Town of Brookline to purchase recycled paper products whenever possible. Currently the Town's office paper supply is 30% post-consumer recycled content. In FY2000 the Town purchased \$73,262 of recycled stock paper.

Other

Reduction of Unaccounted Water

In 1995, Brookline's public water system had 18.4% of its water volume go unaccounted. This figure includes system flushing and leakage. In 1998 this was reduced to 12%. This reduction means a saving of approximately 140 million gallons of water annually. Water conservation leads to reduced energy use during water pumping, treatment, and disposal operations.

New Proposals

Community

Energy

Home Energy Conservation/Efficiency Program

The Town could provide support/promotion of the conservation audit services provided by local utilities. More extensive conservation education programs could be offered by the building department in the form of workshops or project consultation. Such services would be voluntary however energy audits and retrofits could be encouraged through permitting processes or design review.

Energy Efficient Building Code

The state has developed building code regulation to set a standard for quality and safety. The town could develop a regulatory or voluntary green building code that would require enhanced energy efficiency design in all new structures or substantial additions. The Cities of Austin and Fort Collins have implemented a voluntary code that lays out very progressive parameters for sustainable design and construction. The city offers training a workshops in order to promote its green building code. The State of Oregon has written high energy efficiency standards in its mandatory building code. Fort Collins, CO estimated a future savings of 1665 tons of eCO₂ from its voluntary green building program.

Climate Change Outreach and Education

Environmental education has become a greater influence in schools over the past ten years. The town could build additional curriculum resources that specifically discuss climate change issues with a focus on positive solutions for the future. Partnerships with local universities, governmental agencies and non-profits can provide links with science or policy experts as well as opportunities for experiential learning. Additional outreach to citizen and business would encourage more immediate behavior changes with regards to energy and vehicle use. This may include public displays, tabling at local events, continuous public forums, press coverage, and citizen participation in the CCP process.

Block Purchasing of Green Energy

With the deregulation of electricity in Massachusetts consumers are free to change their electricity provider. One option communities have is to pool together their electricity needs and engage in block purchases in order to save money. Additionally electricity providers will be able to sell green energy options that draw electricity from renewable energy resources. Town residents, business, as well as the government could build a block purchasing group to buy green power from a new energy provider. It will be important to research and distinguish between various energy options such as green energy, renewable energy, and clean fuel energy productions.

Encourage Participation in Solar Boston

The Boston Oil Consumer Alliance is leading a collaborative effort to install 10,000 solar water heating or PV systems on homes and businesses in the Boston area over the next 10-20 years. Hot water systems cost between \$3000 - \$6000 however the state offers income tax credits and property tax exemptions for residents installing solar systems. Medford Solar is another program that allowed homeowners to lease PV systems installed on their roofs. Response to this program exceeded expectations.

Transportation

□ T Pass Discounts for Town employees / On-site or Payroll Deduction Purchasing Option

The MBTA offers means for employers to provide employees on-site or payroll deductions for purchasing monthly passes to encourage transit use. The payroll deduction option allows the pass to be paid before taxes, thus resulting in a 20-30% savings. Providing easy and more affordable access to transit passes for various members of the Brookline community could reduce local VMT burdens. Similar operations could be undertaken at public house facilities, the high school, or any local business employing more than 5 transit riders. If 20% of Town employees use transit (280 new transit riders), there will be a one ton reduction in annual CO₂ emissions. Currently public transportation carries 10% of Boston metropolitan area commuters.

□ Designated Bike Lanes and Bike Routes / Increase Bike Facilities

The four greatest impediments for commuters choosing to bicycle to work are safety, weather, distance, and inadequate facilities for storage or changing at destinations. The town can not control weather or people's commuting distance however better infrastructure in the form of bike lanes, racks, and municipal employee facilities can encourage more bicycling in town. Increased bike access to local attractions such as shopping, employment centers, or parks could also reduce automotive use. Changes in VMT and car emissions from improved bike facilities are not easy to quantify. Walking and biking are the only zero emissions forms of transportation. A study in Seattle found dual direction bike lanes on one street reduced VMT by 14,500 miles and eliminated 7 tons of eCO₂ annually.

□ Energy and Transportation Efficient Land Use Regulations

Mixed use zoning and cluster development are frequently established as measures to decrease the energy inefficiency of sprawling land use patterns. Brookline has little room for large scale development projects however the establishment of alternative zoning regulations to encourage energy and/or transportation efficiency.

□ Lobby for Increase Federal CAFÉ Standards

Although the Town can work to increase the fuel efficiency of its vehicle fleet, it has little control over the vehicle choices of its residents and commercial employees. The federal government does however have the ability to set standards for personal automobile fuel efficiency particularly through the Corporate Average Fuel Economy (CAFE) standards. These standards have not been raised since 1975 (implementation began in 1985) and are currently set for 27.5 MPG for cars and 20.6 for light trucks (including SUVs.) This measure would include raising CAFE standards and other vehicle efficiency regulations within the Town's legislative policy agenda. If 50% of the car fleet met proposed new standards by the year 2010 (45 MPG for cars and 34 MPG for light trucks) the improved vehicle efficiency could result in up to 38,000 CO₂ emissions reduction within Brookline. Fort Collins, CO and Portland, OR have made similar measures as part of their local action plans.

Support for Car Sharing Programs

Car Sharing allow residents to become members of an organization that places vehicles around the town for short term hourly use. This provides people who need a car for occasional use access to a local vehicle without having to own their own. In Portland, Oregon CarSharing Portland found that 26% of its members sold their car and 53% of participants avoid purchasing a vehicle as a result of the car sharing program. In Cambridge, a commercial Car Sharing company, called ZipCar has recently started up. They have reserved designated parking spaces

in neighborhood and commercial centers within Somerville and Cambridge, and have approached the Town of Brookline requesting a few public parking spaces.

Tele-Commuting Option for Town Hall Employees or Local Businesses

The town could provide the technology and the flexibility for certain employees to take advantage of telecommunication advances and reduce their number of trips to work. Each department would need to evaluate where this is possible and how such a program can be established fairly. Reducing 2 commutes a month per employee can have significant VMT and emission reductions. A program could be implemented to encourage employers in Brookline to initiate tele-commuting options as well.

Increase T Quality of Service

A large part of Brookline has convenient access to public transit buses and light rail. However crowding and inconsistent schedules may discourage greater use. In their Boston Metropolitan Congestion Management Report for 1997, the Central Transportation Planning Staff (CTPS) concluded that both the C and D lines of the Green Line Trolley as well as bus route number 66 are consistently overcrowded and behind schedule. The town may lobby the MBTA to work to improve service within Brookline. Such improvements may include: the purchase of clean fuel buses, installation of bus shelters with schedules and maps, more frequent green line service, expanded bus routes, provision of bus transfers, bike racks on buses, and avoiding fare increases. Additionally the Town can continue to support MBTA operations in its road and traffic signal improvements. The Town has already registered its support of the Transit Urban Ring Project currently being researched by the MBTA and CTPS.

Town Sponsored Transit Service

The town may consider the establishment of a small scale transit service similar to the Newton's Nexus System or Somerville's CrossTown Shuttle. This 'jintney' service could establish links between commercial centers, existing transit hubs, and community centers, and/or provide service to areas of Brookline without the density to support MBTA access. Such a service would also provide access to other areas of Town for non-automobile drivers such as seniors, students, and low-income populations.

Parking Cash Out

Many businesses and town employment locations offer free parking to their employees. Often this comes at a cost to the employer for leased spaces or parking facility maintenance. A parking cash out program would allow employees who use alternative means of transportation to work, to receive a portion of the cost it would have required to provide them with a parking space.

Waste

Pass Bylaw Requiring Recycling Services

Municipal curbside recycling only reaches residential buildings on Town Trash accounts. Apartment buildings and home owner can choose to use a private haulers for their solid waste. These haulers may or may not provide recycling to those residents. The same is true of commercial solid waste customers. The town could require any permitted hauler with scheduled pick-ups of residential or commercial garbage to offer recycling services. The DEP recommends such regulations to encourage recycling within municipalities. If private haulers reached the Town Trash's current 30% recycling rate, this would result in 2812 tons of eCO₂ savings.

Methane Energy Recovery at Landfill Sites

The DPW has begun developing plans to cap the town's two retired solid waste landfills. The DEP requires the project in order to protect ground water from contamination. Solid waste buried in landfills undergo anaerobic decomposition which generate methane, a greenhouse gas with 21 times the potency of CO₂. The cap will allow all of this methane to be collected to central vents. The town could build a facility that would recover and convert this methane into an energy source. It is estimated that the landfills currently generate approximately 235 tons of methane which is equivalent to 5963 tons of CO₂. The methane could be used to offset the electrical demand of the retrofitted transfer station or other facilities being proposed for the site. This facility currently uses 193,000 kWh of electricity annually. If using the methane for power generation is unfeasible, flaring the methane as it is released will reduce its contribution to climate change. A 75% methane recovery operation would save 1591 tons of eCO₂ in the year 2010.

Other

Brookline Sustainable Business Certificate

The economic development department could issue a certification or award to businesses that initiate emissions reductions activities. The criteria could include energy conservation, waste prevention and recycling, provision of environmental preferred products, use of low pollution technology, accessibility for bicycles, or development of employee VMT reduction program. If a business provide evidence that it has met a certain number of criteria then they would gain promotion from the town through window displays, listings on Cities for Climate Protection materials and web space, or other subsidized advertising opportunities.

Municipal

Buildings

Energy Efficient Procurement / Purchase of Environmentally Preferred Products

Although efforts have been made to retrofit lighting in many town buildings for energy savings, the annual KWH usage and thus CO₂ contribution has remained steady or continued to rise, particularly in schools. This can be partially attributed to the increased use of electronics in offices and classrooms. Between FY1995 and FY1999 the schools annual electricity use has increased by 1,713,338 KWH. The US EPA has developed an Energy Star labeling program for energy efficient equipment and appliances. The State's Operations Service Division has established an Environmental Preferred Products program to assist local governments and state agencies to buy energy saving and pollution preventing materials for their offices and programs. This includes energy star products such as office equipment. Many communities have passed resolutions requiring local government offices to purchase the most efficient and least environmentally harmful products in their procurement decisions.

Municipal Buildings Energy Efficiency Standards

The Town can set minimum standards for the energy efficiency of its own buildings. The city of Tucson established efficiency standards for all new buildings at 50% higher than federal requirements. Such standards could apply to additional as well. For existing structures the Town should set a reduction goal for energy use to encourage continued efficiency and conservation efforts. Fort Collins set a 15% energy reduction goals for all of its city owned buildings. A similar goal set for the Town of Brookline could result in a 3000 ton reduction in CO₂ emissions and \$475,000 savings assuming energy prices remain constant.

□ LED Exit Signs

LED lights similar to those used in the Town's new traffic signals are installed in the EXIT signs of municipal buildings. Exit signs are found in all public buildings and although they are small the signs are always on. LED lights use 80-90% less energy than standard incandescent lamps. LED lights have no filament and are less likely to fail in an emergency. No data is currently available regarding quantity of electricity currently used in Town buildings by Exit signs.

Town Purchase of Clean/Green Energy

Although it is not available in 2000, deregulation will allow electricity providers to sell accounts that contain a high percentage of renewable electrical production. The bulk purchasing of electricity has brought electrical cost down for large purchasing orders. The Town of Brookline could translate some of this savings to making green energy purchases that will greatly reduce the CO₂ emissions of municipal electrical use. The new regulations will also allow local governments to offer residents and businesses the opportunity to join the town in block purchases of green power. This could bring the collective cost of energy lower for the town and residential or commercial consumers while investing in new clean energy technologies. The Town recently negotiated a cheaper electricity supply contract than then previously provided by Boston Edison. The CO₂ coefficient and other emissions of this power supply should be investigated.

Solar Hot Water and/or PV on Public Buildings

Solar hot water facilities could be added to buildings with heavy summer use and water use such as recreation centers. Schools would be best suited for solar photovoltaic panels that contribute to the electrical grid using a high quality inverter, as their peak output would be during the summer vacation months. All town buildings should be evaluated for their daily sun exposure and thus solar energy potential. Lesley College recently installed PV panels upon a shopping center they own in Cambridge that generates 100 kWh on summer days. The state has created new funds for renewable energy projects that may provide assistance for solar projects on public buildings.

Town Owned Demonstration House

The City of Cambridge, MIT, and Tufts University have all created project houses that demonstrate alternative energy technology. The town could sponsor a renovation of town owned property to serve as an outreach center for conservation and renewable energy education for residents or businesses. The Town should discuss partnerships with local utilities and/or Boston Oil Consumers Alliance (BOCA) for such a project.

Vehicle Fleet

Downsize Municipal Fleet Vehicles

Municipal vehicles should be purchased with the true fleet vehicle needs of the department. Many departments have large, less efficient vehicles that are used mostly for passenger transportation. Most of these cars are former police cruisers that have been converted for other uses and thus should be considered recycled vehicles. Downsizing the fleet means reducing unnecessary fleet numbers as well as reducing vehicle size for energy and cost savings. ICLEI estimates that vehicle downsizing from light trucks or sedans to compact cars can result in 2.5 to 6.5 tons of CO₂ reduction per vehicle. More efficient vehicles should be phased in as older vehicles need replacement rather than replacing vehicles before their usable life span is complete.

Alternative Fuel Vehicle Replacement / Conversion of Town Fleet

The state has mandated that almost all state agencies begin purchasing alternative fuel vehicles for their fleet in the upcoming years. Alternative fuels include; compressed natural gas (CNG) which is used extensively by MassPort, hybrid engines that use a combination of gasoline and electrical engines, and electric vehicles. The DPW yard or the Transfer Station could potentially be locations of CNG fueling stations. The vehicle fleet should be evaluated so as older vehicles are retired, departments can begin choosing alternative fuels for their new cars and trucks. Additionally large diesel vehicles can be converted to run on compressed natural gas or be used as dual fuel vehicles. If the Town's garbage packers were converted to CNG, they would emit 124 tons of eCO₂ than their current diesel engines. The Town may also consider establishing an alternative vehicle trial program to explore the use of electricity, hybrid, or in the future, fuel cell vehicles.

Street Lights

Replace Fire Alarm lights with LED or Compact Florescent Bulbs

There are currently 239 incandescent red lights marking the location of fire alarms in Brookline. These bulbs shed 200 lumens of light using 40 - 50 watts each. These light however are on all day and night throughout the year. Annually they use over 600,000 KWH of electricity. Replacing these bulbs with LED or compact florescent bulbs would be an option if these lights were purchased from Boston Edison along with other street lights. If these lights were retrofitted to be 50% more energy efficient, the Town would cut CO₂ emissions by 242 tons and save almost \$33,000 annually. Research is needed to determine what technology would best replace these incandescent lights. Another option is to consider removing the lights and or alarms if it is determined that 911 service and cell phones make them obsolete.

Retrofit the Remaining Mercury Streetlights

If the Town purchases the over 3000 street lights currently owned by Boston Edison, Brookline has the opportunity to complete the retrofitting of these lamps from mercury to high pressure sodium bulbs. Over 95% of the lights owned by Boston Edison are already converted. Only 136 street lights are still using the less efficient mercury lamps. Conversion to mercury can cut their energy use by 1/3 to 1/2 while maintaining or gaining light lumen output. The remaining mercury lamps currently use 116,483 KWH annually. Conversion to high pressure sodium lamps would save 42,756 KWH of electricity, 33 tons of CO₂ emissions, and \$4,276 annually. In negotiations with Boston Edison, the Town may propose that these lights be converted by the utility before they are purchased by Brookline.

Evaluate and Retrofit Park Area Lights

Boston Edison also owns most of the area lights within the Town's parks. These lights collectively use 88,000 KWH of electricity and result in 66 tons of CO₂ emissions at a cost of \$19,000 a year to operate. More research is needed to understand the energy savings potential that exists if high efficient lamps are installed in these areas.

Waste

Expand Town Building Recycling Facilities

Inventory all town buildings to assess their access to recycling and the level of participation within the building. Many schools already engage in this activity. Students could adopt a local municipal building to expand their school's recycling audit. Efforts are already underway within the Conservation Office to promote recycling among Town Hall employees. Another recycling expansion effort is to install newspaper and beverage recycling stations at commercial and transit centers.

Appendix A: Data Contacts and Resources

Community Inventory Data Sources

Electricity:

Boston Edison (EnStar)

Jeff Niro Brookline Area Representative (508)481-7900 x2381 jeff_niro@nstaronline.com
Brian Belcome Energy Conservation (617) 424-2000 x 8127

Natural Gas:

Boston Gas

Pat Reilly Gas Resources (617) 723-5512 x2468 preilly@bostongas.com
Derek Kinball Conservation Programs (978) 322-3302 dkimball@bostongas.com

Heating Oil:

Town Hall

Rachid Belhocine Assessor's Office 730-2042
Jon Snodgrass Director of Information Tech. 730-2314
Pheng Yang GIS Director

Boston Oil Consumers Alliance

Larry Chretien, Executive Director (617) 524-3950

Transportation:

Central Transportation Planning Staff (CTPS)

Scott Peterson Transportation Engineer (617) 973-7078
Vijah Mahal Transportation Engineer (617) 973-7157

Town Hall

Jen Lutke Town Planner 730-2130
Jeff Parenti Transportation Engineer 730-2177

Solid Waste:

Brookline DPW

Alanna Manouk DPW 730-2156

General Brookline Information:

Brookline Assessor's Office

George Moody Chief Assessor 730-2065

Web Resources for Data:

Heating Oil

www.eio.doe.gov/oiaf/servicerpt/nehfuel/index.html
www.eio.doe.gov/oiaf/aeo/tb118.html
www.eio.doe.gov/oiaf/

Solid Waste Incineration

www.epa.gov/globalwarming/publications/waste/greengas.pdf

Forecasting

www.mapc.org

Town of Brookline Municipal Inventory Data Sources

Buildings

Mark Sacco	Building Department , Energy Systems Manager	730-2103
Patricia Norling	Health Department	730-2300
Eleanor Clancy	DPW, Office Manager	730-2166
Bob Lynch	Director of Recreation	730-2069
Sean Cronin	Selectman's Office	730-2206
Kathy Flanagan	Police Department	730-2258

Vehicle Fleet

Eleanor Clancy	DPW, Office Manager	730-2166
Patricia Norling	Health Department	730-2300
Bob Lynch	Director of Recreation	730-2069
Kathy Flanagan	Police Department	730-2258
Chief Robert English -	Fire Department (retired)	730-2263 or 2272
Peter Sellers	Director of Highway and Sanitation	730-2704
Fred Davies	Highway Division	730-2160
Ruth Ann Dobek	Council on Aging	730-2111
Bob Laurie	School Department	730-2400
Linda MacDonald -	Assessor's Office	730-2279

Street Lights

Eleanor Clancy	DPW, Office Manager	730-2166
Tom Condon	Engineering	730-2141
Jamie Pianka	Highway Division	646-2710

Solid Waste

Alanna Manouk	DPW	730-2156
Peter Ditto	Engineering	730-2135
Eleanor Clancy	DPW, Office Manager	730-2166
Tom DeMao	Director of DPW	730-2156

Water

Andrew Pappastergion -	Director of Water and Sewer Division	730-2174 or 2163
Tom DeMao	Director of DPW	730-2156

MWRA

Howard Hughes	Public Affairs Office	(617) 788-1158
Paul Kelly	Operations Control Center, Chestnut Hill	(617) 264-6006
Ken Shilinsky	Senior Program Manager, Deer Island Treatment Plant	(617) 539-4164