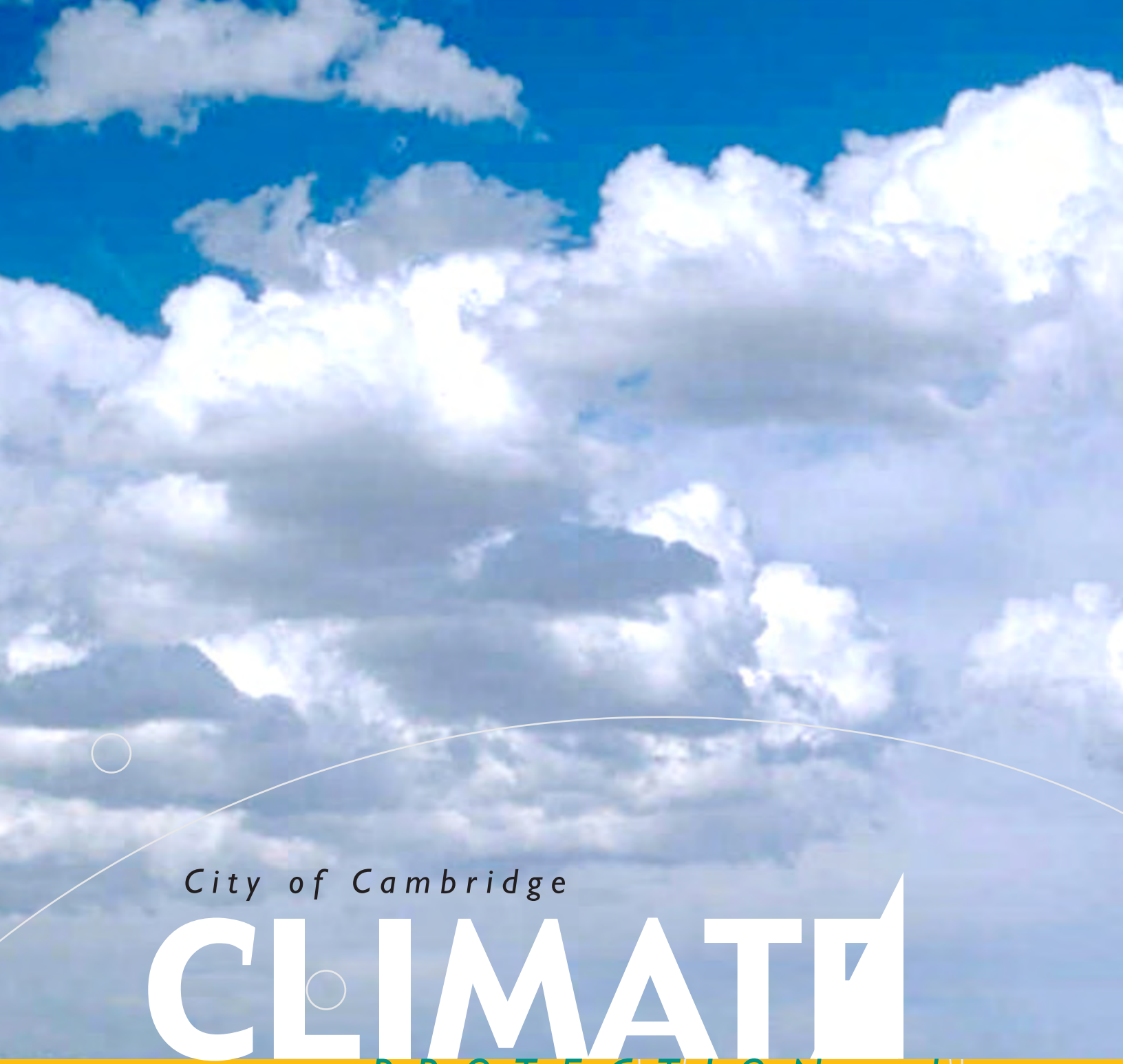

City of Cambridge

CLIMATE PROTECTION *plan*

LOCAL ACTIONS TO REDUCE GREENHOUSE GAS EMISSIONS

City of Cambridge

CLIMATE PROTECTION plan

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Climate Protection Plan Summary

Why Cambridge Should Address Global Climate Change

The International Panel on Climate Change, a United Nations advisory body involving about 2,500 scientists around the world, and the U.S. National Academy of Sciences have both issued findings that global climate change is happening and that greenhouse gas emissions from human activities play a significant role. The debate over climate change is no longer about whether it is happening but about how fast it is happening, what the impacts will be, and what to do about it. The evidence of climate change is seen in the measured increase of carbon dioxide and other greenhouse gases in the atmosphere, rising average temperatures, and rising sea level.

While climate change is a worldwide phenomenon, the impacts will be felt locally. The New England Regional Assessment prepared by the federal government predicts that average temperatures in our region will increase from 6 to 10 degrees F within the next 100 years. At the lower level, our climate will shift to one more like Richmond, Virginia. At the upper level, it would be more like Atlanta, Georgia. The impact of climate change will involve more than hotter temperatures. Among other effects, it will create habitat for disease-carrying insects that do not occur here now; change rain and snowfall patterns, affecting water supplies, agriculture, and the frequency of flooding; cause changes in natural habitats that will eliminate some species from our area and introduce new ones; and cause sea-level rise and greater coastal storm damage. Local and state governments, businesses, institutions, and citizens will bear the brunt of adapting to these changes through payment for public works projects, insurance premiums, and disaster response.

How Cambridge is Responding

In May 1999, the City Council voted to join Cities for Climate Protection (CCP), an international consortium of communities working to reduce the emission of greenhouse gases. CCP is a project of the International Council for Local Environmental Initiatives (ICLEI), which is an association of hundreds of local governments working on environmental problems. As of October 2002, 18 Massachusetts communities had joined CCP. Since joining, Cambridge has inventoried its 1990 and 1998 greenhouse gas emissions and written this plan, which includes a proposed emissions reduction target and recommendations to reduce emissions.

It is understood that any actions taken by Cambridge alone would have a small effect on climate change. This plan is an effort by Cambridge to take responsibility for its share of the problem and to demonstrate that taking action is feasible and desirable. By joining with other communities around the world, we hope to contribute to a cumulative solution to climate change.

Cambridge's Greenhouse Gas Emissions

The greenhouse gas (GHG) emissions inventory indicates that most of Cambridge's contribution to climate change is associated with energy use in buildings. Fuel oil, natural gas, and electricity used to heat and cool buildings and to run machinery and equipment account for nearly two-thirds of our GHG emissions. Transportation, primarily in the form of gasoline use, is a smaller source of emissions compared to elsewhere in the country because Cambridge has such a large commercial sector, is a compact area that facilitates walking and biking, and has an extensive public transit system. The contribution to GHG emissions from disposal of solid waste is a small, but important, source as well.

GHG Emissions Reduction Goal

The climate protection plan proposes that we reduce GHG emissions by 20 percent below 1990 levels. This means the community needs to reduce and prevent annual GHG emissions of 494,400 tons of carbon dioxide. The 20 percent target is typical of those set by other CCP communities.

Many scientists indicate that far greater worldwide reductions, in the realm of 75 to 85 percent, will be necessary to stabilize the concentration of greenhouse gases in the atmosphere. At present, we do not know how to achieve such a reduction without considerable social disruption. However, the plan proposes that we begin by undertaking actions that are feasible now and that for the most part provide multiple benefits.

Vision and Strategies

The vision of this plan is for Cambridge to be smarter and more resourceful about the manner in which its buildings use energy, people and goods are transported, and waste is managed. Cambridge is in a position to apply many existing technologies and approaches to tackle this problem and to take advantage of emerging trends and resources in energy, transportation, land use, and waste management that hold promise to change for the better the way our city works and the way we live. By undertaking the actions in the plan, Cambridge can reverse the trend of increasing GHG emissions and begin to reduce our annual emissions.

The plan proposes strategies based on increasing energy efficiency, switching to renewable energy sources, reducing vehicle miles traveled, and reducing the generation of solid waste. Some of the reductions are not in Cambridge's control and depend on action at the federal or state level. The City can play an advocacy role in these cases. The following table summarizes the strategies. Estimates are largely based on projections from other sources.

Summary of GHG Reduction Strategies

- Improve efficiency of electricity use by 12.5%.
- Reduce natural gas and fuel oil use by 10%.
- Reduce emissions associated with electricity generation by 40%.
- Purchase 20% of electricity from green power sources.
- Increase average fuel economy to 40 MPG.
- Reduce vehicle miles traveled by 10%.
- Increase recycling rate to 60%.

While these strategies are focused on reducing greenhouse gas emissions, they will have added benefits including reduced conventional air pollution (i.e., smog), savings on utility and fuel bills, reduced traffic congestion, conservation of natural resources, and other positive effects.

The strategies will be put into effect through actions on energy, transportation, land use, and waste management. The full plan describes the existing situation in each area, available tools and resources, and actions. The following is a summary.

Proposed Actions

Energy

Cambridge relies on electricity, natural gas, and fuel oil for energy. Almost all of this energy is imported. Electricity comes from generating facilities throughout the Northeast and eastern Canada and is delivered to the city over a network or transmission grid. Natural gas is delivered from an even wider area through pipelines. Independent dealers deliver fuel oil.

Improve energy efficiency. Institute an energy management system for municipal facilities; recruit businesses and institutions into the EPA Energy Star program; help residents carry out efficiency and other measures; utilize energy service companies and performance contracting; take greater advantage of utility energy conservation programs; implement purchasing policies to favor energy efficient equipment.

Green the Electricity Fuel Mix. Promote replacement of electric generating facilities fueled by coal and oil by supporting a federal and state renewable portfolio standard; support federal legislation to regulate carbon dioxide emissions from power plants.

Buy Green Power. Purchase green power for the municipal electric load and encourage green power purchasing by businesses, institutions, and households; install renewable energy systems and fuel cells to improve electric system reliability, reduce reliance on imported oil and encourage clean sources of energy; work to provide options to businesses, institutions, and residents to purchase green electricity through such steps as consumer aggregations.

Expand District Steam. District steam produces fewer GHG emissions than individual boilers and furnaces. The existing district steam system in eastern Cambridge, which is supplied by Mirant's Kendall Square Station power plant, has additional capacity. Efforts should be made to extend the distribution system and add customers.

Transportation

Emissions from transportation come from vehicles that use gasoline and diesel. The amount of emissions is a function of the fuel economy of the vehicle and the number of miles traveled. The current trend is toward lower fuel economy and more vehicle miles traveled, which means more emissions of GHGs and other air pollutants. Car ownership is increasing at a faster rate than the population.

Reduce SOV commuting. Continue and expand measures to reduce commuting by single-occupancy vehicles (SOVs) and encourage alternative modes of transport; continue to implement the Vehicle Trip Reduction Ordinance; and enforce the Parking and Transportation Demand Management Ordinance.

Improve facilities for walking and cycling. Install more bicycle lanes and parking facilities; create and improve off-road paths including railroad rights-of-way; expand efforts to retrofit streets and intersections to better accommodate bicycles and pedestrians.

Reduce motor vehicle travel with promotion and education programs. Conduct information and promotion programs to encourage alternative modes of travel; establish a bicycle-sharing program.

Reduce motor vehicle emissions. Acquire alternative fuel and hybrid vehicles; develop a municipal green fleet policy; install emission controls on heavy-duty vehicles; establish a compressed natural gas refueling station; discourage idling.

Promote Transit Improvements. Support extension of the Green Line, acquisition of alternative fuel buses, and plans for the Urban Ring.

Land Use

Urban form—the layout of our streets and parcels, design of buildings, and distribution of open space—affects how much energy buildings use, how easy it is to use alternatives to cars, and other factors that influence GHG emissions.

Use zoning and incentives to foster mixed-used, transit-oriented development. Encourage denser development near transit stations; design durable buildings with flexible re-use options; use permitting and incentives to create more open space and plant more trees; carry out the Green Ribbon Commission's open space recommendations.

Optimize building design and the use of vegetation to shade buildings and reduce the urban heat island effect. Use geographic information systems to map the city's tree canopy coverage and assess the environmental services provided by the urban forest; maximize the tree canopy cover, particularly over parking lots and air-conditioning units; install roofs with high reflectance or "green" landscaped roofs; incorporate reflectance and shading standards in designs for parking lots and building construction.

Promote the design and construction of "green buildings." Encourage the use of the Leadership in Energy and Environmental Design (LEED) green building standards through zoning incentives and requirements; provide information to developers and citizens to facilitate the use of LEED; encourage reuse of materials from existing structures during renovation and redevelopment.

Work for transit-oriented regional land use planning. Work with public officials in other communities to create an effective regional land use plan; actively participate in regional land use planning processes.

Waste Management

The disposal of waste results in the direct emission of greenhouse gases when it is burned in incinerators and when it degrades in landfills and produces methane. The manufacturing, processing, and transporting of new goods also create emissions. GHG emissions are the result of the amount of material that is consumed and the amount that is disposed of at landfills and incinerators.

Prevent waste. Implement waste prevention programs at the municipal, business, and institutional levels; increase the rate of recycling; increase food composting by commercial and institutional establishments; facilitate recycling of construction debris and waste.

Do environmentally preferable purchasing. Assess and improve existing municipal purchasing policies to increase the use of recycled paper and other products.

Implementation

Cambridge has a multitude of opportunities to reduce greenhouse gas emissions. The challenge is to marshal the people, resources, funds, and knowledge to act on this problem in a focused and sustained way. This plan recognizes that reducing greenhouse gas emissions needs to be a community-wide process that involves all sectors—residents, businesses, institutions, and government.

The main elements of the plan's implementation strategy are:

Provide City leadership. The City will undertake actions to reduce GHG emissions by improving the energy efficiency of municipal buildings, installing renewable energy systems and purchasing green power, increasing the fuel economy of the City vehicle fleet, introducing sustainable practices into City work, and reducing waste.

Undertake a citywide campaign. A campaign is needed to draw all sectors together in a common effort to reduce greenhouse gas emissions. Such a campaign should engage all stakeholders in the community and could include a marketing campaign; a community organization to coordinate activities; publications and other informational material for each stakeholder group; public recognition of notable accomplishments; and a means for the community to see whether progress is being made.

Build on Existing Efforts. There are many efforts already underway in Cambridge aimed at the goals of climate protection. Businesses are constructing green buildings, installing renewable energy systems, participating in transportation demand management programs, and reducing waste. Universities have created green campus programs to assess their GHG emissions and develop more sustainable practices. The faith community has launched programs to improve the energy efficiency of places of worship and to involve congregations in living more sustainably. Numerous community organizations active in Cambridge have related goals and programs. Other communities in Massachusetts, the United States, and abroad are involved in Cities for Climate Protection and offer opportunities for learning and partnership.

Monitor Progress. Indicators such as energy use, transportation factors, and waste volumes should be tracked and reported at regular intervals to assess progress toward the emissions reduction target.

Establish a Coordinating Committee. The City should establish a standing committee to monitor progress and advise the City Administration on implementation of the plan.

SECTION 1: Introduction

Climate change, or global warming, is ultimately a local problem. Its causes lie in the daily activities that take place in our workplaces and homes, in our schools and universities, at our places of worship, and on our roads. Its effects will be felt in our community. And while local action alone can't solve the problem, we are well positioned at the local level to reduce our contribution to climate change.

Cities for Climate Protection

The Cities for Climate Protection Campaign (CCP) is a project of the International Council for Local Environmental Initiatives (ICLEI), which is a worldwide association of municipal, county, and other local governments that addresses environmental problems at the local level. As of October 2002, there are 561 local governments involved around the world, including 134 in the United States and 18 in Massachusetts. The U.S. participants account for 17% of total U.S. greenhouse gas (GHG) emissions.

On May 24, 1999, the Cambridge City Council passed a resolution to join CCP. All CCP participants agree to enter into a process that involves five basic steps:

- conduct an inventory of GHG emissions;
- set an emissions reduction target;
- prepare a local action plan;
- implement the local action plan;
- monitor the results.

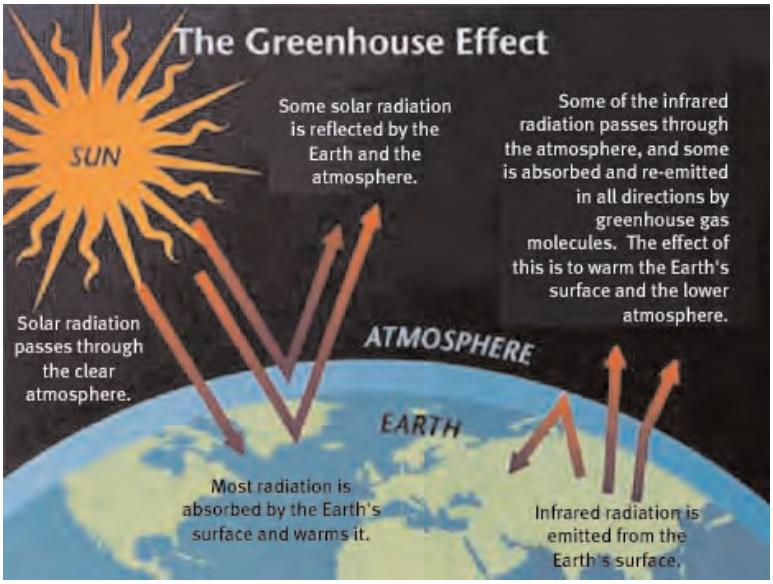
Cambridge has conducted an emissions inventory and with this plan is setting a reduction target with strategies and actions to achieve it. Many actions that reduce GHG emissions have already been initiated by the City and by organizations and individuals in the community.

A task force comprising interested residents and representatives of the business and university communities met regularly for over a year and worked closely with City staff to develop the plan. The task force was instrumental in shaping the plan's principles, strategies, and actions. The task force guidelines can be found in Appendix II.

•I•C•L•E•I
International Council for
Local Environmental Initiatives

Cities for Climate Protection in Massachusetts

Amherst	Medford
Arlington	Newton
Barnstable	Northampton
Boston	Salem
Brookline	Shrewsbury
Cambridge	Somerville
Falmouth	Springfield
Gloucester	Watertown
Lynn	Williamstown



Climate Change Science

Climate change is basically the result of too much of a good thing. The good thing is the greenhouse effect. The Earth's atmosphere contains gases, including carbon dioxide, methane, and nitrous oxide, which have the ability to allow sunlight to pass through while trapping heat that radiates back out from the surface. The name of this phenomenon comes from the way that this layer of heat-trapping gases in the atmosphere resembles a glass greenhouse. The greenhouse effect is a beneficial and necessary process. Without it life on Earth as we know it would not be possible. The planet's temperature would be around 0 degrees Fahrenheit instead of the average 60 degrees F that sustains life.

On the scale of geologic time—hundreds of thousands or millions of years—climate has always varied; ice ages and hot periods have come and gone. Our society has only existed for a very short time, in geologic terms, during which the climate has been relatively stable. We have adapted to a fairly narrow range of climatic conditions—temperature, rain and snowfall, etc.

Climate change is a problem because it threatens to disrupt the conditions on which society is based—our agricultural and marine fisheries, economic systems, roads and rail systems, water supplies—in an abrupt manner, without leaving enough time for society to adapt its support systems. Moreover, while we humans have some capacity to adapt, many of the animal and plant species on which we depend for food, fiber, recreation, beauty, and other ecological services, do not.

There is a consensus in the scientific community that climate change is happening, that human activities are contributing to it, and that the potential consequences are grave. The remaining debate is over how fast it will occur, how much more warming will take place, and what the specific impacts will be in a particular region.

Scientific Consenus on Climate Change

"There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities."

International Panel on Climate Change (IPCC), Third Assessment Report, 2001

U.S. Scientists Agree on IPCC

"The IPCC's conclusion that most of the observed warming of the last 50 years is likely to have been due to the increase in geenhouse gas concentrations accurately reflects the current thinking of the scientific committee on this issue... Despite the uncertainties, there is general agreemant that the observed warming is real and particularly strong within the past twenty years."

National Research Council, Climate Change Science: An Analysis of Some Key Questions, June 2001

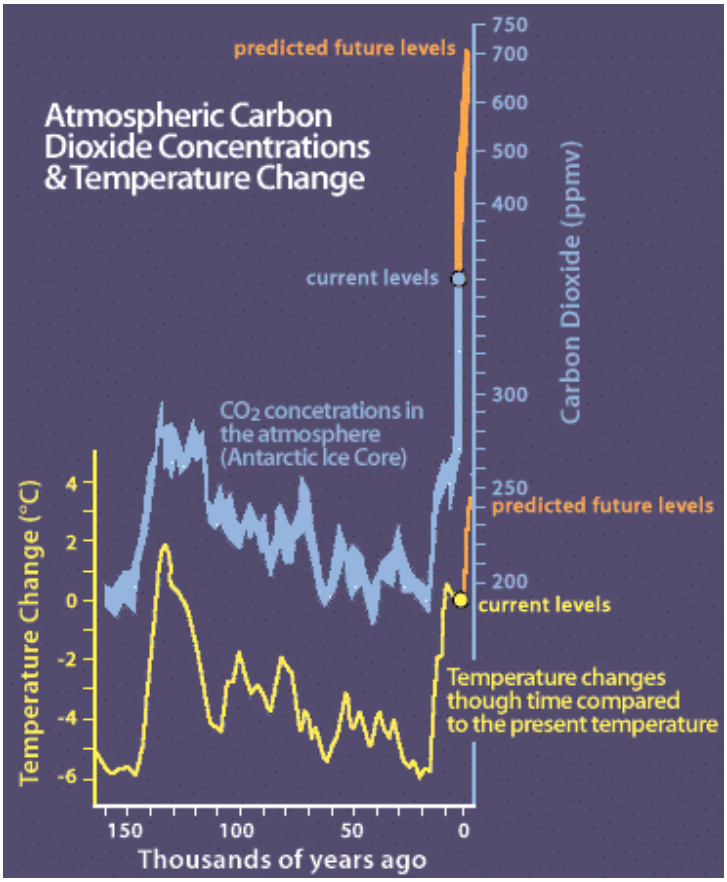
Climate Change and Greenhouse Gases

The buildup of greenhouse gases in the atmosphere is a major contributor to the increase in global temperatures. Carbon dioxide is the main greenhouse gas; methane, nitrous oxide, and certain man-made gases (chlorofluorocarbons, sulfur fluoride compounds) are also significant contributors. Soot and the level of solar activity also influence temperatures. The loss of forests reduces the planet's capacity to store, or sequester, carbon.

The concentration of carbon dioxide in the atmosphere has been rising since the beginning of the Industrial Revolution, when fossil fuels like coal and oil began to be burned in large quantities. As carbon dioxide concentrations increased, temperatures rose too.

The climate change problem has developed as human activities have added growing amounts of carbon dioxide and other greenhouse gases to the atmosphere, thereby increasing the natural greenhouse effect. The more greenhouse gases increase, the more heat is trapped.

If the trend in increasing emissions continues through this century, CO_2 concentration will rise to levels not seen on Earth for 50 million years.



What Are the Signs?

- Temperatures are in fact rising. Over the twentieth century, average global surface air temperature has warmed between 0.7 and 1.5 degrees F.
- Sea level has been rising by an average of 0.1 to 0.2 meters during the twentieth century. This is mostly attributed to heat expansion of global waters.
- Concentrations of carbon dioxide in the atmosphere have increased 31% since 1750. The present CO_2 concentration has not been exceeded during the past 420,000 years and probably not during the past 20 million years.

The current rate of increase is unprecedented during at least the past 20,000 years. Concentrations of other greenhouse gases have also increased significantly since 1750, including methane (151%) and nitrous oxide (17%).

- Mountain glaciers around the globe are retreating. Glaciers in the European Alps have lost about 30 to 40% of their surface area and about half of their volume since 1850. In the New Zealand Southern Alps, glaciers have lost about 25% of their area over the past 100 years. Mount Kilimanjaro in East Africa has already lost 82% of its ice since 1912. At current rates of warming, the famous snowcap will disappear in 20 years. In Glacier National Park, Montana, the number of glaciers dropped from an estimated 150 in 1850 to about 50 today; at current rates of warming experts predict that the park's glaciers will be gone by 2030.
- The extent and thickness of Arctic sea ice is decreasing. Declassified data collected by U.S. and Russian submarines show that the central Arctic ice has thinned 1.3 meters over the past 20 to 40 years, representing a 40% decrease in volume. Satellite data indicate a 10 to 15% decrease in summer sea ice concentration over the entire Arctic.
- Spring melting of ice on rivers and lakes is arriving earlier. Ice-out dates in Lake Winnipesaukee in New Hampshire are four days earlier on average than in 1886.

Climate Change Impacts

Warming of air temperatures is just the first step in climate change. Rising temperatures lead to changes in rainfall and snowfall patterns, soil moisture, and sea level, which in turn cause physical changes in the landscape, modifications in the ranges of plants, animals, and other living organisms, and impacts on human structures and systems.

The federal government commissioned the New England Regional Assessment (NERA) to evaluate potential impacts on our region. Based on climate models, NERA projects that average temperatures in New England may increase by 6 to10 degrees F by 2090. While this may not seem like a large difference, consider that there was only a 10 to 12 degree F difference between the peak of the last glacial period, when New England was under two miles of ice, and now. NERA provides another perspective; a six-degree increase would cause Boston's climate to become more like that of Richmond, Virginia. A ten-degree increase would make our climate more like that of Atlanta, Georgia.

Risks to the Global Ecomony

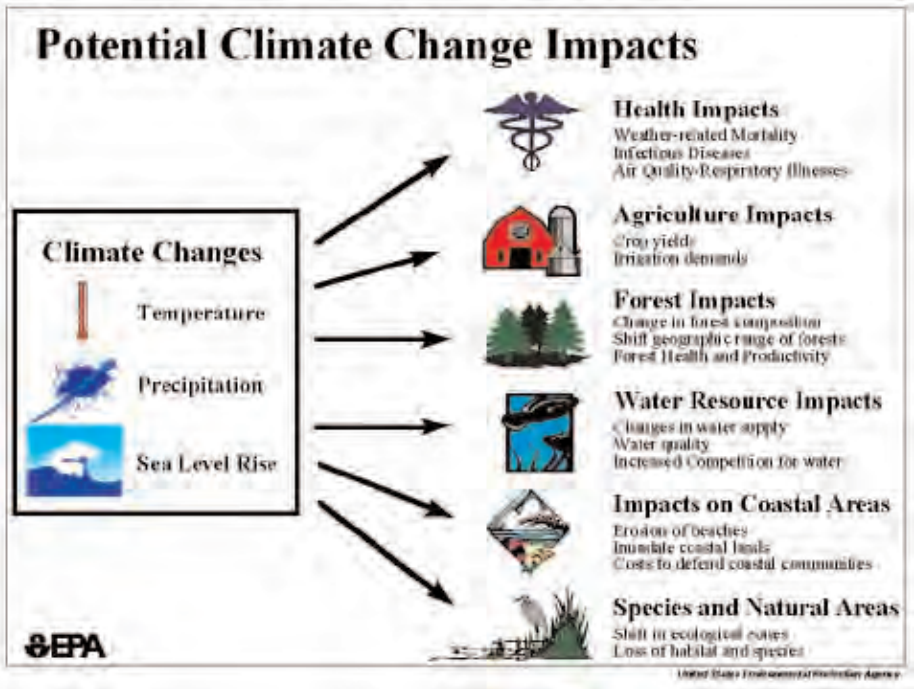
According to the United Nations Environmental Programme and the financial services industry, worldwide economic losses due to natural disasters appear to be doubling every 10 years. Each year, four times as many weather-related natural disasters occur compared to 40 years ago. On current trends, annual losses will reach nearly $150 billion in the next decade.

Climate Change & the Financial Services Industry, UNEP FI Climate Change Working Group, July 2002

Possible impacts that could affect our region include the following:

- Extreme weather events such as heavy rainfall, ice storms, floods, droughts, and heat waves are likely to become more frequent. Increased damage to public and private property and more insurance claims would be the result.
- Summer temperatures will likely increase, causing more 90 degree days. Smog levels would increase and more frequent unhealthy air quality days would damage public health.
- Conditions may become more favorable for disease-carrying organisms such as mosquitoes.
- Droughts may affect water supplies as runoff decreases and evaporation increases.

  Outside Cambridge, other impacts will indirectly affect the city as the United States and other countries cope with the impacts of climate change.



Why Waiting is not an Option

Because climate systems are complex and we can't predict the nature and extent of the impacts with certainty, some people advocate delaying action. Unfortunately, waiting to resolve the scientific uncertainties in predicting climate could be disastrous.

To slow and eventually reverse global warming, we must lower the concentration or total amount of greenhouse gases in the atmosphere. This means that not only do we have to lower the rate of greenhouse gas emissions, but we have to reduce the total quantity of emissions until they are lower than the rate at which nature removes carbon from the air. Otherwise, the concentration of carbon dioxide and other GHGs will continue to rise as will temperatures. Currently, the rate of human-made GHG emissions is roughly double the rate of removal. Consequently, emissions must fall by at least half to stabilize GHG concentrations at current levels, and even more to lower the concentration. Scientists indicate that ultimately emissions need to fall to 75 to 85% of current levels.

Waiting to take action is dangerous because of the nature of GHGs. When carbon dioxide emitted by a motor vehicle, building furnace, or power plant enters the atmosphere, it will stay there for a long time—50 to 200 years. This means the warming trend cannot be reversed quickly. The longer the wait, the worse the problem becomes.

While uncertainties in predicting how climate will change in the future may cause scientists to overestimate the impact, there are also uncertainties that may cause them to underestimate the impact. For example, it is unlikely that nature will continue to absorb carbon dioxide at current rates; the latest science suggests it will absorb less as natural systems become saturated, and that several factors limit the ability of plants to take up more CO_2.

This plan proposes that rather than gamble that the scientific community is wrong about climate change, Cambridge take action to reduce emissions by taking advantage of existing technology and resources.

Reasons to Take Action

The primary purpose of this plan is to reduce the GHG emissions that cause climate change, but actions that reduce GHG emissions also achieve other goals. In fact, many actions already taken in Cambridge for other reasons have reduced our GHG emissions.

Reduce air pollution: Burning fossil fuels results in conventional air pollutants that cause smog and other air quality problems. By reducing fossil fuel use through efficiency and switching to alternative fuels, actions can reduce GHGs while decreasing conventional air pollution.

Save money: Using fuels and electricity more efficiently can lower operating costs. Savings can then be used for other purposes.

Improve energy security: Petroleum and its products, such as gasoline, are a major source of GHG emissions. The United States depends on petroleum imports from other countries. Reducing petroleum use makes us less vulnerable to disruptions in supply.

Improve livability: Actions that reduce automobile dependency can decrease traffic congestion. Planting trees cools summer air temperatures. Encouraging walking and bicycling can improve public health. These actions can make Cambridge more livable.

Ultimately, however, Cambridge should act in order to take responsibility for its share of GHG emissions.

Structure of the Plan

This plan proposes to establish a process to start the reduction of GHG emissions in Cambridge, primarily CO_2. The following sections describe Cambridge's emissions; set an emissions reduction target and strategy; present overviews of emissions from energy, transportation, land use, and waste management activities; identify resources and programs available to address these areas; list possible actions; and propose implementation steps. The plan proposes rather than prescribes actions. It also proposes steps to engage the entire community so that businesses, institutions, government, and individuals can develop appropriate responses in a coordinated process with ongoing monitoring of results and adjustments.

SECTION 2: Greenhouse Gas Emissions in Cambridge

GHG Emissions Inventory

The City has inventoried GHG emissions for the years 1990 and 1998 and forecasted emissions in 2010. The inventory focuses on carbon dioxide and methane. Significant sources of other greenhouse gases are not present in Cambridge.

Carbon dioxide results from the combustion of fossil fuels—oil, coal, natural gas, gasoline, and diesel. Methane results from the decomposition of organic waste-paper, food scraps, wood, etc.—in landfills. These fuels and materials are used in our daily activities at home and work. Burning oil and gas to heat our homes and workplaces, using electricity to power lights and machines, burning gasoline and diesel to run cars and trucks, and disposing of trash all result in the emission of greenhouse gases.

The GHG inventory is based on accepted international protocols and is the same approach other participants in Cities for Climate Protection use. The inventory is not meant to be a precise accounting, but it does provide a broad-brush examination of our GHG emissions and helps point out where actions are most needed. It does not include the emissions related to the production of most goods bought or consumed in Cambridge; these emissions would be included in inventories done by the communities in which the goods were made.

GHG Emissions in Cambridge

The GHG emission inventory and forecast are summarized in Table 2.1. The inventory indicates that annual GHG emissions rose between 1990 and 1998 and will likely continue to increase until the year 2010 unless action is taken to counter the trend.

In the commercial (businesses, institutions, and government) and industrial sectors, which were combined for the purposes of this inventory, electricity use was the major contributor of GHG emissions. Commercial energy use as a whole accounted for 61% of GHG emissions in Cambridge in 1998. In the residential sector, the use of natural gas (used primarily for home heating, water heating, and gas ranges) and fuel oil account for most of the emissions, although electricity is a significant contributor at over a quarter of the residential emissions. In the transportation sector, driving personal vehicles dominates emissions.

About GHG Numbers in the Plan

In this plan, greehouse gases are primarily meant to include carbon dioxide and methane. Greenhouse gas quantities are expressed in tons of carbon dioxide. This includes the conversion of quantities of methane into equivalent quantities of carbon dioxide (methane is approximately 20 times more potent than carbon dioxide as a greenhouse gas).

GHG Emissions Summary *Table 2.1*

Tons of CO_2		1990	1998	2010
Residential				
– Electricity		112,631	117,624	135,586
– Natural gas		236,505	213,275	321,646
– Fuel oil		133,049	108,734	133,049
	Subtotal	482,185	439,633	590,281
Commercial/Industrial				
– Electricity		799,879	843,975	985,120
– Natural gas		146,064	179,524	195,726
– Fuel oil		36,690	37,433	36,690
	Subtotal	982,633	1,060,931	1,217,535
Transportation				
Rail				
– Diesel		711	711	824
– Electricty		4,367	4,065	4,691
Road				
– Gasoline		182,104	193,966	211,240
– Diesel		21,981	23,332	25,498
– Electricity		1,359	1,265	1,460
	Subtotal	210,522	223,339	243,714
Waste		24,039	9,999	26,923
	TOTALS	1,699,378	1,733,902	2,078,454

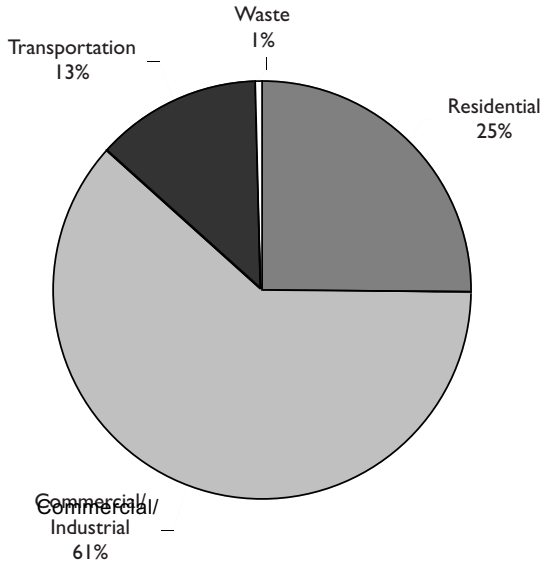
Comparisons

Comparing Cambridge's GHG emissions to those of other communities can provide some sense of how high our emissions are. Communities vary greatly in population, income levels, mix of economic activities, and land use patterns—all of which influence the rate of emissions.

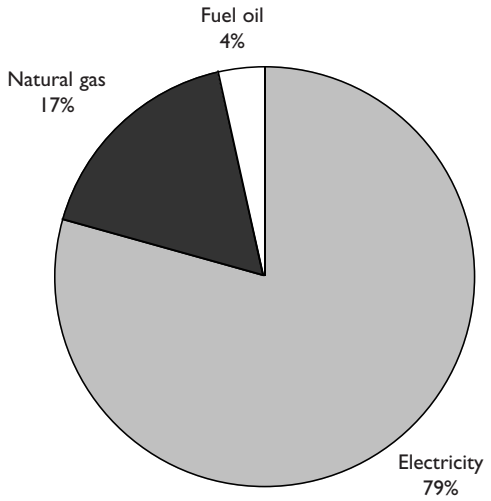
Compared to the national average, Cambridge's emissions are relatively low. Cambridge has a natural advantage in its small geographic area, dense land use pattern, large stock of multifamily housing, and availability of public transit.

However, compared to other countries, Cambridge's emissions are high. This is generally true of all American communities. The United States, with only about 5% of the world's population, emits about a quarter of all greenhouse gases; we are the single largest source of emissions.

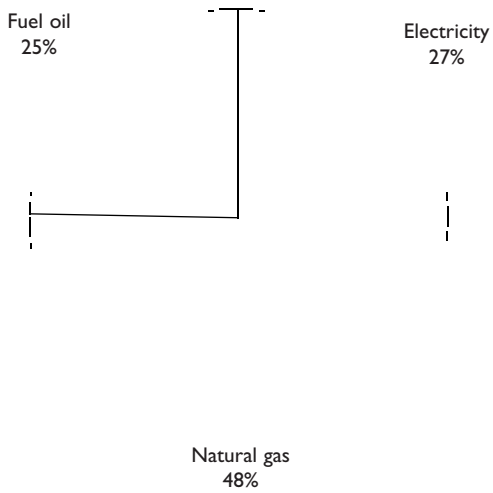
1998 Cambridge Greenhouse Gas Emissions



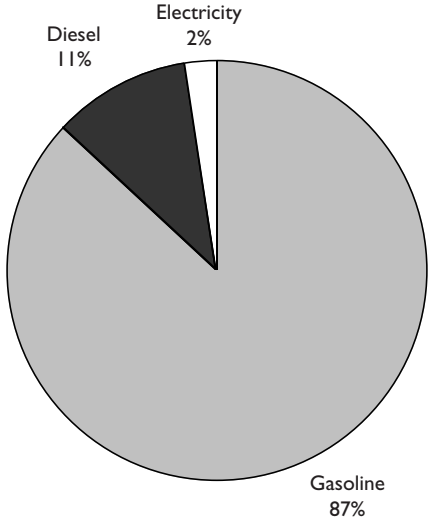
Commercial/Industrial GHG Emissions by Energy



1998 Residential GHG Emissions by Energy



Transportation GHG Emissions by Energy



Comparison of 1990 GHG Emissions *Table 2.2*

City	Population	Total Emissions (Tons CO_2)	Per Capita Emissions (Tons/person)
Cambridge	*95,802*	*1,699,378*	*17.7*
Burlington, VT	39,127	438,931	11.2
Fort Collins, CO	87,758	1,673,861	19.1
Newton, MA	82,585	1,973,540	23.9
Santa Fe, NM	55,859	1,418,819	25.4
Santa Cruz, CA	54,575	747,679	13.7

Emissions Inventory and the Plan

The inventory shows that in order to reduce GHG emissions, Cambridge needs to address building energy use, particularly among businesses, institutions, and government. This need reflects the mix of activities that is present in the city. In comparison, a "bedroom community" with primarily residential land uses would conclude that action needs to focus on household energy use and transportation.

Section 4 of this plan discusses in detail how energy use contributes to GHG emissions, lists the resources and programs available to support actions, and describes past, present, and future actions that can be taken to reduce emissions. Table 2.3 lists energy consumption associated with the use of different types of appliances and devices. The table shows that consumers can make choices that affect how much greenhouse gas their activities emit. For example, replacing one 60-watt incandescent light bulb with a 15-watt compact fluorescent light bulb that provides the same amount of light while using less electricity saves 85 pounds of carbon dioxide in a year.

The inventory can be used as a baseline to track progress in meeting the plan's goals. It is recommended that the City conduct inventories on a regular basis to evaluate the results of Cambridge's efforts to reduce GHG emissions.

Energy Use in the Home *Table 2.3*

Device/Appliance	Wattage *(watts)*	Annual Electricity Use *(kilowatt-hours)*	CO_2 Emissions *(pounds)*
Lighting (4 hours a day)			
Incandescent light bulb	60	84	119
Energy Star compact fluorescent light *(same output as 60 watt incandescent bulb)*	15	24	34
Halogen torchiere floor lamp	300	432	613
Energy Star compact fluorescent floor lamp	58	84	119
Appliances			
Refrigerator/freezer 17.5 cubic ft., frostless	757	2,256	3,203
Energy Star Refrigerator/freezer 17.5 cubic ft., frostless	551	1,572	2,232
Dishwasher, heated dry	1,200	264	374
Energy Star Dishwasher, heated dry	1,200	132	187
Washing machine Hot wash w/electric hot water	512	540	766
Energy Star washing machine, hot wash w/electric hot water	259	276	391
Central air conditioner *(4 months of use)*	5,000	1,620	2,300
Room air conditioner *(4 months of use)*	1,500	804	1,141
Ceiling fan *(4 months of use)*	100	120	170
Electronics			
Color television	155	420	596
Home computer	150	240	340
Laser jet printer	500	60	85

SECTION 3: Vision & Strategy

Vision Statement

In 2025, we see our world and city doing things better and smarter. We live and work in "energy smart" buildings that use readily available technology to maximize energy efficiency. Computerized controls on heating, cooling, and lighting systems automatically adjust for daylight levels and turn off when rooms are vacated. Appliances and office equipment use much less energy for the tasks they perform. Geothermal heat pumps eliminate the need for furnaces and boilers in many buildings. The demand for energy conservation services has created a bustling industry with well-paying jobs. Compared to 1990, citywide energy use is down by 50%.

Cambridge also has dramatically reduced its reliance on centralized electricity systems. Buildings do not just consume electricity; they also produce power. Some have fuel cells that provide the energy reliability important to Internet businesses, biotech laboratories, and public safety operations. Solar photovoltaic panels and roof tiles are common; any excess power they produce is sold into the regional electricity grid, allowing the building owners to run their meters backwards. Solar thermal systems are installed to heat air and to produce hot water, reducing the need for fuel and electricity. Where electricity from the regional grid is still needed, users have negotiated contracts with suppliers, often through group buying programs, to buy electricity from renewable sources. Consumer demand is driving the installation of wind power turbines in the Berkshires and offshore, large-scale fuel cell facilities are running on hydrogen, and landfill gas is being recovered to generate electricity. Where renewable energy supply is insufficient, natural gas fuels clean-burning combined cycle generators.

Rooftop gardens and green roofs are routinely installed on buildings of all types to reduce the need for air conditioners in the summer and to reduce stormwater runoff to the Charles and Mystic rivers. The city's tree canopy has expanded as a result of aggressive planting and maintenance, reducing energy needs for adjacent buildings and increasing shading to offset the urban heat island effect. There is enough quantity and variety of vegetation to support songbirds, and the shaded sidewalks and pleasant open space encourage people to enjoy the city in summer instead of fleeing the heat.

Fewer cars with single occupants are seen on the road. The regional transit system has expanded in response to demand for more and better service. Vehicles running on alternative fuels, hybrid technology, and fuel cells have replaced diesel buses. Cyclists and pedestrians dominate the street instead of automobiles, since mixed use neighborhoods mean many destinations are within walking or biking distance. With so many people on the street, crime is significantly lower; with so many fewer cars, the streets are safer for everyone.

Very little material is thrown away. Products are increasingly made out of recycled materials. Manufacturers and retailers take back old products for refurbishing or recycling.

The city provides a welcome home for diverse communities with its clean air, safe neighborhoods, and easy access to jobs, services, and recreation. Children have a sense that they are partners with adults as community stewards , and the city is safe for them to explore.

As a result of all these changes, the buildup of greenhouse gases in the atmosphere is abating and the threat of climate change is diminishing. While past emissions have caused the climate to shift, changing precipitation patterns, average temperatures, and sea level, scientists have lowered their concern about the scale of the impacts. This has happened because the previous generation recognized the problem and chose to modify their ways to protect future generations.

Strategy

Reversing climate change is a daunting task. Some scientists state that reductions in the emission of greenhouse gases of 75 to 85% are likely to be required to stabilize GHG concentrations in the atmosphere. This plan does not propose actions that would result in such deep cuts in emissions. The plan does propose actions to begin the necessary process of shifting away from our reliance on fossil fuels. As people begin to experience the multiple benefits of these actions, more ambitious steps will become more acceptable. We can draw on the examples offered by nations that have taken such steps and continue to enjoy a high quality of life. Clearly the rate at which we move away from fossil fuels will need to increase dramatically; working on actions like those proposed here is an important start.

This plan's basic strategies are ***fuel switching, energy efficiency,*** and ***waste reduction.*** These strategies aim to reduce and replace the use of fossil fuels and reduce emissions from landfills and incinerators. The focus of these strategies is on CO_2 and to a lesser degree methane.

Fuel Switching. Fuel switching involves converting existing fossil fuel uses to alternative fuels that reduce or eliminate the emission of CO_2. Wherever possible, renewable forms of energy such as solar and wind, and landfill gases should replace fossil fuels. Fuel cells running on hydrogen should replace oil and coal fired electric generating stations. Where these technologies cannot be employed, energy systems should be switched to natural gas, which is a fossil fuel that can be used much more efficiently and cleanly than oil or coal.

In the transportation sector, alternate fuels such as natural gas, electricity, and biodiesel can replace gasoline and diesel. Affordable hybrid engines have recently arrived on the market, with their significant fuel economy benefits, and vehicles powered by fuel cells are on the horizon.

Energy Efficiency. By being smarter about how we design and use buildings and devices and by taking advantage of technological innovations, we can use less energy to accomplish our tasks. In buildings, this means taking advantage of daylight to reduce artificial light, insulating while maintaining adequate indoor ventilation, and using green building techniques. Appliances and other machines have become dramatically more energy efficient in recent decades. Choosing products with energy in mind can reduce demand, particularly for electricity.

Fuel economy is the transportation version of energy efficiency. The current federal corporate average fuel economy (CAFE) standard for new cars is 27 miles a gallon. Vehicles are on the market and on the road now that vary from 12 miles a gallon to over 50 miles a gallon. The key is consumer choice.

Drivers can purchase a 50-mile/gallon vehicle instead of a 12-mile/gallon vehicle. Another form of fuel economy is the choice of transportation mode. Greater use of public transit, carpooling, private shuttle buses, cycling, and walking would significantly reduce vehicle miles traveled (VMT). In this way, the consumption of fuel could decline.

Waste reduction. In the waste arena, strategies to create less waste and to recycle have been in place for many years. Efforts must be made to increase the return of materials to productive use by preventing waste, increasing recycling, and purchasing products with recycled content.

External Factors

Cambridge does not entirely control its fate. Our current energy, transportation, and waste systems are dependent on structures and forces outside the community. This plan proposes a role for the community to play in taking responsibility for its GHG emissions. However, the plan assumes that actions at the international, national, and state level are required and essential.

Changes in laws, standards, subsidies, and incentives at the federal and state levels can have huge impacts on local emissions; they can either undermine or enhance local actions. People from all sectors need to be active participants in the debate over issues such as increased funding for mass transit, stronger vehicle emissions standards, incentives for renewable energy research and development, regional land use planning, and improved power plant standards.

Greenhouse Gas Emissions Reduction Target

A target of reducing GHG emission rates to a level 20% below 1990 levels by the year 2010 is achievable in Cambridge. The following figures show the amount of emission reductions that may be attained to reach a 20% reduction.

Projected 2010 total GHG emissions (assumes 20% cleaner electric fuel mix)	1,837,400 tons CO_2
12.5% electricity efficiency improvement	107,000 tons CO_2
10% reduction in natural gas use	49,000 tons CO_2
10% reduction in fuel oil use	2,000 tons CO_2
Purchase 20% of electricity from green power	193,000 tons CO_2
Increase average fuel economy to 40 MPG	103,000 tons CO_2
Reduce vehicle miles traveled by 10%	12,000 tons CO_2
Reduce solid waste	28,000 tons CO_2
Total GHG Redcution in 2010	**494,000 tons CO_2**
Projected 2010 Total GHG with Reductions	**1,343,400 tons CO_2**
1990 Total GHG emissions	1,682,500 tons CO_2
Percentage GHG reduction	20%

A cleaner electric fuel mix. The projected total of GHG emissions in 2010 assumes that the regionalelectric system will reduce emissions per kilowatt-hour by about 20%. By 2010, many new combined cycle natural gas fired power plants are expected to be on line in the Northeast, replacing most of the current oil and coal facilities. The construction of these cleaner plants is being driven by the deregulation process. It is estimated that this will reduce GHG emissions for each kilowatt-hour (kwh) of electricity generated from 1.54 pounds of CO_2 per kwh to 1.23 pounds. Whether an actual reduction in emissions materializes will depend on developments in the market beyond Cambridge's control.

Energy efficiency. The plan includes an improvement in electricity efficiency based on an assessment of demand side management prepared for Commonwealth Electric Company. That analysis indicates a market potential for a 12.5% improvement in the efficiency of electricity use. Additional efficiency improvements may become economically feasible with changes in the electricity market.

Natural gas and fuel oil use reduction. An assessment of the potential to reduce natural gas and fuel use was not available to the task force. A 10% reduction of each is a reasonable estimate, however, given the potential to improve building energy performance through measures such as upgrading of furnaces and boilers, adding insulation, and improving efficiency of water heaters and stoves.

Green power purchases. Currently, the availability of renewable energy supplies in New England is very limited. However, new requirements under electric utility deregulation legislation are expected to spur the installation of solar, wind, biomass, landfill gas, and low-impact hydropower. The Renewable Portfolio Standard requires all suppliers to include increasing amounts of green power sources in their mix of generation, and the Massachusetts Renewable Energy Trust is investing renewable energy benefits charges collected on all utility bills in green power installations. The use of "green tags," which involves purchasing the environmental attributes of electricity generated from renewable sources, is another option. In other regions of the country, local governments and businesses are committing to purchase all or a portion of their electricity from renewable sources. A goal of purchasing 20% of electricity in Cambridge from renewable sources is comparable to goals established in other municipalities.

Increasing fuel economy. The Federal government sets fuel economy standards for vehicles in an effort to improve air quality and increase the nation's energy security. The American Council for an Energy Efficient Economy states that a combined CAFE standard of 40 miles a gallon is achievable. This position is supported by a recent National Academy of Sciences report on the CAFE standard that states that a standard in the low- to mid-30 range is achievable without reducing vehicle weight.

Reduce Vehicle Miles Traveled. It is a priority of the City to reduce traffic congestion. Programs are already in place to require and encourage alternatives to single occupancy vehicle travel. A 10% reduction is consistent with the goals of the Cambridge Parking and Transportation Demand Management Ordinance.

Reduce waste. The 2000 Solid Waste Master Plan prepared by the Massachusetts Department of Environmental Protection sets a goal of reducing municipal solid waste by 60% by 2010. Currently, Cambridge has achieved a recycling rate of 33%, so the City will essentially need to double its efforts with a combination of waste reduction, composting, and recycling.

Achieving the Target

To achieve the emissions reduction target, all sectors of the community will need to take action. While the City can take a leadership role, businesses, institutions, community organizations, and individuals will have to be motivated to take part.

While this plan lays out a set of strategies and proposed actions, it is not prescriptive. It builds on past actions and proposes new actions within a framework that incorporates tracking of progress, accountability to the public, and ongoing reassessment and adjustment based on experience.

The following sections of this plan describe the role of energy, transportation, land use, and waste generation in the emission of greenhouse gases (primarily CO_2 and methane). Each section describes trends, tools, and resources to reduce emissions; actions taken since 1990 that have reduced emissions; and proposed actions to move Cambridge toward a 20% GHG reduction goal. The final section on implementation discusses the basic elements needed to ensure that effort is sustained.

Taking steps to make 20% reductions in so many activities will help us develop a systemic understanding and commitment to looking at all activities in the light of stopping climate change. It is this systemic shift that is needed for us to reach the solution that is ultimately needed-to end GHG emissions from most human activity.

SECTION 4: Energy

Principles

- Energy should be used to maximize the community's well-being, taking into consideration technological effectiveness, cost, environmental impacts, and social equity.
- Given that existing buildings consume the bulk of energy, retrofitting them should be a priority.
- Renewable energy provides a way to meet the community's energy needs with few or no GHG emissions.
- As natural gas emits less GHGs than other fossil fuels, it can serve as a transition fuel.
- Efforts to promote energy efficiency and renewable energy are needed to compensate for imperfect market signals that do not reflect the actual costs to the environment and society of energy production and use.
- Since climate change is underway, the future energy system should better enable the community to adapt to impacts and to changes in energy availability.

The Role of Energy in Cambridge's GHG Emissions

According to the GHG emissions inventory, energy used to heat and cool buildings, provide lighting, and power equipment accounted for 87% of Cambridge's GHG emissions in 1998. (Fuel to power vehicles is addressed in the plan's transportation section.) Most of this was from the commercial/industrial sector, which accounted for 63%. To achieve the goals of this plan, this source of GHG emissions must be addressed.

The commercial/industrial sector plays a relatively large role in energy use because Cambridge is a major location for economic activity and educational institutions. The city is a net importer of jobs and contains a significant square footage of office buildings, research institutes, laboratories, and commercial establishments.

GHG Emission Factors by Fuel

Electricity *(1998)*	1.43 lb. CO_2/kwh
Heating Oil	25.2 lb. CO_2/gallon
Natural Gas	11.8 lb. CO_2/therm

Massachusetts Electric System Fuel Mix

Oil	28.7%
Coal	27.9%
Natural Gas	26.4%
Nuclear	10.9%
Hydro	1.2%
Other	5.0%

How Energy is Used and Supplied in Cambridge

Cambridge consumes energy in the form of electricity, natural gas, and fuel oil. Each form of energy is distributed differently.

Electricity for most of the community is distributed by NSTAR, which includes the Cambridge Electric Light Company, from generation sources located throughout the northeast region of the United States and Canada. Electricity comes to Cambridge over a network, or grid, of overhead and underground transmission cables. It is generated by a variety of fuels, primarily coal, oil, natural gas, nuclear, and hydropower. The impact of the electricity fuel mix varies between regions of the country and changes over time. For example, if a region relies relatively more on coal, it will emit relatively more greenhouse gases for each kilowatt-hours of electricity than a region that relies more on hydropower.

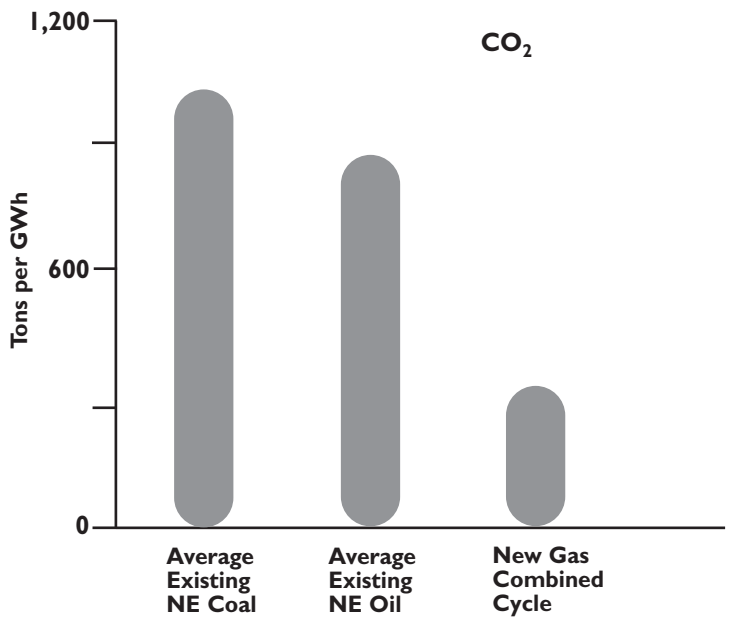
Cambridge has two electric generating facilities. The Kendall Square electric generating station owned by Mirant Corp. in East Cambridge has a 234-megawatt generating capacity. Kendall's electricity is not consumed in Cambridge directly; it is fed into the regional grid. Mirant completed construction in 2002 of an upgrade to the existing facility with a more efficient combined cycle natural gas fired turbine to bring its generating capacity up to 234 megawatts of electricity. It also continues to produce steam for district heating and industrial uses.

MIT Cogeneration Plant

MIT began operating its own 21-megawatt cogeneration facility on Vassar Street in 1995. The power plant replaced most of the electricity previously supplied by Cambridge Light Company and made the production of steam more efficient. The plant meets most of the campus' electricity needs and provides steam for heating, cooling, and chilled water. The $40 million investment is expected to save the university millions of dollars over the its life. In comparison to electricity provided by the national grid, MIT's plant significantly reduces the emission of carbon dioxide and conventional air pollutants. Based on 1998 data, the plant reduced CO_2 emissions by 76,955 tons copmared to the pre-existing situation in 1990. In addition, the conventional air pollutants are reduced by 45% or about 211 tons per year, which is equivalent to the pollution emitted by about 13,000 average round trips into Cambridge per day.

For more information view the website at http://cogen.mit.edu

GHG Emissions of Electric System Fuels in New England



MIT owns the second facility, a 22-megawatt cogeneration plant that generates most of the university's electricity. By regulation, MIT is not allowed to sell its electricity to the regional grid system. In addition to electricity, the facility generates steam for heating, cooling, and chilled water. GHG reductions associated with MIT's facility are discussed in the sidebar.

Natural gas is also distributed by NSTAR, through its subsidiary Commonwealth Gas Company. In New England, natural gas arrives through transmission pipelines from Canada, the Gulf of Mexico, and Texas. A network of underground pipelines conveys the natural gas to buildings and other facilities around the city. Natural gas consists primarily of methane, which is a potent greenhouse gas, but it tends to release less GHG per unit of energy used than other fossil fuels. Switching to natural gas can be seen as a bridge to a non-fossil fuel economy that could be based primarily on hydrogen and renewable energy resources.

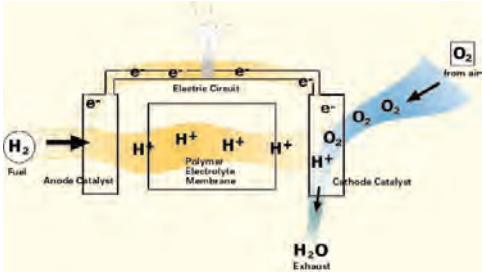
Fuel oil comes in different grades and is used for different purposes. It is used in individual boilers and furnaces to heat buildings and run large commercial boilers to generate steam in power plants. In Cambridge, fuel oil is distributed by independent dealers, and it is difficult to determine with precision how much fuel oil is consumed here. For this plan, fuel oil consumption was estimated using census figures and U.S. Department of Energy statistics.

Renewable energy is generally defined to include solar, wind, geothermal, low-emission biomass, and low-impact hydropower. Some types of renewable energy, such as large-scale hydropower, have significant negative environmental impacts that must be considered. Currently, renewable energy supplies less than 1% of New England's energy needs, but promises to become a growing sector. Technological advances and rapidly decreasing costs are making renewable energy competitive with conventional energy. An independent eco-label, called "Green-E," has been established to certify electricity based on environmental criteria.

The fuel cell is another technology for producing electricity with reduced GHGs. Chemical energy from hydrogen is transformed into electricity without the need for combustion and with virtually no carbon dioxide emissions. The hydrogen combines with oxygen from the atmosphere to drive the process. The source of hydrogen can be water, but in the near term natural gas, ethanol, and petroleum products are likely to serve as the source. Applications of fuel cells are being developed for automobiles, premium power, and small electronic devices. In the long term, fuel cells may serve as the primary source of electricity for many buildings, including residences.

Fuel Cells

Basically, a fuel cell works like a battery. Oxygen passes over one electrode and hydrogen over the other, generating electricity, water, and heat. Unlike a battery, a fuel



cell does not run down or require recharging, as long as fuel is supplied to it. A hydrogen-based fuel cell emits only water and heat. In addition to the environmental benefits, fuel cells are more reliable than conventional grid electricity. Banks, credit card companies, Internet servers, and public safety agencies, which are willing to pay higher prices for electricity to avoid interruptions, are current users of the technology.

The Massachusetts Water Resources Authority installed the first fuel cell in New England at its Deer Island Wastewater Treatment Facility in 1997; the 200 kw fuel cell runs on sewage sludge gas. New York city installed a fuel cell at the Central Park police station to avoid installation of power lines through the historic park; a fuel cell was also installed in the nation's first "green" skyscraper at 4 Times Square. In Cambridge, the MRET has awarded grants to Cambridge Savings Bank to plan for fuel cell installlations at one or more of its facilities and to Source One, Inc. and Laverty Lohnes Properties to plan for an installation at an Internet data center in Kendall Square.

Strategic Approaches

GHG emissions associated with energy use can be reduced by using less energy and by converting from fossil fuels to sources of energy that emit fewer GHGs or none at all.

For the purposes of this plan, using less energy means achieving higher efficiency—accomplishing the same task with a lower amount of energy. Fortunately, myriad measures to increase energy efficiency are available, such as increasing building insulation; improving window glazing; installing more efficient heating, ventilation, and air conditioning (HVAC) equipment; and using more lighting, appliances, and equipment.

The deployment of these energy efficiency measures requires education and publicity about the technologies and their costs and benefits. Financial incentives could further encourage the public and businesses to adopt these measures.

Energy System Trends

Electric Utility Deregulation

The energy marketplace is changing, especially in respect to electricity. In 1997, Massachusetts enacted the Electric Utility Restructuring Act, which changed the way the generation of electricity is regulated. As a result, utilities such as Commonwealth Energy (an NSTAR company), of which Cambridge Electric Light Company is a subsidiary, sold off their generating assets and became solely distributors of electricity. The act seeks to create a competitive marketplace for electricity similar to the market that now exists for telephone service. *The major features of the act are:*

- By 2005, market forces rather than the Department of Telecommunications and Energy (DTE) will determine the price of electricity. Until then the DTE is gradually raising the standard offer price of electricity.
- Beginning in 2003, 1% of the utilities' generation portfolio must be renewable energy. The proportion increases to 4% by 2009. This requirement is called the Renewable Portfolio Standard (RPS). It is estimated that by 2009, about 2 million megawatt-hours of electricity will be produced, which would double the electricity generated from renewable sources in New England.
- The act established the Renewable Energy Trust Fund, described in the "Systems Benefit Charges" sidebar.

These regulatory changes have increased the pace of adding generation capacity in New England. About 21,500 megawatts of new generating capacity was proposed or under construction in New England as of the summer of 2000. All of the new plants are designed to run on cleaner burning natural gas. Combined cycle gas turbines are significantly more efficient than older generating facilities

System Benefit Charges

When consumers pay their electricity bills, state law requires utilities to include small surcharges to support energy conservation and renewable energy projects. NSTAR customers pay 0.25 cents per kilowatt-hour for energy conservation services offered through NSTAR. This amounts to about $6 on the average residential coustomer's annual utility bill. A benefits charge of 0.0075 cents per kilowatt-hour is also added for renewable energy projects. These funds are collected for the Massachusetts Renewable Energy Trust Fund, which provides grants and financing to solar, wind, fuel-cell, landfill gas and other alternative energy projects.

that run on coal, petroleum, and nuclear energy. Compared to coal and oil, they also emit less air pollution, including carbon dioxide, per unit of energy. It is expected that these new, more efficient generating facilities will out-compete and replace older facilities. If this happens, the emission of carbon dioxide associated with electricity consumption will decline.

Appliance Standards

The federal government has raised energy efficiency standards for clothes washers, water heaters, commercial heating and cooling equipment, and residential central air conditioners and heat pumps. Central air conditioning and heat pumps must become 20% more efficient. Nationally, this will save the energy output equivalent to 37 power plants.

The new clothes washer standard requires washers to be 22% more efficient by 2004 and 35% more efficient by 2007. The federal Department of Energy estimates that the new standard will save over 7,000 gallons of water a year for the average consumer and $48 annually in utility bills for energy to heat water. Nationally, DOE estimates that the new standard will save the equivalent of the energy output of 12 new 400-megawatt power plants.

The new water heater standard requires gas heaters to be 8% more efficient and electric heaters 4% more efficient. This will save the equivalent of the energy output of 37 new power plants.

Energy Demand Trends

Electricity

According to NSTAR, demand for electricity is increasing. From 1990 to 1998, electricity consumption in Cambridge increased by 17,832,000 kwh or 12.2%. The 1998 figure does not include the output of MIT's co-generation facility, which went on line in 1995. By 2010, electricity consumption in Cambridge is projected to increase to 190 million kwh, or 30% above 1990.

Natural Gas

The consumption of natural gas in Cambridge decreased from 38,329,279 therms in 1990 to 34,555,539 therms in 1998. The reasons for this decrease are not clear, but natural gas is used significantly as a heating fuel. Weather can affect usage. However, NSTAR projects that natural gas consumption will increase to 52,114,219 therms in 2010, an increase of about 36% from 1990.

Cambridge Housing Authority Saves Energy

Since 1995, CHA has been upgrading its housing facilities to save energy and money. Improvements have been made to over 1,000 housing units with new energy efficient lighting and refrigerators, air conditioning covers, degree-limiting thermostats, heating zone valves and controls, pipe insulation, and weather stripping. At the Daniel F. Burns Apartments, a 199-unit elderly housing development in North Cambridge, the all-electric heat and hot water systems were converted to gas. The total annual utility bill decreased from $1,870 per unit to $876 per unit, resulting in total savings of over $197,000. CHA hopes to convert the 303-unit Millers River Apartments in East Cambridge as well, which would reduce electricity use by 3,817,969 kwh annually.

Reduction in electricity use: 3,032,587 kwh

Reduction in natural gas use: 113,566 therms

Reduction in GHG emissions: 2,338 tons CO_2 per year

Oil

Unlike electricity and natural gas, fuel oil is distributed by independent dealers, and no central organization meters its consumption. Fuel oil data used in this plan are derived from U.S. DOE statistics, which indicate use decreased from 1990 to 1998. Based on this, we estimate that Cambridge fuel oil consumption dropped from about 11.5 million gallons in 1990 to about 9.5 million gallons in 1998, an 18% decrease. Projections of fuel oil use in 2010 are not available, so for the purposes of the GHG emission inventory, we assumed that consumption would remain at 1990 levels in 2010. This is reasonable given that many buildings are converting from fuel oil to natural gas for heating and hot water.

Tools and Resources

Massachusetts Renewable Energy Trust Fund

Under the Electric Utility Restructuring Act of 1997, the legislature established the Renewable Energy Trust Fund, which is administered by the Massachusetts Technology Collaborative. The MTC is a quasi-state agency based in Westborough.

The fund receives the proceeds of the system benefits charges paid by consumers and collected by utilities (0.00075 cents per kwh). To date about $150 million has been collected. Some of the funds are earmarked for one-time grants to communities tied by contract to purchase power generated by waste incineration.

Energy Conservation Funds

Consumers contribute a portion of their electricity charges to activities to reduce or avoid electricity consumption. The current charge is 0.25 cents per kwh. In 1999, ratepayer-funded energy efficiency expenditures totaled $125 million and saved 272 million kwh in Massachusetts. The Massachusetts Division of Energy Resources estimates that energy efficiency programs were cost effective by a ratio of 1.5 to 1.

In Cambridge, NSTAR disburses the energy conservation funds through its demand-side management program. NSTAR offers a variety of conservation services to consumers including residential, commercial, and industrial energy audits and programs to improve the efficiency of lighting, heating and cooling, appliances, industrial processes, and other energy uses. The NSTAR website, www.nstaronline.com, provides up-to-date information about current programs and rebate offers.

Solar Air Heating

Houghton Place Apartments installed 840 square feet of SOLARWALL panels on the south side of the penthouse. The system pre-heats ventilation air for the building's common areas. It saves 2,000 therms of natural gas yearly, a 12-ton annual reduction in greenhouse gas emissions. The system also saves $1,500 a year in energy costs. The developer was able to take advantage of a federal 10% investment tax credit and a depreciation credit.

Energy Star

The U.S. Environmental Protection Agency's Energy Star program provides a variety of tools to measure energy use in buildings and products and to recognize superior performance. The EPA evaluates products for their energy performance and awards the Energy Star label to those that meet its criteria. This provides consumers with a guide to compare products for their energy attributes.

The EPA also awards the Energy Star label to commercial and industrial buildings that perform above the agency's criteria. The designation is contingent on use of the EPA's energy benchmarking tool and monitoring of actual energy consumption. Residences can be awarded an Energy Star Homes designation, which qualifies the owners for utility rebates on high-efficiency major appliances and high-efficiency natural gas heating and water heating equipment.

The Energy Star program provides a process for businesses and institutions and other organizations to become partners and make a commitment to the program's goals. The City is a partner in the Energy Star program.

Energy Star

The EPA launched its Energy Star program in 1992 to raise consumer awareness about energy performance in products and buildings.

Currently, 30 product categories, such as lighting, consumer electronics, roofs, and heating and cooling equipment. are rated by the EPA. Those products that carry the Energy Star label arte significantly more efficient than required by minimum government standards.

Energy Star buildings are in the nation's top 25% in terms of energy efficiency.

Energy Star partners, which can be businesses or other types of organizations, have entered into agreements with the EPA to undertake energy efficiency improvements and promote good energy practices.

DOE 1605(b) Voluntary GHG Reporting Program

The DOE maintains a system for businesses and institutions to report their voluntary reductions of GHG emissions. Congress created the 1605(b) voluntary GHG reporting program through the Energy Policy Act of 1992. Nationwide in 2000, 222 firms and organizations reported on 1,882 projects that reduced or sequestered 269 million tons of carbon dioxide. This reporting system can be coupled with the Energy Star program and other efforts to document emission reductions. If in the future a system for trading GHG emission credits is established, reporting emission reductions to DOE may become valuable to the participants. Some states, such as New Hampshire and California, have established GHG registries as well.

Energy Facilities Siting Board CO_2 Offset Policy

New power plant projects in Massachusetts that will create or add 100 megawatts or more of electric generating capacity are required to obtain approval from the state Energy Facilities Siting Board (EFSB). The EFSB has established a policy to require project proponents to offset the emission of CO_2 from their projects in one of several ways. Mirant's Kendall Square upgrade received EFSB approval and has started operating. Mirant's required offset will be about $250,000 paid in five installments over the first five years of the facility's operations or a one-time lump sum payment of about $200,000. Mirant has committed to working with the City to use the money to fund GHG emission reduction projects in Cambridge. These projects are subject to approval by the EFSB.

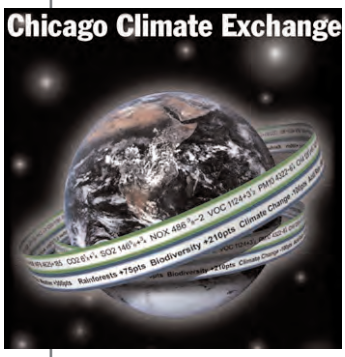
Offset funds from power plant projects in other communities might also be available for Cambridge to use.

Energy Service Companies (ESCOs)

An ESCO is a business that audits energy performance in buildings and other facilities and develops, installs, monitors, and finances projects to improve energy efficiency and maintenance costs. Typically, an ESCO is involved with projects that take from a few months to ten years to pay off. A common tool used by ESCOs is the performance contract. For example, an ESCO might organize, install, and finance replacement of lighting in a large commercial building at no cost to the property owner. In exchange, the ESCO recovers its cost and makes a profit by recouping a portion of the energy savings over a period of time according to terms agreed upon with the owner. ESCOs also operate as contractors to utilities and other entities. A number of ESCOs are active in Massachusetts.

GHG Trading

Systems are being developed to enable greenhouse gas emissions reduction credits to be traded in the marketplace as a valued commodity. The idea behind trading is to allow for cost-efficient reductions of greenhouse gases. Such trading already takes place for conventional air pollutants such as sulfur and nitrogen oxides. While these pollution credits are traded on a regional basis, greenhouse gas emissions have the potential to be traded on the international market because a quantity of greenhouse gas emitted in one area of the world is equal to that emitted in another area.



The Chicago Climate Exchange is being established to serve seven Midwestern states in 2002 with plans to expand nationally in 2003. In Massachusetts, the Department of Environmental Protection is developing a process to enable the owners of six older power plants (the so-called filthy five plus one other) to buy GHG credits to offset their emissions.

For Cambridge, the implication is that GHG reductions may become a commodity, which would create another avenue to finance actions that reduce GHG emissions.

Federal and State Renewable Energy Tax Incentives

Various federal and state tax incentives are available to support renewable energy projects. They include:

- The federal Renewable Energy Tax Credit of 1.5 cents per kwh; applicable to wind, solar photovoltaic, and biomass.
- The federal Modified Accelerated Cost Recovery System for wind, solar, and geothermal properties, which allows businesses to recover investments through depreciation deductions.
- A federal solar tax credit of 10% of purchase and installation costs.
- A Massachusetts 100% income tax deduction for solar energy systems on commercial and industrial properties.
- An exemption from Massachusetts excise taxes for solar energy systems on commercial and industrial properties.
- A 15% Massachusetts tax credit for residential renewable energy systems up to a maximum of $1,000.
- A Massachusetts sales tax exemption for residential renewable energy systems.
- Exemption of renewable energy systems from property taxes. In other words, installation of a renewable energy system does not increase the assessed value of a property.

Porter Square Shopping Plaza Goes Solar

Gravestar, Inc. completed its $13 million renovation of the shopping plaza in 1999, including several green building improvements:

- *20 KW of photovoltaic panels (PV) that produce about 22,000 KWH/year*
- *Stormwater system that recharges runoff and stores a portion for use in landscape irrigation*
- *Building energy efficiency improvements such as thicker insulation*
- *Highly reflective roof*
- *400 new trees and shrubs*

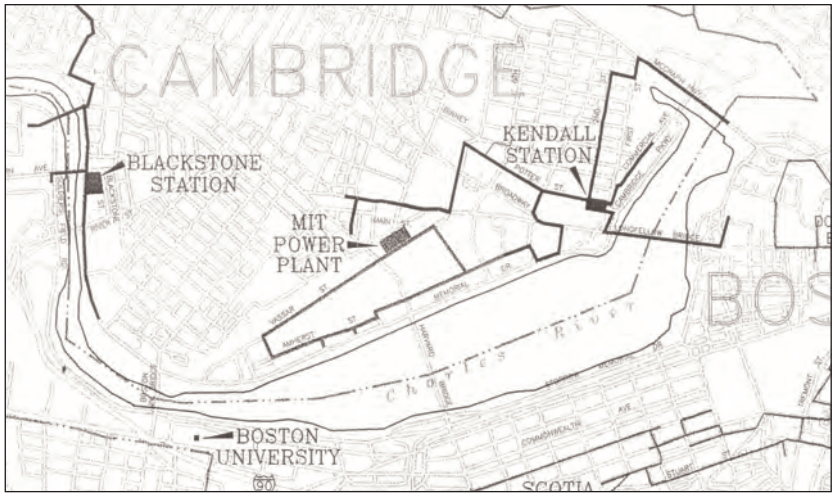
Gravestar installed an electronic kiosk in front of the complex to explain the PV system.

Energy generated by PV 22,000 kwh annually

GHG reduction by PV 15 tons CO_2 annually

Aggregation

Under the electric utility deregulation law, municipalities or groups of consumers can create aggregations to buy electricity. In addition to a lower price, aggregations can negotiate about the source of the power they buy. A contract between an aggregation and the utility could specify that all or a portion of the power be generated by renewable energy sources.



Cambridge Steam System

District Steam

Portions of Cambridge are served by steam created from cogeneration. The steam is used for industrial processes and for heating. A steam distribution system exists in East Cambridge where steam is a byproduct of the Kendall Square electric generating station owned by Mirant Corp. (formerly Southern Energy), which acquired the plant in 1999 from Commonwealth Energy. AES, Inc. operates the steam distribution system. Its clients include businesses and institutions in Cambridge and Boston such as the Museum of Science, Massachusetts General Hospital, and Amgen. Mirant has recently installed a highly efficient combined cycle natural gas-fired generator that will increase the plant's capacity to generate electricity and produce steam. The installation will also produce both much more efficiently and cleanly.

MIT's cogeneration facility also produces both electricity and steam. The steam is used for heating, cooling, and chilled water on the campus. AES operates the Blackstone Station facility located on Blackstone Street, which produces steam for Harvard University and Genzyme. This facility runs on gas and oil.

ACTIONS TO REDUCE GHG EMISSIONS

Note: Actions are classified based on which sectors of the community would be directly involved:

B=Business community
G=City government
I=Institutions
R=Residents

Proposed actions are listed by sector in Appendix III.

Strategy 1: Improve Energy Efficiency

Improvements in energy efficiency are the most cost-effective way to reduce GHG emissions. These include heating and cooling equipment upgrades, replacement of refrigerators, installation of heat pump systems, insulation, replacement of incandescent lights with compact fluorescents, energy management system controls, and many other measures. Additional building insulation, upgrades to more efficient boilers and furnaces, and other measures reduce the use of natural gas and fuel oil

Actions: 1990-2001

- The City participated in the EPA Greenlights Program, beginning in 1998, to upgrade lighting in municipal buildings with more efficient fixtures.
- Harvard University replaced approximately 7,200 halogen torchiere lamps in 1999 and 2000 with energy efficient fluorescent torchieres. In addition to the environmental and economic benefits, the project reduced the risk of fires associated with halogen lamps.
- Cambridge Housing Authority has saved 3,032,587 kwh of electricity and 113,566 therms of natural gas since 1995 through a variety of energy saving actions.
- MIT constructed a cogeneration facility in 1995 to replace electricity from the regional grid and steam from on-campus boilers.
- Mirant acquired the Kendall Square Station power plant in 1999 and upgraded it with a combined cycle gas-fired generator.
- Many businesses and residents throughout the city have undertaken energy efficiency measures in their buildings.

Boston to Reduce City Energy Consumption

On August 15, 2001, Mayor Thomas Menino announced a goal of reducing Boston's municipal energy use by 10 percent by 2005. Mayor Menino also established an Advisory Committee on Energy to develop affordability strategies for low- and fixed income households, develop a safety prevention and response plan, find ways to make municipal facilities more efficient with advanced technology, and investigate the use of alternative fuel vehicles in the city motor fleet.

Proposed Actions

Short-term

- Establish a municipal working group on energy management with representatives from the public works, electrical, school, library, community development, and other departments to track energy use in City buildings. Based on the use data, set a municipal goal on reducing energy use. [G]
- Replace incandescent traffic signals with light emitting diode (LED) lights, which are 80 to 90 % more efficient and rated to last 100,000 hours compared to 8,000 hours for incandescents. Take advantage of available utility rebates. [G]
- Recruit businesses and organizations into the federal Energy Star program with the goal of reducing energy use. Utilize pledges, peer exchanges, and public recognition programs to sustain involvement. [G,B,I]
- Work with local stores to promote Energy Star products and educate consumers about the Energy Star label. [G,B]
- Organize "green teams" to promote household practices that reduce GHG emissions. [R,G]
- Organize "green teams" within City departments to promote more sustainable practices in municipal operations. [G]
- Assess the condition of existing buildings to understand the inefficiencies prevalent in the building stock and design appropriate programs to address them. [G]
- Publicize utility energy efficiency programs. [B,G]
- Promote the use of ESCOs and performance contracting, where appropriate, to facilitate energy efficiency improvements when initial financial costs are a barrier. [B, I, G]
- Implement a City purchasing policy favoring Energy Star products. [G]
- Explore options to increase the efficiency of City street lighting. [G]

Medium-term

- Implement an energy management program for municipal facilities to evaluate use patterns, identify opportunities for energy efficiency improvements and renewable energy installations, pursue utility and other outside funding sources, manage contract work, and evaluate options for the energy supply. Consider establishment of an energy management position. [G]
- Integrate energy efficiency upgrades and renewable energy installations into the City capital planning process. [G]

Strategy 2: Promote Cleaner and Greener Electricity

While the City does not control how our electricity is made, we can have some influence by supporting local renewable energy installations and green power purchasing choices. This strategy assumes that deregulation will bring cleaner gas-fired generation facilities and renewable energy sources will displace generation based on coal and oil. The transition to cleaner fuels appears to be underway with the construction beginning on new gas-fired facilities in Massachusetts. The emission of CO_2 per kilowatt-hour of electricity is estimated to decrease from 1.54 pounds per year in 1990 to 1.23 pounds per year in 2010.

The opportunity to install and purchase green power is growing. Deregulation provides an opportunity to negotiate not only the price, but also the attributes of electricity supply. Municipalities have the possibility of aggregating consumers to create group buying power. The Massachusetts Renewable Energy Trust has begun to disburse grants and other financing for clean energy projects. Consumers can buy green tags to support green power projects.

Because municipal aggregation automatically includes all electricity consumers in a town or city unless they proactively opt out, pursuing a municipal aggregation would require a significant community process given the differences in costs and benefits to different ratepayers. One possible benefit of municipal aggregation is that the city or town can petition the Massachusetts Department of Telecommunications and Energy (DTE) to grant it control of energy efficiency funds, which are currently controlled by the local utility. The municipality would have to establish and run a program to utilize the funds effectively.[1]

The City is working with the Massachusetts Energy Consumers Alliance, a non-profit organization based in Jamaica Plain, and other municipalities and organizations to assess the feasibility of creating a non-profit consumer aggregation program that would offer electricity that is entirely or partially generated by renewable sources. Such a program would differ from a municipal aggregation by including consumers who voluntarily join. This program would be similar to for-profit and non-profit operations in other states such as Green Mountain Power.

1. Given the current lack of competition in the Massachusetts electricity marketplace, there are few suppliers with which an aggregation can negotiate. Consequently, little activity has taken place to date, but the 21 Cape Cod and Martha's Vineyard communities have formed the Cape Light Compact (CLC). CLC has contracted with Select Energy to provide electricity. However, the contract does not take effect until the standard offer price of electricity reaches a certain level. In the meantime, the CLC offer price of electricity reaches a certain level. In the meantime, the CLC has petitioned the DTE and taken over NSTAR's energy efficiency program. Other aggregations in the state include the Health Education Facilities Authority "Power Option" program, which includes many hospitals and other entities, and the aggregation the Massachusetts Municipal Association offers to local governments.

Currently, the only way most consumers can purchase green power is through green tags, which are the difference in cost between conventional energy and a renewable source. For example, if energy from the local utility costs 10 cents a kwh and energy from a wind generator costs 12 cents, a green tag for that would be valued at 2 cents. A person, business, or organization would buy green tags to offset the environmental costs of their electricity use. In Massachusetts, Conservation Services Group markets a green tag product called ReGen, which is used to pay for installation of solar, wind, and landfill gas projects that generate electricity. ReGen provides 2,000 kwh blocks of clean energy which anyone can buy.

The Massachusetts Renewable Energy Trust receives the proceeds of the system benefits charges paid by consumers and collected by utilities. To date about $150 million has been collected. Some of the funds are earmarked for one-time grants to communities tied by contract to purchase power generated by waste incineration.

MRET has issued solicitations for the following areas:

- ***Green buildings***—to promote the installation of photovoltaic solar panels on energy efficient buildings.
- ***Premium power***—to promote the installation of fuel cells to provide electricity at higher levels of reliability compared to conventional sources.
- ***Renewable energy planning***—to support planning for the installation and marketing of wind and other distributed energy systems.
- ***Consumer aggregation planning***—to support planning for efforts to pool electricity consumers for green power purchasing.
- ***Green schools***—to promote the design and construction of high performance school buildings.

These funds are offered on a competitive basis. The City has received funding for a photovoltaic installation on the City Hall Annex roof.

Newton Sunergy Project

The City of Newton joined the U.S. Department of Energy's Million Solar Roofs Partnership in the spring of 2000. Newton has pledged to create 500 new solar projects, by adding solar collectors on public buildings and promoting the use of solar energy by private organizations and citizens.

The City has surveyed property owners to assess the potential to install solar energy systems and is working to facilitate installations.

The Renewable Energy Trust recently awarded Newton a grant of $115,200 to support the installation of a 60-70 kw photovoltaic system on Newton South High School.

Actions: 1990-2001

- Gravestar installed 20 kw of solar photovoltaic (PV) panels on Porter Square Shopping Plaza and 6 kw of PV panels on the Greenworks building at 160 Second Street.
- The Union of Concerned Scientists installed 2.1 kw of PV panels on their headquarters building in Harvard Square. The top three floors, which UCS owns, were outfitted with green building technology. UCS also buys green tags to offset 100% of the emissions associated with its electricity use.
- The state installed 12 kw of PV on the Alewife Station Parking Garage to offset the power used at six electric car recharging stations. The recharging stations are part of a Division of Energy Resources electric vehicle demonstration program. The system produces a surplus of power, which is sold to the regional electricity grid.
- The Massachusetts Energy Consumers Alliance, the City of Cambridge, other municipalities, and organizations partnered to undertake a feasibility study of green power consumer aggregation. The Massachusetts Renewable Energy Trust and the Merck Foundation awarded grants to support the project. The study will be completed in the summer of 2002.
- MIT constructed a cogeneration facility in 1995 to replace electricity from the regional grid and steam from on-campus boilers.
- Mirant acquired the Kendall Square Station power plant in 1999 and upgraded it with a combined cycle gas-fired generator.

Cities Go for Green Power

- *Santa Monica, California purchases 100% of the electricity used by the municipal government from renewable sources.*
- *The City of Chicago has contracted with Consolidated Edison to purchase 10% of its municipal electricity from renewable sources in the first year of the contract and 20% within 5 years.*
- *The City of Los Angeles is purchasing 10% of its municipal power needs from renewable sources.*

Proposed Actions

Short-term

- Join Solar Boston, a partnership of the U.S. Department of Energy, solar energy businesses, and local community organizations, to promote and facilitate solar energy installations. [G]
- Pursue funding of solar energy installations through the Massachusetts Renewable Energy Trust. [B,G,I]
- Install solar energy systems on City facilities. [G]

Medium-term

- Develop funding sources for solar energy installations in partnership with NSTAR to address distribution system bottlenecks and RPS requirements. [B,G]
- Develop one or more projects with schools to install solar energy systems and conduct associated classroom activities. [G, I]
- Support implementation of the Clean Air Act regulations on older power plants. Advocate for a federal renewable portfolio standards. [G,R]

Long-term

- Support federal action on lowering power plant emissions of CO_2 and conventional air pollutants. [G,R]

Strategy 3: Increase Use of East Cambridge District Steam

Cogeneration facilities, such as the ones at Kendall Square Station and MIT, increase the efficiency of power plants by recovering the waste heat from the electric generators and using it to heat and cool buildings and provide chilled water for various processes. This prevents GHG emissions by avoiding the use of natural gas and oil to heat and electricity to cool buildings.

Mirant estimates that steam from the new generator at Kendall Square Station will involve 0.15 pounds less $C0_2$ emissions per pound of steam than steam produced by individual boilers typically found in commercial buildings. Existing buildings can be converted to the district system and new buildings can be tied in from the start.

Currently AES supplies approximately 400 million pounds of steam annually to its East Cambridge customers from the Kendall Square power plant. AES estimates that there is a reasonable potential to increase the demand with the existing distribution system to 600 million pounds of steam annually.

Proposed Actions

Medium-term

- Add additional customers to the East Cambridge steam system and increase steam use by 200 million pounds annually. [B]
- Extend the steam distribution system to the North Point area, which is slated for development. [B,G]

SECTION 5: Transportation

Principles

- Focus on access, not mobility. A focus on access—being able to get to and use resources—means locating resources so they are convenient to people. A focus on mobility—being able to get from one place to another—promotes road building.
- As access by other means improves, motorists should pay more of the true costs—direct and indirect—of driving. Currently, motor vehicle travel is heavily subsidized.
- Travel by single-occupancy vehicle should be a last resort.
- Motorists should use an alternative-fuel vehicle and/or one that is fuel-efficient.

Role of Transportation in Cambridge

According to the city's 1998 GHG emissions inventory, transportation is responsible for about 12% of the GHG emissions in Cambridge. This is a smaller proportion than in communities in other parts of the country. The national average is about a third.

Several factors contribute to this smaller role:

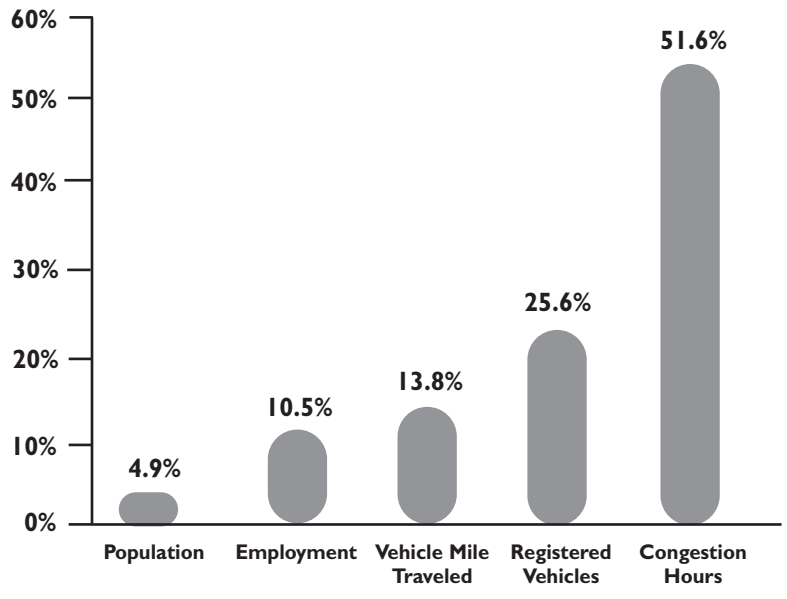
- Cambridge has a large institutional/commercial component with high energy use.
- Trips tend to be relatively short because the city is geographically small and dense, mostly with mixed-use development, and destinations tend to be close to each other. Most people, for example, do not need to travel more than a mile to buy groceries or go to a movie.
- An unusually large percentage of people walk or bike in Cambridge, because there is a high percentage of students, the streets are bicycle and pedestrian-friendly, and the public transportation system provides an easy way to get to many destinations.

Somewhat offsetting these factors is the volume of truck and commuter traffic passing through the city. Because the Boston area consists of many geographically small communities, a large portion of trips in one community originates in another city or town. As Cambridge is part of the region's inner core, it probably has more pass-through traffic than most other communities in the region. Because people in much of Greater Boston do not have easy access to destinations and lack adequate public transportation, many people do not currently have convenient alternatives to driving.

Trends

- The City projects about 12 million square feet of new development in Cambridge over the next 20 years. Even with the parking and transportation demand management (PTDM) program, this development will mean an increase in motor vehicle traffic. To reach a 10% reduction in the face of this projected growth will require major shifts in travel choices.
- Car registration in Cambridge has steadily increased over the past few years. In January 1991, 43,684 cars were registered; in January 2001 the total was 55,679.
- Regional data shows that while the population of Massachusetts increased by about 5% between 1990 and 2000, the annual vehicle miles driven increased nearly 20%.
- As a nation we are driving vehicles that are less fuel efficient. The EPA reports that from 1988 to 2000 new light vehicle fuel economy has declined 1.9 miles per gallon. The average fuel economy for a 2000 model vehicle is 24.0 mpg, as low as it has been any year since 1980. Ownership of large vehicles (SUVs, vans, minivans, and pickup trucks) has risen steadily for the past 20 years; they now make up 46% of the U.S. light vehicle market.[1]

The Metro Boston Area Shows Growth in the Dependence on Private Cars between 1990-1999



Mass. Executive Office of Environmental Affairs, Shape of Our Environment.

1. U.S. Environmental Protection Agency, *Light-Duty Automotive Technology and Fuel Economy Trends 1975 through 2000.*

CAFE Standards: Corporate Average Fuel Economy

The U.S Energy Policy and Conservation Act of 1975 required passenger car and light truck manufacturers to meet CAFE standards. The standards are applied on a fleet-wide basis for each manufacturer. The entire line of passenger cars must average at least 27.5 mpg for the manufacturer to comply with the standard. A manufacturer is liable for a civil penalty of $5.00 for each 0.5 mpg its fleet falls below the standard, multiplied by the number of vehicles it produces. The 1994 and 1995 CAFE standards for light trucks are 20.5 mpg and 20.6 mpg. If manufacturers exceed CAFE standards they can earn credits that can be used to offset fuel economy shortages in the three previous or three subsequent model years.

Source: http://www.ita.doc.gov

Strategic Approaches to Reduce GHG Emissions from Transportation

The desire to reduce traffic congestion has been a longstanding community priority. The City's 1993 growth policy document, Toward a Sustainable Future, offers the following transportation vision:

Significantly reduced automobile traffic. Walking, carpooling, public transit, bicycling, and jitney trips are the norm. Employers and families compete annually to reduce single occupant car trips by the greatest percentage. All corners of the city (and adjoining cities) are stitched together by bicycle lanes and paths.

There are two strategic approaches to reducing GHG emissions related to transportation: reducing the vehicle miles traveled (VMT) and reducing the GHG emissions per mile of travel. Promoting use of transit is an example of the first approach; replacing conventional vehicles with electric-powered vehicles is an example of the second approach. In weighing approaches, it is important to remember that reducing VMT has many benefits. In the United States, motor vehicles caused an estimated 41,800 deaths and 3,236,000 injuries in 2000 from collisions and 2,000 deaths from air pollution.[2] They affect the livability of a community and the ability of children to play outside independently or travel on their own. The quantity of paving cars require makes cities hotter, cuts down on the availability of space for planting trees, increases stormwater runoff, and is aesthetically unpleasing. Motor vehicles are noisy and pollute soil and water, as well as the air. In addition, they make sprawl possible, which has many deleterious social and environmental effects. Motor vehicle traffic causes many direct problems for communities and profound indirect effects, including increased GHG emissions.

The City of Cambridge has a comprehensive program to reduce VMT. Affecting the GHG emissions of vehicles on the road has been less of a focus. However, national trends toward less efficient vehicles dwarf potential environmental gains from programs like the City vehicle trip reduction program.

2. U.S. Department of Transportation and the American Lung Association. Over 10% of those killed in collisions—4,727 people—were pedestrians.

Kinds of measures

To date, most of the projects the City has undertaken have featured positive incentives for using means other than driving alone. There is considerable evidence that negative incentives (e.g., reducing the availability of parking) are more effective than positive incentives (e.g., improving sidewalks) on reducing driving. In general, there is strong public support for taking action to reduce traffic. On the other hand, measures that make it more difficult for residents to drive have often failed to be implemented because of community opposition.

Success in achieving a mode shift is likely to come when there is a cultural shift-when using modes other than single-occupancy vehicles is seen as desirable, rather than the fate of those who don't have access to a car. This is why emphasizing the benefits of other modes—e.g., the health benefits of walking, the convenience of transit—is important. It is also why measures that involve high-profile people may be especially important, e.g., removing special parking privileges for executives.

Why Bicycle lanes?

Many Cambridge streets now have bicycle lanes. These lanes can provide several benefits:

- *Help organize traffic;*
- *Offer more space for cyclists by keeping motorists away from the far right edge of the road;*
- *Remind motorists to watch for cyclists;*
- *Encourage cyclists to ride on the street (where, in general, they are safer) rather than on the sidewalk;*
- *Convey a message that cyclists are welcome on Cambridge roads.*

Tools and Resources

Tools to Reduce VMT

Vehicle Trip Reduction Ordinance

In 1992 the Cambridge City Council passed the Vehicle Trip Reduction Ordinance, which mandates bicycle and pedestrian programs and other measures to reduce motor vehicle travel. While it is impossible to calculate emissions benefits from these measures, they may eventually add up to a shift in the city's culture.

Cambridge bicycle and pedestrian committees

These committees, appointed by the City Manager, give input into City bicycle and pedestrian projects and policies, review new development, and promote cycling and walking.

Parking and Transportation Demand Management Ordinance

In 1998 the City Council passed the Parking and Transportation Demand Management (PTDM) Ordinance, which mandates that whoever wants to build non-residential parking facilities (with some exceptions for small projects), or expand existing facilities, must develop a PTDM plan. The plan is a commitment to take specific actions to minimize the number of trips made by car to the site. The City must approve the plan before the project can receive necessary permits to proceed. The ordinance also mandates monitoring to ensure that the PTDM plans are being implemented and goals are being met. The City's PTDM Officer administers and enforces the ordinance.

Zoning

Zoning is an important tool for transportation management. It determines what kinds of land uses and densities are allowed. Zoning that allows for higher density around transit, that allows for housing, commercial, and institutional uses in the same area, and that places limits or other requirements on parking helps reduce automobile travel. In February 2001, the city council passed comprehensive new zoning measures, including some designed to reduce the traffic impacts of new development. These include reducing parking at new developments, counting parking garage floors when determining a building's height, and requiring traffic impact mitigations for new development. It is estimated that these measures will cut in half the otherwise anticipated number of trips from new development by 2020.

Public transportation

Much of Cambridge is well served by public transportation. While the City does not have direct control over the transit system, staff work with the MBTA to improve subway and bus services. The City is a member of the Urban Ring Compact, a consortium of communities working to create a new transit line that would run from Columbia Point in Boston through Roxbury, the Longwood medical area, Cambridgeport and East Cambridge, Somerville, Everett, and Chelsea to Logan Airport. The Urban Ring is planned in three phases: Phase one, optimizing bus service in the corridor, is planned for about 2006; phase two, a bus rapid transit system, is planned for about 2011; phase three, with light rail, is envisioned for about 2020.

Shuttles

Along with the City's shuttle service for elderly people and the MBTA's service, The Ride, for people with disabilities, several private employer and institutional shuttles serve portions of the Cambridge community. These include the Longwood Medical Area shuttle; shuttles for Harvard and Lesley College students; the Wave, a bus service between the Galleria Mall and Kendall Square; the Charles River Transportation Management Association E-Z Ride shuttle connecting North Station, Kendall, and University Park; and others.

The Hunt for the Golden Shoes

In 2001 and again in 2002, Cambridge Walks has organized a hunt for golden shoes.

During the month of May, 100 gold-painted shoes, many of them decorated by elementary school art classes, are placed around the city in parks, playgrounds, and on walking paths. Any pedestrian who finds a golden shoe can turn it in for a gift certificate good for a free pair of sneakers donated by New Balance. Shoe winners are also entered into a grand prize drawing for a "walking shopping spree."

cambridge walks

State and federal funding

Much of the funding for roadway construction comes from the state and federal governments. Federal funds are channeled through the state.

The Transportation Equity Act for the 21st Century, known as TEA-21, is the federal authorizing legislation for surface transportation. It is a six-year authorization, signed in June 1998. The funds are allocated and administered through the states. Under TEA-21, funds can be spent on pedestrian and bicycle facilities and on public transportation.

TEA-21 also includes some programs that fund projects to provide clean air benefits. The major programs are:

- The Congestion Mitigation and Air Quality Improvement (CMAQ) program, which funds projects to help meet the requirements of the Clean Air Act, e.g., transit improvements and public fleet conversion to cleaner fuels.
- The Transportation Enhancement Program, which can pay for bicycle, pedestrian, and transit facilities and improvements.
- In Massachusetts, Chapter 90E, Section 2A of the General Laws requires the commissioner of the Massachusetts Highway Department to "make all reasonable provisions for the accommodation of bicycle and pedestrian traffic in the planning, design, and construction, reconstruction or maintenance of any project undertaken by the department."

The Health Benefits of Walking

Lack of physical activity is thought to be a primary factor in more than 200,000 deaths a year in the United States. Making walking part of a daily routine is feasible for most people, as nearly 25% of all trips people take are less than a mile. Thirty minutes of walking a day has significant health benefits:

- *It helps prevent heart disease.*
- *It builds bone density.*
- *It helps with weight loss.*
- *It can relieve tension and fatigue.*
- *In winter, it can help prevent the depression some people suffer from lack of sunshine.*

Tools to Reduce Vehicle Emissions

Clean Cities Program

Under this federal program, municipalities can be reimbursed for the cost difference between a conventional and an alternative fuel vehicle. The program is administered in Massachusetts by the state Division of Energy Resources (DOER). DOER offers $2,000 grants to offset the incremental cost of alternative fuel vehicles. The program also provides assistance for creating the infrastructure needed for alternative fuel vehicles. DOER is working with other agencies and private entities to expand the network of compressed natural gas refueling stations. A station is proposed to be built in Brighton on Western Avenue, which is close to Cambridge.

State Contracts for Vehicle Acquisition

The City can use existing state contracts for products and services to purchase fuel-efficient and alternative fuel vehicles. This allows the City to benefit from the stronger negotiating position of the Commonwealth. Several state contracts are in place for alternative fuel and hybrid vehicles.

Clean Vehicles under State Contracts

Hybrid

- *Toyota Prius/sedan*

Electric

- *Ford Ranger EV/truck*
- *Solectria Force/sedan*

Compressed Natural Gas

- *Ford Crown Victoria*
- *Ford Club Wagon*
- *Ford F250/truck*
- *Honda Civic GX/sedan*
- *Ford E250/cargo van*
- *Ford E350/cargo van*

Federal Tax Incentives

The federal government offers an income tax deduction to individuals and businesses for the incremental cost to purchase or convert qualified clean fuel vehicles. The deduction varies based on vehicle weight and ranges between $2,000 and $50,000. For electric vehicles, a tax credit of 10%, up to $4,000, of the purchase price is available. This tax credit declines by 25% a year until 2004, when it phases out.

ACTIONS TO REDUCE GREENHOUSE GAS EMISSIONS

Note: Actions are classified based on which sectors of the community would be directly involved:

B=Business community
G=City government
R=Residents
I=Institutions

Proposed actions are listed by sector in Appendix III.

Strategy 1: Reduce Commuting by Single-Occupancy Vehicles

Commuting accounts for about 10% of motor vehicle trips in Cambridge. Traffic generated by new commercial development has been a particular concern of residents, and reducing commuter trips has been a major focus for the City.

Actions: 1990-2001

- The PTDM Ordinance and program were developed and carried out.
- The City set up a T pass subsidy program for City employees, purchased bikes that are available for City employees to use to carry out their work, and instituted a program to inform employees of alternatives to the auto mobile for commuting.
- Minimum parking requirements for new commercial development were lowered.
- Working with the City or independently, some employers have carried out a variety of PTDM measures.

EZ Ride Shuttle

In January 2002, the Charles River Transportation Demand Management Association, its member businesses and organizations, and the City started the EZ Ride Shuttle Service between North Station and University Park. The City hopes the shuttle will replace 500 round trips into and out of Cambridge each day.

Proposed Actions

Short-term

- Expand City outreach to other businesses to increase participation in voluntary TDM programs. [G]
- Expand incentives and increase participation in the City TDM program for municipal employees. [G]
- Undertake aggressive TDM measures and monitor the results. [B, I]
- If driving alone to work, discuss with employer ways to make it easier to ride-share, take transit, walk, or bike. [R]

Medium-term

- Monitor results of PTDM program and investigate increasing the requirements. [G]
- Investigate lowering further the minimum parking standards for new development, especially near T stations. [G]

Long-term

- Continue aggressive TDM measures and monitoring. [G, I, B]

Strategy 2: Improve Facilities for Walking and Cycling

For an American city, Cambridge has exceptional pedestrian and bicycle facilities.

For pedestrians, it has sidewalks on both sides of virtually all its streets, and all city roads have speed limits of 30 MPH or lower. Most people live within a comfortable walking distance of a variety of destinations.

Making intersections safe and comfortable for pedestrians and making the pedestrian environment appealing, through urban design, short blocks, vegetation, and other means are vital for encouraging people to walk. Ensuring that sidewalks are kept free of snow and ice is important to make sidewalks accessible to everyone throughout the year. Pedestrian facility standards and conditions are described in detail in the Cambridge Pedestrian Plan.

While most pedestrian improvements are made on an intersection-by-intersection basis, the City also undertakes major roadway projects that improve both pedestrian and bicycle access, often in conjunction with other projects. If a road is being torn up to install new water and sewer lines, for example, the City takes the opportunity to look for ways to put the road back so it works better for pedestrians and cyclists and/or to slow down traffic, if speeding is an issue.

Many people walk in Cambridge as their primary mode of getting around the city; many fewer ride bicycles. Cambridge has excellent potential to increase cycling because the city is flat, has destinations that are close together, and has a large student population. The City's policy is to make all streets bicycle-friendly, rather than designating some as bicycle routes. The City installs bicycle lanes on roads where there is enough space for them. Where there is less space, the City often installs guidelines, which direct motor vehicle traffic toward the center of the street, leaving more room for cyclists.

Off-road bicycle paths are used both for recreation and as transportation facilities. The Minuteman Commuter Bikeway is one of the most heavily used bike paths in the United States. A recent City project extended the bikeway, which runs 11 miles to Bedford, from the Arlington line to the Alewife T Station. From there it connects to Linear Park and Somerville. The City of Somerville is working on plans to extend the path through to the Lechmere area, which would connect with extensions to the Charles River Reservation.

It is impossible to measure the benefits of any single bicycle improvement. Experience elsewhere indicates that a community can increase the number of people who choose to cycle by improving facilities and visibility for cyclists and through community education. According to the League of American Bicyclists, if every resident in a city of 100,000 replaced a car trip with a bicycle trip once a month, CO_2 emissions would drop by 3,764 tons a year.

Free bike and bike-sharing programs have been successful in some cities. Typically they involve either non-profit groups providing a fleet of bicycles that are either available on the street for anyone to use or are available to fee-paying members only.

Police enforcement is also an important safety education tool. Efforts by the police include handing out warning citations and tickets to cyclists for traffic violation

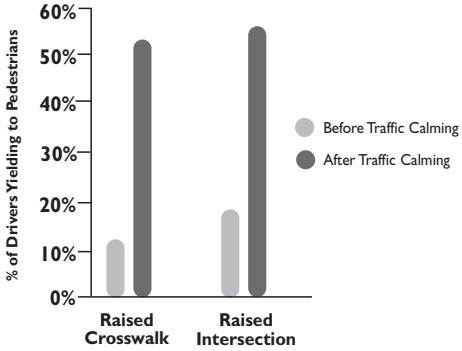
Raised Crosswalks

Raised crosswalk on Columbia Street

Raised crosswalks make it safer to cross the street by bringing the roadway up to the level of the sidewalk at the crosswalk. They reduce vehicle speeds by acting as a speed hump (but are safer than old-style speed bumps that are seen in locations such as parking lots). They also help to make the crosswalk more visible and allow people to walk straight across the street without having to step down to the level of the roadway and then back up on the other side.

How many drivers yield to pedestrians?

Effects of Columbia Street traffic calming project on driver behavior



Actions: 1990-2001

Pedestrian improvements at various sites throughout the city have included:

- Programming traffic signals to give pedestrians a head start on turning vehicles (leading pedestrian intervals).
- Decreasing pedestrian wait times by removing most pedestrian push buttons.
- Repainting many crosswalks to make them more visible.
- Instituting an aggressive education and enforcement program to ensure that sidewalks are kept clear of snow and ice.
- Widening sidewalks and installing curb extensions and raised crosswalks at many intersections to make it easier for people to cross the street.

Bicycle facility improvements have included:

- Installing bicycle lanes or guidelines on many major streets.
- Installing parking for more than 800 bikes, mostly at commercial areas, parks, and schools.
- Making bicycle facility planning a routine part of the City's transportation planning. When changes to intersections, traffic signal operations, or travel lane widths are planned, the needs of cyclists are factored in.

Major roadway projects featuring facility improvements for pedestrians and cyclists include:

- ***Fresh Pond Parkway***—Trees were planted and bicycle paths and sidewalks and pedestrian-actuated traffic signals were installed.
- ***Columbia and Third streets***—Improvements include neckdowns, a raised crosswalk at a park entrance, tree planting, and installation of chicanes to slow down traffic.
- ***Central Square***—A travel lane was eliminated and the recovered space was used to expand the sidewalks and install bicycle lanes. This, along with curb extensions at most crossings, dramatically reduced the distance pedestrians need to walk to cross Massachusetts Avenue. A right-turn slip lane at Magazine Street and Massachusetts Avenue was eliminated and the plaza on the corner was expanded, making the crossing easier and safer for people on foot.

Smaller projects have been done at many locations, including Quincy, Arsenal, and Sheridan squares.

Proposed Actions

Short-term

- Expand the pedestrian program to further improve intersections and increase year-round sidewalk maintenance, provide public restroom access and benches, and make aesthetic improvements, e.g., trees, flowers, buildings with windows, fences that are low and transparent. [G, B, I, R]
- Install additional bicycle parking and look for new opportunities to install bicycle lanes or guidelines and improve intersections for cyclists. [G]

Medium-term

- Create and improve off-road bicycle and pedestrian paths, e.g., a new path along the Grand Junction railroad right-of-way, improvements along the Charles River, and paths connecting to Belmont and Watertown. [G]
- Consider creating a bicycle commuter station, possibly at Kendall Square. [B]

Long-term

- Continue pedestrian and bicycle programs [G]
- Investigate possible shared-use very low-speed neighborhood streets [G]

Strategy 3: Reduce the Amount of Motor Vehicle Travel through Parking Incentives and Restrictions, Car-Sharing, Promotion, and Education

Studies indicate that parking restrictions are by far the most effective way to reduce driving, but they tend to be unpopular and therefore difficult to implement. Because most residents do not have off-street parking and very little space is available to create more parking, there are built-in constraints on residential parking.

An early successful effort to reduce the amount of parking for new commercial development was the City's work with the developer of the Galleria Mall to reduce parking and institute a shuttle bus that runs from the mall to the Kendall Square Red Line station.

Driving Tips for Tree-Huggers from CarTalk.com

1. Get your car serviced regularly.

Regular servicing uncovers many problems that reduce gas mileage and increase pollution.

2. Check your tire pressure.

Tires that are under-inflated by only four pounds of air can reduce your mileage by as much as 10 percent.

3. Don't top off your gas tank.

Topping off fills the vapor recovery equipment with liquid gas instead of the vapors the gas gives off. When this happens, the equipment ceases to work properly, contributing to the formation of ground level ozone, smog, and acid rain.

4. Don't use more octane than you need.

Most modern engines neither require nor benefit from premium gas. The extra octane may in fact increase the pollution given off by your car.

5. Stop your idling.

Car exhaust does not stink as much as it used to, but it still pollutes. Cars no longer need to warm up unless the temperature is below zero, so just turn on the motor and go.

6. Slow down.

Wind resistance increases dramatically with speed. For every mile over 55, your gas mileage goes down 2%. If you drive 70 MPH you get half the fuel economy you get at 55.

Another possible approach to reducing driving is car sharing, an increasingly popular alternative for people who need a car occasionally but don't use one for most of their transportation. People who opt for car sharing instead of owning a car may make many travel decisions differently; the cost of using a car is based on mileage, rather than largely based on its purchase price. Zipcar, a car-sharing company based in Cambridge, has attracted many members. Initially, the GHG emissions reductions from car sharing will probably be small, as subscribers are likely to be people who do not own cars and who may actually drive more after joining a car-sharing program. Eventually, however, emission reductions may increase as people opt for car sharing instead of replacing their cars.

The City has undertaken a number of promotional and educational efforts to encourage people to walk, cycle, carpool, or take transit. These have tended to focus on the community and environmental benefits of car-free travel. Recent efforts have also featured the health benefits of walking and cycling. It seems clear that convenience and cost are not the only factors that affect people's decisions about what travel mode to use. For example, for some people, riding the bus is a low-status activity, while for others, it's a convenient way to avoid the hassles of parking. For some people, walking—even a relatively short distance—seems like too much effort; for others, it's welcome exercise. In Holland or Denmark, most people cycle, regardless of their age, for transportation as well as recreation; to many Americans, cycling is only a recreational activity for young people. Promotion—making alternatives appear attractive and socially acceptable—is an important component of a GHG reduction program.

The Cambridge Walks coalition was organized in 1999. This coalition includes the Cambridge Health Alliance, the public schools, the community development department, community groups, and others interested in promoting walking for health. It has organized a variety of successful promotional events.

Actions: 1990-2001

- The City produced and distributed educational and promotional information, including various brochures, the map *How to Get Around in Cambridge*, information at the City web site, promotional ads at local movie theaters, a billboard campaign featuring local celebrities, and informational kiosks in four City buildings.
- The City organizes a series of events during Go Green Month (May) and participates in community events.
- Bicycle safety education programs were established in the schools.
- Stanchions have been posted in some crosswalks to remind motorists to yield to pedestrians, and police enforcement has increased, including citing motorists for failing to yield to pedestrians in crosswalks and citing cyclists for failing to obey traffic laws.
- Zipcar, a for-profit organization that provides car-sharing services for fee-paying members, was established. The City provided discounted parking spaces to help launch Zipcar.
- The Cambridge Walks coalition was created to promote walking for health through various activities, including the annual hunt for golden shoes and Walk Your Child to School Day celebrations.

Proposed Actions

Short-term

- Install signs with schedule and route information at bus stops in Cambridge. [G]
- Install shelters or benches at busy bus stops where there is room on the sidewalk. [G]
- Investigate traffic measures to expedite bus travel. [G]
- Continue to develop and distribute promotional material and hold promotional events. [G]
- Continue the work of Cambridge Walks, including Walk Your Child to School Day. [G,B]
- When giving directions to businesses, events, and institutions, include directions by T. [G, B,I]
- Work with community groups to promote walking and biking for health. [G, R]

Fuel Efficiency and Oil Imports

Increasing the fuel efficiency of new cars and light trucks just 5% a year would cut U.S. oil use by 1.5 million barrels a day within a decade, according to the American Council for an Energy-Efficient Economy (ACCEE).

U.S. oil imports more than doubled in the past 15 years and oil imports now exceed domestic oil production. According to some military analysts, over half the U.S. military budget is for defending our international oil interests, especially in the Middle East.

Medium-term

- Investigate measures to expedite bus travel. [G]
- Establish a "walking bus" program in 3 schools. [G,R]
- Publicize proximity to transit as a reason to shop in local stores, distribute free subway tokens to customers where parking vouchers are provided, and offer discounts to cyclists. [B]

Long-term

- Examine the feasibility and logistics of establishing a city-wide bicycle-sharing program. [B]
- Establish car-free celebrations in Cambridge. [B,R]

Strategy 4: Reduce Motor Vehicle Emissions

In the United States, motor vehicle fuel efficiency has decreased because of the proliferation of sport utility vehicles (SUVs) and light trucks. Locally, this can be countered primarily by buying alternative fuel vehicles and by using the most fuel-efficient vehicle possible to complete the task.

The way that vehicles are driven affects emissions. Driving speed, tire pressure, and braking habits all affect mileage. Idling is a significant source of GHG emissions as well as local air pollution.

Installing emission controls on heavy-duty trucks and construction vehicles is an inexpensive measure that removes significant amounts of air pollutants. This was done on vehicles working on the Central Artery project. While this measure does not appreciably affect GHG emissions, it is included here because of its high level of benefits, especially given the quantity of construction in Cambridge.

The federal corporate average fuel economy (CAFE) standards were last raised in 1975 and implemented in 1985. Attempts to raise them again have been unsuccessful to date, largely because the automobile and petroleum industries have claimed that increasing fuel efficiency standards would place an economic burden on society. As the economic burdens to society of not raising the standards become more evident, this argument will probably carry less weight in the future.

If new standards of 50 MPG for cars and 35 MPG for light trucks were adopted, and 50% of the vehicles in Cambridge met improved standards in 2010, the CO_2 savings would be 46%, compared to 50% of the vehicles meeting only the current standards of 28 MPG for cars and 21 MPG for trucks. Changing the CAFE standards is the single most important measure the nation can take to curtail GHG emissions from motor vehicles.

ACEEE Vehicle Safety Standards

A report on auto safety released March 28, 2002 found that the average sport utility vehicle or pickup truck is more dangerous than most cars on the road, when risk to other drivers is considered.

The report also shows that many small cars have a lower fatality rate among their own drivers than SUVs or trucks. SUVs are currently the fastest growing segment of new vehicles, comprising 21% of the market, up from 6% just 13 years ago.

The study finds that mid-size models such as Jetta, Accord, and Camry have driver fatality rates as low or lower than those of any of the major SUV or pickup models. The findings of the report conclude that all popular car models score better than any popular SUV or truck model on deaths to drivers in other vehicles. This goes directly against the myth that SUVs are safer on the road than smaller vehicles.

Actions: 1990-2001

- Cambridge has acquired two electric trucks and one CNG truck.
- DOER has an electric vehicle recharging facility at the Alewife T station (part of a demonstration electric vehicle commuter leasing program).
- Under the Cambridge Parking and Transportation Demand Management Ordinance, electric vehicle recharging facilities must be provided in new, large parking facilities.

Proposed Actions

Short-term

- Adopt a City green fleets policy that incorporates energy efficiency criteria for acquiring municipal vehicles, including sizing of vehicles appropriate to their tasks and giving preferences to alternative fuels and hybrid vehicles where possible and promotion of using the smallest vehicle necessary for jobs (including City bikes). [G]
- Establish a municipal work group to coordinate implementation of alternative fuel vehicle acquisition and infrastructure installation. [G]
- Switch to alternative fuel and minimum-sized vehicles. [R]
- Provide a program on driving and maintenance practices that reduce fuel use and emissions for employees who use City vehicles and for the community. [G]
- Publicize the health and environmental costs of motor vehicle emissions. [G,I]
- Reduce the number of nonresident citywide stickers. [G]

Medium-term

- Undertake an anti-idling campaign. Do education about idling through signs, targeted mailings to schools, parents, bus companies, shipping desti nations; follow up with enforcement. [G,R] Make sure vehicles engaged in business do not idle unnecessarily. [B,I]
- Work with the city's congressional delegation to advocate for higher CAFE standards. [G,R]
- Work with state agencies to develop a system to more closely tie vehicle insurance costs to vehicle miles traveled. [G,R]
- Develop stickers on tire pressure for optimum energy efficiency to install at service station air pumps. [G,B]

Long-term

- Establish infrastructure for AFVs, including a CNG fueling station for City vehicles, free public access refueling stations, partly solar-powered, for electric vehicles; and reserved spaces for zero and super low-emission vehicles in municipal garages and parking lots. [G,B]
- Install emission controls on heavy-duty City trucks and construction vehicles; investigate requiring emissions mechanicals on trucks doing business with the City. [G]
- Investigate possible programs to encourage taxis to switch to CNG. [G,B]
- Link parking sticker fees to engine size and put a cap on the tonnage of vehicles eligible for residential parking permits. Increase fees for second, third cars. [G]
- Establish a parking maximum for residential units. [G]
- Study possible creation of neighborhood-zoned parking. [G]

Strategy 5: Promote Local and Regional Transit Improvements

Actions 1990-2001

- The Urban Ring Compact, a consortium of communities working with the MBTA to create a circumferential transit line, was formed. The City has worked on every aspect of planning for the Urban Ring.
- The City has coordinated with the MBTA on improving and publicizing service and taken a leadership role in regional transportation planning efforts, such as the Regional Transportation Advisory Council.

Proposed Actions 2002-2010

Short and medium-term

- Advocate for additional federal and state transit funding. [G,B,I,R]
- Work with other communities to create new MBTA services, including an Orange Line stop at Assembly Square, Somerville; a Green Line extension from Lechmere to Medford, and the Urban Ring line. [G,B,I,R]
- Advocate for low-emissions buses. [G,B,I,R]
- As the federal transportation funding reauthorization process unfolds, advocate with state and federal elected officials to shift federal funds from highways to transit. [G,B,I,R]

Long-term

- Advocate that federal and state officials begin planning an interstate transportation system that does not include large trucks on roadways other than limited access highways. [G,B,I,R]

SECTION 6: Land Use, Buildings, & Vegetation Management

Principles

- Maintaining a socially, economically, ethnically, racially, and culturally diverse population is important for Cambridge.
- A mixture of land uses makes the city healthier, more livable, and more economically sustainable.
- Planting native and water-efficient plant species improves the city's microclimate and reduces energy use.
- Life-cycle costs and benefits of buildings, landscaping, and infrastructure should be considered when planning, building, or renovating.[1]
- It is important to think regionally about land use; regional sprawl affects Cambridge.

Role of Land Use and Vegetation in Cambridge

Cambridge is densely populated, with 14,899 people per square mile and 111,325 jobs.[2] This density can foster energy efficiency, but Cambridge has not yet taken full advantage of its opportunities. With so many jobs, stores, places of worship, neighborhoods, and cultural destinations in easy walking distance of each other, people need to drive much less than they do in other communities. The density also helps support relatively convenient public transportation services.

Ninety-one percent of the housing stock in Cambridge is multifamily housing, which tends to be more energy efficient than single-family housing. There is continuing demand both for more housing and for more commercial and institutional buildings, with a considerable amount of new construction planned in some areas of the city.

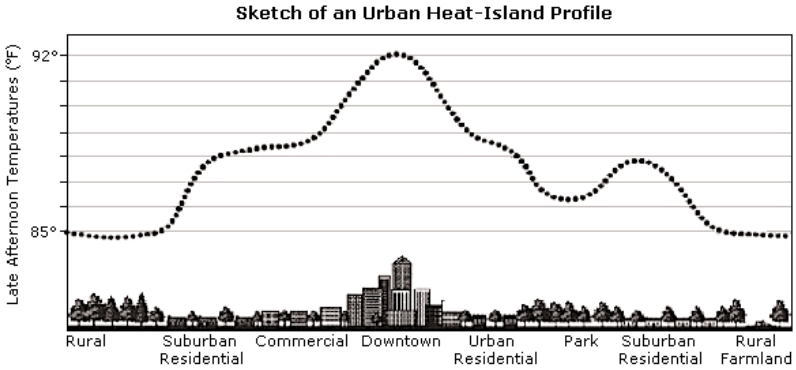
The high percentage of land paved for roads and parking and the many rooftops packed close together, with a relatively small percentage of green space and tree canopy in many neighborhoods, mean that the city absorbs a great deal of heat, creating a "heat island effect." This raises the air temperature during the summer, which in turn increases the use of air conditioning. It impairs air quality and affects people's health.

The challenge is to create a city that benefits from its density, reduces its environmental impact, and remains livable. Land use planning and vegetation management play an important role in meeting this challenge and can affect both emissions of greenhouse gases and the removal of CO_2 from the atmosphere (sequestration). Environmental justice considerations include ensuring the proximity of the less affluent neighborhoods and residents to employment, public services, stores, and safe and pleasant green space.

1 Life-cycle costs are the costs associated with producing a product, transporting it, using it, and disposing of it.
2 Boston, by comparison, has 11,860 people/square mile, and Belmont has 5,305. Somerville has 18,797 people/square mile, but only 22,932 employees. These numbers are from the 2000 census.

Vegetation, especially trees, cools the city in summer both by shading buildings, cars, parking lots, sidewalks, and streets, and through transpiration (i.e., giving off water vapor). It also removes a small amount of CO_2 from the atmosphere, storing it in roots, stems, and leaves. Effective vegetation management, which requires good on-site water management, will also help mitigate some of the anticipated changes in the weather due to climate change-more extreme storms, floods, and droughts. Both flooding and drought-induced water shortages can be reduced by re-using on-site water and maintaining healthy vegetation that increases water infiltration and absorption. Well-maintained trees are less likely to suffer or inflict damage due to high winds or snowfall.

As the climate warms, it becomes ever more important to reduce the urban heat island effect and create cool natural outdoor spaces for people to enjoy in the summer.



Trends

- ***Land use trends:*** Cambridge is a desirable location for housing, businesses, and industries. The number of jobs in the city increased from 109,490 to 111,325 between 1990 and 2000. The high demand for commercial, industrial, and residential buildings, along with the end of rent control, has driven up real estate prices and led to both new construction and extensive renovation of existing buildings. These competing uses create more pressure on existing open space-as well as higher demand for it.

- ***Demographic trends:*** The number of people per housing unit is decreasing, which means that each person is taking up more space. This is in line with national trends. In 1950, the 120,740 Cambridge residents lived in 32,921 units (an average of 3.67 people/unit); in 2000, the 101,355 residents occupied 41,320 units, (2.45 people/unit).

- ***Tree cover/vegetation trends:*** Cambridge has about 11,118 street trees and another 2,500 to 3,000 trees in parks and other City property, but there is no hard data about the total number of trees in the city or about trends. There is no striking decrease in the amount of vegetative cover; while there is considerable new development, most of it replaces less intensive uses, such as parking lots or buildings with lower heights, rather than trees or other vegetation. The percentage of land that is paved or built on is not known. The City is currently assessing tree canopy cover.

- ***Open space trends:*** Approximately 11%, or 492 acres, of the city's total land area is public open space that is owned by entities such as the City and MDC and is accessible to all. However the open space is distributed unevenly; much of it is concentrated in the north and west sections of Cambridge.

- ***Regional trends:*** Sprawl continues to dominate regional land use changes, resulting in more traffic, lower regional air quality, less access to open space, and loss of farmland and natural habitats. From 1972 to 1996 developed land in Massachusetts increased by 59%, while the population grew by only 6%.[3] Sprawl undermines urban environments and increases the number of people who commute to or through Cambridge, adding noise, air pollution, and traffic congestion. With sprawl has come a dramatic increase in vehicle miles traveled.

Tools and Resources

Zoning

The Cambridge Zoning Ordinance governs how land and buildings may be used. It is a local law, adopted by the City Council, but it must conform to state zoning law. The zoning ordinance covers four areas: how land may be used; the intensity of activity and size and location of buildings on a piece of land; the amount of off-street parking required for each type of land use; and special regulations for activities and land uses that would not be sufficiently regulated under the first three areas.

The ordinance has two parts, a map and the text. The map shows the boundaries of the city's complex zoning districts, which include ten kinds of residential district, four classes of office district, eight categories of business district, seven classes of industrial district, eleven special districts, and several special overlay districts. The text lists the regulations for each class of district and the procedures for enforcing and administering the regulations.

The ordinance is often amended. In 2000, after an extensive community process, the City Council adopted a comprehensive rezoning package to encourage more housing, including affordable housing, especially in areas where other uses have dominated; limit future density and traffic growth; and provide additional opportunities for public review of large projects.

Toward a Sustainable Cambridge

This Cambridge growth policy document, published in 1993 by the Community Development Department, advocates many directions and strategies that are congruent with the Climate Protection Plan. While the growth policy document, which was written with extensive citizen involvement, has no formal legal status, it continues to guide policy decisions.

3. *Losing Ground*, Mass. Audubon Society, 1999.

Green Ribbon Report
In 1999 the City Manager appointed the 17-member Green Ribbon Open Space Committee to develop criteria for expanding and improving the city's open space system. Its recommendations are included in the possible actions listed below.

Community Preservation Act
In November 2001, Cambridge voters adopted the Community Preservation Act (CPA). The CPA allows communities to increase their property taxes and devote the funds to open space protection, affordable housing, and historic preservation. The allocation of the funds is determined through the preparation of a community preservation plan.

Citizen groups, boards, and committees
Civic activism is a great asset of the city. Cambridge and the region have a number of citizen organizations working on issues related to land use and vegetation management, among them the Friends of the Alewife Reservation, Cambridge Tree Project, Charles River Conservancy, Charles River Watershed Association, and Mystic River Watershed Association, and several friends groups for local parks.

Citizen boards and advisory committees are also important assets. Those that perform roles relevant to land use and vegetation management include the Planning Board, Conservation Commission, and Committee on Public Planting.

Regional planning organizations
The Metropolitan Area Planning Council, based in Boston, is the regional planning organization for the area's 101 cities and towns. While it is advisory, without much clout for regional land use planning, its staff and other resources can provide valuable modeling and other services. The Metropolitan Planning Organization does regional transportation planning and approves allocations of some roadway funds.

LEED
A growing trend in architecture and development is to design buildings in an environmentally holistic manner so that site choice, energy performance, indoor air quality, resource efficiency, water consumption, and waste management are optimized in terms of environmental values. The U.S. Green Building Council (USGBC) developed the Leadership in Energy and Environmental Design (LEED) rating system to provide a process and guidelines by which to evaluate buildings for their environmental and energy performance. The current system is applicable to commercial, industrial, institutional, and multifamily residential buildings of 40,000 square feet or more area. The USGBC is in the process of developing rating systems for residential buildings and for building remodeling. The City became a member of the USGBC in June 2001.

Green Ribbon Committee

The 2000 Green Ribbon Committee report recommended that the City consider several next steps while pursuing open space acquisition:

- *establish a permanent open space committee to provide advice on open space acquisition and enhancement;*
- *form or closely affiliate with an open space non-profit;*
- *expand resources for open space enhancement, maintenance, and design, with a focus on facilities in priority areas and for priority uses;*
- *continue the city's efforts to improve access to open space; and*
- *incorporate review of open space into the permitting process for large development projects.*

LEED-Registered Projects in Cambridge

- *Cambridge Park Place Apartments/Oaktree Development*
- *823 Main Street/Gravestar, Inc.*
- *Genzyme Headquarters*
- *Stata Center/MIT*
- *City Hall Annex/City of Cambridge*

The LEED rating system provides a standard that can be used as a reference in design and construction documents, government policies, and laws and regulations. It is being widely adopted as a guideline across the nation. In Cambridge, five projects have been registered as having been designed using the LEED standards. The City's renovation of City Hall Annex is using LEED, as will the main library expansion. Other projects in Cambridge are using LEED but have not sought official designation from the USGBC.

The recent revisions to the zoning ordinance established a new project review process with urban design objectives. One objective calls for developments to minimize environmental impact from resource use and cites LEED as a means to document these impacts. The Planning Board will take the objective into account when it reviews applications for special permits.

The Green Roundtable
This Boston area non-profit organization, which is an USGBC affiliate, includes architects, engineers, developers, environmentalists, government agency staff, and other interested people. It provides education and training programs and technical assistance and also advocates for policies that promote green buildings.

Northeast Center for Urban and Community Forestry
This office, based at the University of Massachusetts at Amherst, is a partnership of the U.S. Forest Service, private and state forestry concerns, and the university. It provides information and assistance in planning and conducting urban forestry activities.

Massachusetts DEM Urban Forestry Program
The state Department of Environmental Management helps communities and nonprofit groups build long-term management programs and develop support for urban forest management. Grants are offered for urban forest planning and education and for tree plantings.

Actions to Reduce GHG Emissions from Land Use Activities

Note: Actions are classified based on which sectors of the community would be directly involved:

B=Business community
G=City government
R=Residents
I=Institutions

Proposed actions are listed by sector in Appendix III.

Strategy 1: Foster Mixed Use, Transit-Oriented Development and Redevelopment and Public Open Space through Zoning and Incentives

Life-cycle analysis of buildings shows significant energy savings and reduced environmental impact when existing structures are reused or rehabilitated rather than replaced. Compact mixed-use development lowers energy use within buildings, promotes less automobile travel, and helps make the city livelier and more livable.

Unpaved open space offers opportunities to grow vegetation that can serve as a CO_2 sink and reduce the heat island effect. Opportunities for new open space are limited in Cambridge, because most land has been built on and buying and converting property to green space is very expensive. Opportunities for new green space include converting small spaces to vegetated miniparks, establishing a multi-use path along the Grand Junction railroad line, developing rooftop gardens, and redesigning lawns around office buildings in areas like Kendall Square to include more varied vegetation and public access.

The City's Green Ribbon Committee recommendations on open space provide a blueprint for open space preservation and acquisition.
In addition, existing natural areas should be conserved, and restored where damaged. Open space should maximize tree canopy cover compatible with proposed uses and be maintained with energy- and water-efficient practices and vegetation (see strategies 3 and 5).

Having access to wilder nature—woods, fields, and beaches—is also important for people who live in the city. If access is difficult, it encourages more out-of-town travel and, for those who can afford them, second homes, creating a negative spiral of more sprawl, less access, more desire for vacation homes, etc.

Actions: 1990-2001

- The city's mixture of building uses has been strengthened with the comprehensive rezoning adopted in 2000.
- The City committed to making City Hall Annex and the new main library green buildings.
- The Green Ribbon Committee was formed and delivered a plan for acquiring more open space.
- New public parks were built as components of developments at Kendall Square, University Park, and Quincy Square. A landfill site was reclaimed to create Danehy Park, now the city's largest park. The buildings at 238 Broadway were acquired for demolition to expand park space, and two large new parks are planned for eastern Cambridge.
- Citizens and community activists, along with City staff, Harvard, and MIT, have worked with the MDC on the master plan for improving the Charles River Basin.
- Residents have led efforts to restore urban wilds at Blair Pond and Alewife Reservation.

Possible Actions

Ongoing

- Use zoning to continue to encourage pedestrian-scaled mixed-use development, with residential infill throughout the city. Strengthen orientation toward denser development near public transportation. [G]
- Design and construct durable buildings with flexible re-use options. [G,I,B,R]
- Conduct consistent open space review during the permitting process for development projects to incorporate public open space into project design. [G]
- Provide incentives for planting trees and creating additional green space open to the public as part of new development and major renovations. [G]
- Carry out the recommendations in the Green Ribbon Report. [G]
- Create appealing small-scale public gathering spaces with well-adapted vegetation as part of development and redevelopment projects. [B,I]

Chicago's Green Rooftop Demonstration Projects

Summer roof temperatures can reach up to 140°F in cities. This intense heat creates updrafts of tiny particles that can clog lungs as well as increase the need for more electricity for air conditioning, which is a major contributor to air pollution. In response, the city of Chicago is planting gardens atop several city buildings as part of a U.S.

EPA program studying ways to help cool cities and reduce smog. A study conducted by Weston Design Consultants concluded that the greening of all city roofs in Chicago would produce $100,000,000 in saved energy annually, with the peak demand cut by 720 megawatts. The city will also plant trees and other vegetation in medians to help cool pavement and will consider using light-colored paving surfaces. Green roofs help capture and filter air pollutants and retain 50-70% of storm water. They require less maintenance and repair and help muffle noise. Because green roofs can't get hotter than 77°F they should help to cool Chicago by 5°F during the hot summer months.

Strategy 2: Optimize Use of Vegetation to Shade Buildings and Reduce the Urban Heat Island Effect

The tree canopy reduces the urban heat island effect, sequesters carbon, reduces gasoline evaporation from parked motor vehicles, and makes the city more visually attractive. Preserving existing trees is the key to increasing the canopy since mature trees provide significantly more canopy than recently-planted ones. Trees grow slowly, and typically it takes many years for a tree to reach its full growth and capacity to sequester carbon. Vines and arbors can also be used in constrained spaces.

Removal of CO_2 from the air by trees is on the order of 25 tons/tree/year. There are about 13,000 to 15,000 City-owned trees and an unknown number of privately owned trees. Conditions for trees are more difficult than they used to be, so it is important to boost maintenance of old trees, as well as to add trees wherever possible. For trees and other vegetation, sufficient water and good soil, with the proper nutrients and drainage, are crucial. Selection of species adapted to the local environment, and minimizing lawns, keep maintenance and energy costs low. There are multiple benefits to good vegetation maintenance and on-site water management, including avoidance of costs of storm damage and loss of vegetation from droughts, energy savings for building owners, and a pleasant summer environment.

Benefits from Trees

Urban trees have many benefits besides sequestering CO_2:

"Forest Service research suggests that when the economic value of benefits trees produce (e.g., removal of air pollutants, heating energy savings, reduced storm water runoff, increased property values, scenic beauty, and biological diversity) are assessed, total benefits can be two to three times greater than costs for tree planting and care . . . Furthermore, many of these benefits extend beyond the site where a tree grows, to influence quality of life in the local neighborhood, community, and region."

McPherson & Simpson, Carbon Dioxide Reduction through Urban Forestry. USDA, 1999.

Actions: 1990-2001

- The City has implemented new tree programs, including a four-year pruning cycle for its trees to help them survive storms and minimize the need for later more drastic pruning, and an expanded client and commemorative tree program, through which residents and businesses can pay for new street and park trees and work with the City to maintain them.
- Tree education has included the City Arborist's neighborhood tree walks and Arbor Day celebrations in local schools, both of which feature tree identification and tips on caring for trees, and educational activities conducted by the Cambridge Tree Project.
- The Department of Public Works has carried out efforts to reduce storm runoff into the storm-water system.
- Renovations to the parking lot at the Porter Square shopping center included a system to capture and reuse runoff.

Proposed Actions

Short-term

- Use GIS or other computer imaging, such as the CITYgreen software developed by American Forests, to accurately determine current canopy cover, assess environmental benefits, and plan plantings. [G]
- Increase public education efforts on stormwater management practices, particularly those that complement GHG emission reductions. [G]
- Increase public education on the benefits and proper care of trees. [G,R]

Medium and Long-term

- Develop and carry out policies and programs to maximize the canopy cover, with special attention to parking lots and other heat-absorbing locations and to shading air-conditioning units. This should include attention to soils, water retention, and appropriate species. [G, B,I,R]

Strategy 3: Reduce the Urban Heat Island Effect through Design of the Built Environment

The less incoming solar radiation buildings, streets, and other surfaces absorb, the cooler the city becomes. There are two main ways to reduce the absorption of heat: increase transpiration and shading by vegetation and increase the albedo (reflectance) of surfaces. There are many low-cost ways to make surfaces more reflective. It can be as simple as selecting light-colored asphalt shingles instead of black shingles when re-roofing a building.

Actions: 1990-2001

- The City Council passed an order requiring that green roofs be considered in new construction or major renovations of City buildings and to encourage their use in private construction.

Cool Roofs

Black surfaces in the sun can become up to 70°F hotter than most reflective white surfaces. The heat from a roof can increase the surrounding air temperature by up to 5°F, contributing to the heat island effect. Cool roofs can reduce the heat island effect and save energy for air conditioning.

While there are benefits to using black roofs in some colder areas in the United States, Cambridge would see better results from using a cool roof system. A white roof system is both environmentally conscious and economically sound. The installation cost for a white membrane roof per 10,000 sq. ft. is up to $22.80 cheaper than a traditional black roof system. The use of cool roof systems is an important method Cambridge can use to reduce its growing air pollution problem.

Proposed Actions

Short-term

- Provide developers and property owners with information about using green roofs or high reflectance roofs on buildings and other reflectance and shading techniques. [G]
- Provide developers and property owners with information about reflectance and shading for parking lots. [G]

Medium and long-term

- Provide incentives for new construction and renovations to meet LEED standards for reflectance and shading. [G]
- Incorporate LEED standards for reflectance and shading in all City and private parking lots and in new construction and major renovations. [G,B,I,R]

Strategy 4: Promote the Design and Construction of Green Buildings

Designing green buildings involves different approaches and techniques than does conventional design. It explicitly considers factors such as the energy efficiency of a structure and the level of air quality that will result. It requires tools such as energy modeling to support the design process. The aim of the green building approach is to construct buildings that are more durable, are sited optimally, use less energy, provide a safe and comfortable indoor environment, and conserve natural resources—in other words, to minimize the environmental footprint of our built environment.

On July 1, 2001, a new energy code for commercial and high-rise residential buildings took effect in Massachusetts. The code affects the construction of new buildings and is projected to save 27 trillion BTUs of power generation. It is estimated that statewide the new code requirements will reduce annual emissions of CO_2 by about 2.4 million tons, sulfur dioxide by about 14,500 tons, and nitrogen oxides by about 3,500 tons. The new code does not affect existing buildings, which outnumber new buildings, except when they undergo major renovations.

Actions: 1990-2001

- The 2000 city-wide rezoning includes a provision to advise developers on the merits of using LEED standards.
- Several projects have been constructed as green buildings. Some projects predated the LEED rating system, including Cambridge Co-housing (on Richdale Ave.), the Union of Concerned Scientists headquarters (top three floors of 2 Brattle Square), and the renovation of the Porter Square shopping plaza. Several construction projects proposed or under way are planned with the goal of meeting LEED certification criteria.

Proposed Actions

Short-term

- Provide developers, citizens, and City staff with information to assist them in applying LEED standards. [G]
- Develop green standards for renovation of City-owned properties. Utilize the City energy management workgroup to coordinate department implementation. [G]

Medium-term

- Strengthen zoning incentives to include LEED in project review and planned unit development (PUD) processes. [G]
- Reuse materials from existing structures during renovation or redevelopment projects (See LEED Materials Credit 1). [G,I,B,R]

Strategy 5: Work for Transit-Oriented Regional Land Use Planning

Currently, the mechanisms for doing regional land use planning in the Boston area are weak. The metropolitan area includes 101 cities and towns, many of them quite small geographically. The Metropolitan Area Planning Council is advisory, and there is no governing regional body. While sprawl is not an issue within Cambridge, which is already very densely developed, it directly affects the city in important ways as it promotes increased traffic to and from the city. In addition, the loss of open space outside Cambridge is a loss to Cambridge residents who seek access to forests, beaches, other natural areas, and farms.

Regional concerns may sometimes conflict with local concerns: People looking at transportation issues in the region may want to concentrate new jobs near places easily reached by public transportation, e.g., Cambridge, while many Cambridge residents, concerned about traffic on their streets, may not. In addition, new jobs draw people to Cambridge at the same time that the high cost of housing makes it impossible for many of them to live in or near the city, which induces further sprawl and more driving.

It is important for the entire Boston metropolitan area that there be a regional land-use plan that includes powerful incentives to stop sprawl and shift to in-fill development. While there is growing agreement among planners that in-fill development is often preferable to sprawl, there seems to be a lack of consensus on what kind of in-fill development is desirable or on how to make it happen.

Actions: 1990-2001

- Through participation in the Metropolitan Area Planning Council and other regional and statewide organizations, the City works to promote a regional approach to land use.

Proposed Actions

Ongoing

- Increase support for and involvement in regional land use planning activities. [R]
- Work with legislators and other public officials toward creating a regional land use plan with teeth. [G,R,I,B]

SECTION 7: Waste Management

Principles

- Source reduction, or the avoidance of generating waste, is the most effective way to reduce GHG emissions associated with waste.
- Because energy is needed to transport and process wastes, recycling reduces but does not eliminate GHG emissions associated with wastes.
- Environmental purchasing is key to establishing and supporting the demand for recycled materials in products.

Role of Waste Generation and Management in Cambridge

The typical municipal solid waste stream consists of a variety of materials including paper products, metal, glass, plastics, food scraps, and landscape trimmings. These are collected by the Department of Public Works or by private disposal firms and sent to landfills and incinerators located outside Cambridge. Other types of waste including construction debris and appliances are also landfilled. Hazardous wastes are handled by special facilities.

Waste materials are related to GHG emissions in the following ways:

- The unmanaged decomposition of organic material (e.g., food scraps, landscape trimmings, paper, cardboard) in landfills releases methane, a powerful GHG (20 times more potent than CO_2). Increasingly, scientists are finding that the release of methane is a major component of global climate change.
- Incineration of solid waste results in the emission of CO_2 and other pollutants.
- Energy, usually in the form of fossil fuels such as gasoline and diesel, is used in the collection, transport, and handling of waste materials, which in turn releases CO_2.
- Some wastes, when landfilled, sequester or store carbon because they do not decompose. This keeps CO_2 out of the atmosphere.

In Cambridge, the City collects most residential waste. About 94% of households are served by the City's recycling program whether they are on City trash service or not. Some multi-residential dwellings use private waste contractors. The City collects recyclable materials, including paper, cardboard, metal, yard waste, and plastic from residences and City government buildings and schools. Currently, Cambridge recycles about 33% of its solid waste. Businesses are also required under the Cambridge Recycling Ordinance to develop and implement a recycling plan. The City's curbside recycling contractor services over 100 small and medium-sized businesses in a City-subsidized commercial curbside program. Most businesses utilize private contractors. Businesses with fewer than 50 employees can use the City's drop-off center at no cost.

Actions that prevent or reduce the generation of waste—efficient use of resources, reuse, composting, and recycling—also prevent or reduce the emission of greenhouse gases. In this plan, preventing the emission of greenhouse gases at landfills and incinerators and the sequestration of carbon in landfills are considered. While not counted in this plan, waste minimization and prevention also prevent and reduce the use of energy in mining, transportation of raw materials to mills, production of goods, and transportation of goods to consumers. Preservation of forests, by reducing the demand for wood products, allows trees to continue removing CO_2 from the atmosphere and storing it in a process called carbon sequestration.

Trends

Various initiatives undertaken during the 1990s, particularly the establishment of the Cambridge recycling program in 1990, have achieved significant reductions in GHG emissions from waste. Since 1990, annual GHG emissions have been reduced by 14,343 tons. The table below summarizes trends in residential solid waste generation and recycling since 1990.

It is difficult to develop a full picture of solid waste management in Cambridge because there is not a unified system for the collection, recycling, and disposal of all waste. While the City collects most residential waste, some is collected by private contractors. We can have relative confidence in the figure for the total volume of material that residents recycle, but we do not have a handle on how much material businesses recycle. Therefore it is not possible to calculate the total volume of material that is recycled in Cambridge.

Cambridge Curbside Recycling Statistics

	FY 1990	FY 1998	FY 1999	FY 2000	FY 2001
Trash Collected	40,424	22,361.45	21,606.79	21,671.53	21,806.61
Curbside recyclables	0	8,976.92	8,903.47	9,749.99	9,648.38
Drop-off recyclables	0	163.90	171.70	175.95	195.5
Home composting	0	619.13	670.88	744.38	794.63
Other waste	0	8.6	8.3	8.0	35.03
Total recycled	645.6	9,847.35	9,831.27	10,759.11	10,866.23
Total solid waste	41,069.6	32,208.8	31,438.06	32,430.64	32,672.84
Population	95,802	99,772	99,772	101,355	101,355
Per capita trash generated	0.4985	0.2648	0.2559	0.2526	0.2542
Per capita recycled	0.0067	.09870	.0985	0.1062	0.1072
Per capita Solid Waste	0.5065	0.3721	0.3626	0.3680	0.3706
Recycling rate	.57%	30.57%	31.27%	33.18%	33.26%

Relationship between Waste and GHG Emissions

After products and materials have served their useful life, they are sent to landfills and incinerators for disposal. At landfills, wastes with organic constituents give off methane, a powerful GHG, as they decompose. At incinerators, burning of some kinds of waste produces CO_2, among other pollutants.

Strategies to Reduce GHG Emissions from Waste

Waste Minimization and Prevention

The generation of waste can be minimized and prevented by using materials more efficiently and by extending the length of use to avoid replacement. Even small steps, like making two-sided copies, can add up when a lot of people take them.

Reuse of Products

Reusing products and materials extends the usefulness of these items and prevents sending them to landfills and incinerators. Examples include recovery and reuse of building materials such as windows, wood beams, doors, and cabinets in construction.

Recycling of Materials

Recovering materials to reuse in the production of new goods—recycling—prevents disposal in landfills and incinerators. Some materials that the recycling program collects, such as glass or metal, do not generate greenhouse gases if they are disposed of in a landfill or incinerator, but recycling them prevents the use of energy in mining virgin materials and producing and transporting products. Recycling of paper products does prevent the emission of greenhouse gases, because they would generate methane if they decomposed in a landfill or CO_2 if incinerated.

Composting

Composting food scraps, instead of sending them to landfills, results in a net reduction of greenhouse gases. Composting in backyards or in central facilities does not produce methane. In a landfill, food scraps will degrade and produce methane.

Composting of yard trimmings also does not produce methane. In landfills, yard trimmings tend not to decompose and the carbon contained is sequestered, but they use up limited landfill capacity, and their potential for improving soil is lost.

Environmentally Preferable Purchasing Practices

The Commonwealth of Massachusetts defines environmentally preferable products as having less negative effect on human health and the environment than competing products or services that serve the same purpose. Such products or services may include, but are not limited to, those that contain recycled content, minimize waste, conserve energy or water, or reduce the amount of toxics disposed or consumed. Purchasing products with recycled content is necessary to support the collection of recyclable materials. Without environmentally preferable purchasing, the recycled materials would simply accumulate and would ultimately require conventional disposal.

Tools and Resources

Massachusetts Solid Waste Master Plan

The state Department of Environmental Protection is required by law to develop and maintain a statewide master plan for solid waste management. The first plan was issued in 1990 and the most recent plan was issued in December 2000. It lays out goals and mechanisms to minimize the disposal of solid waste in landfills and incinerators, using a mix of regulatory requirements, incentives, and educational programs.

The basic strategy of the plan is to reduce the amount of solid waste produced, recycle the maximum amount that is produced, and dispose of the remaining portion as a last resort in an environmentally sensitive manner. The plan calls for a 70% reduction of municipal solid waste and construction and demolition debris (60% MSW reduction and 88% C&D waste reduction). DEP proposes to achieve this milestone through

- expanding source reduction programs especially targeted at businesses;
- launching new initiatives with manufacturers to take responsibility for managing the wastes associated with their products;
- making recycling more accessible to multi-family units;
- banning the disposal of unprocessed construction and demolition waste in 2003;
- enhancing enforcement of waste bans;
- requiring recycling facilities to implement recycling benefits plans

Department of Environmental Protection/Bureau of Waste Prevention

DEP is responsible for state waste management policy. Various regulations, education programs, and incentives are used to reduce the generation and disposal of waste in Massachusetts. DEP offers a range of technical assistance programs to municipalities, businesses, and institutions and a variety of grants to support the recycling industry and municipal waste management programs.

Recycling Ordinance

The Cambridge Recycling Ordinance (Section 8.24.070 of the City Code), passed by the City Council in 1991, mandates recycling in Cambridge by:

- establishing the recycling program within the Department of Public Works;
- requiring that each owner or occupant in Cambridge separate recyclable materials;
- requiring all buildings that do not receive City solid waste collection service to prepare and implement a recycling plan. All City-owned buildings including schools must also have plans.

DPW Recycling Program

The recycling division of the Department of Public Works coordinates administration of the City's recycling ordinance. The division works with contractors to provide recycling services to residents and businesses and promotes efforts to increase the rate of recycling. The division is advised by the Recycling Advisory Committee, a group appointed by the City Manager and composed of citizens and representatives of the business and institutional sectors.

WasteCap

WasteCap of Massachusetts is a nonprofit organization that provides services to businesses across the state on recycling, source reduction, reuse of materials, and buying recycled products. Services include site visits to develop waste reduction and recycling strategies, a surplus inventory donation program, recycling cooperatives, buying recycled technical services, and a recycled paper purchasing cooperative.

Boston Building Materials Cooperative

The BBMC is a private, nonprofit consumer cooperative that takes good-quality used and surplus building materials and distributes them to low and moderate income homeowners, schools, nonprofit organizations, and churches. The value of materials donated to BBMC is tax-deductible.

Center for Ecological Technology

The Center for Ecological Technology initiated the Greater Boston Food Waste Recycling Project in an effort to divert food waste from landfills and incinerators. CET is working to identify all composting and other end users of food waste (e.g., farms and feed manufacturers) in eastern Massachusetts and to expand their capacity to accept food waste. The center will also work with generators, such as supermarkets, food manufacturers, and food distributors, to divert food waste from landfills and incinerators.

Institution Recycling Network

The network, based in Concord, New Hampshire, works to improve the financing and operations of recycling programs at New England institutions such as universities, hospitals, nursing homes, and private schools. Services provided to institutions include help in finding markets for recycled materials, arranging transportation, setting up "milk runs" for collection and marketing of small quantities of materials generated at several locations, assuring compliance with health and safety standards, and coordinating group purchases of recycling-related supplies and equipment.

ACTIONS TO REDUCE GHG EMISSIONS FROM WASTE

Note: Actions are classified based on which sectors of the community would be directly involved:

B=Business community
G=City government
I=Institutions
R=Residents

Proposed actions are listed by sector in Appendix III.

Strategy 1: Prevent Waste

The most effective way to reduce greenhouse gases from waste is to prevent the generation of waste in the first place. Not only are the impacts of disposal prevented, but the cost and impacts of producing and transporting products and transporting materials for recycling are also avoided.

Proposed Actions

Short-term

- Implement a waste prevention program for City government. [G]

Medium and Long-term

- Promote waste prevention measures in the commercial sector, after having implemented a waste prevention program in City government. Finally, promote residential waste prevention. [B,G,I]

Strategy 2: Increase Recycling

The Commonwealth has raised the goal for recycling. To meet these goals, Cambridge—the City, businesses, institutions, and residents—will need to consider new initiatives to increase the rate of recycling.

Actions: 1990-2001

- Since 1990, the Department of Public Works Recycling Program has provided curbside recycling, a drop-off recycling center, and distribution of home composters. In 2001, 10,866 tons of material was recycled.
- Harvard University operates an extensive campus recycling program that collects and recycles paper, cardboard, glass, metal, plastic, telephone directories, leaves, food waste, and wooden pallets. In 2000, Harvard composted 685 tons of food waste, landscape trimmings, and laboratory animal bedding; this was up from 340 tons in 1999.
- MIT expanded its campus recycling program in 2000. Recycling rates were increased from 5% of total waste in January 2000 to 18% by November of 2000. A food waste program was started that composts four tons of food a month. MIT also initiated a construction debris recycling program and a yard waste recycling program.

Proposed Actions

Short-term

- Carry out projects to increase participation in existing recycling programs using community-based social marketing techniques, starting with a pilot project. (See Section 8 for a description of community-based social marketing.) [G]
- Facilitate construction and demolition waste recycling. The state is planning to implement a construction and demolition debris disposal ban by 2003. The City can help contractors prepare for it by requiring a construction and demolition debris recycling plan as a condition of receiving a building permit. [G]

Medium-term

- Conduct waste composition studies every two years to develop information about which new portions of the waste stream to target for recycling or reduction and to evaluate the success of the current program. The study should examine the waste streams from residences, City government buildings, schools, and the commercial sector across all the seasons of the year. [G]
- Expand electronics recycling to include printers and other computer peripherals, as well as old phones, VCRs, stereos, and other electronic equipment. [G,B]

Long-term

- Develop a program to ensure that commercial waste paper is being recycled. Since 67% of Cambridge businesses provide professional, business, real estate, or insurance services, commercial waste paper is undoubtedly the largest portion of the commercial waste stream by far. The program should be based on a monitoring program and application of the Recycling Ordinance requirements. [G,B]
- Facilitate commercial food waste collection. This would help Cambridge businesses and institutions prepare for a state ban on food waste disposal that should go into effect soon under the Solid Waste Master Plan. Large institutions with food services have opportunities to efficiently divert food waste to composting facilities. Appropriate disposal facilities need to be identified. [G,B,I]
- Conduct a thorough composition study of the residential waste stream to assess the feasibility of a residential food waste collection program. Picking up food waste, yard waste, and cardboard in the same packer trucks should be considered. [G]
- Develop a program to pick up used clothing for recycling at the curb. Used clothing can comprise up to 6% of the waste stream. [G]

Strategy 3: Implement Environmentally Preferable Purchasing

Purchasing products with recycled content is essential to support a market for recycled waste material.

Actions: 1990-2001

- The City established a "buy recycled paper" policy in 1998.
- MIT initiated a "green goods" procurement program in 2000 that increased recycled paper (i.e., 30% to 50% recycled content, chlorine-free) use from less than 5% to 64% of total paper use on campus. The campus copy center's recycled paper use constitutes over 90% of its paper use.

Proposed Actions

Short-term

- Reevaluate the City's system for tracking recycled and non-recycled paper and plastic purchases to ensure accurate recording of the quantities purchased and set goals for increasing the percentage. Work with the school department to accomplish the same steps. [G]
- Work with stores to develop and use point-of-sale reminders to customers to purchase recycled products. [G, B

SECTION 8: Implementation

The Need for an Implementation Process

This plan does not prescribe actions that specific stakeholders must implement. That would require additional research and much more community involvement. At this point all sectors of the community—City government, including individual agencies; businesses; institutions, particularly the universities; and individuals—need to become engaged in the process of making a commitment to carrying out the effort to reduce Cambridge's GHG emissions. For us to reach our 20% reduction target, all sectors of the community will need to embrace the goal and develop actions to attain it.

Developing a community consensus on the need to reduce GHG emissions and gaining active participation by stakeholders are feasible for the following reasons:

- Climate change will directly affect Cambridge.
- The actions needed to reduce the buildup of greenhouse gases have many additional benefits, including increased energy reliability and security, cost savings, cleaner air and water, and a higher quality of life.
- Opportunities exist for economic development and job creation.
- Many resources are already available to support actions that reduce GHG emissions.
- Actions to reduce GHG emissions are already taking place in Cambridge.

Environmental Justice Considerations

While opportunities to counter climate change abound, there is a range of choices in the actions to be taken, and some may have different impacts on different social groups. To ensure equity and to sustain community support for the actions, it is important to give attention to the possibility of unintended effects. For example, energy efficiency upgrades in a building may involve initial costs that are recouped over time. Lower-income households may not be able to afford to make the initial investment.

To protect against inequitable outcomes, the implementation process should endeavor to be inclusive and provide for genuine dialog. Reaching out to a wide segment of the community and conducting the process openly will foster better ideas, greater commitment, and more effective action. For example, identifying obstacles that low-income households face in implementing energy efficiency measures can and should lead to solutions.

Strategies

A community-wide outreach campaign is a very large undertaking. To be successful a campaign must be able to marshal resources and build community support. It makes sense to start with projects that have tangible goals and will generate positive results that can build upon one another. The elements of the implementation process should include the following:

- Use City leadership by example to help catalyze community action.
- Develop a citywide campaign that involves all sectors of the community, using community-based social marketing tools.
- Build on existing efforts in the community.
- Engage the schools.
- Network with other communities and organizations that are already successfully engaging in local climate protection campaigns to learn from their programs and experience.
- Monitor progress and report the results.
- Establish a committee or other entity to coordinate action.

Provide City Leadership

There are many opportunities for the City to reduce GHG emissions by improving the energy efficiency of its buildings and vehicle fleet, installing distributed energy systems to produce power, training staff to adopt more sustainable practices in the workplace, and reducing waste. By carrying out such actions and publicizing the results, the City can show that it is willing to do what it asks others to do.

It is difficult to conceive of an entity other than the City that could carry out a community—wide campaign. This plan does not suggest that the City be responsible for the entire effort, but it can act as an initiator, convenor, and leader. Ultimately, it will be necessary for people in each sector of the community to also play these roles.

Create a Citywide Campaign

All sectors of the community—the City, businesses, institutions, and individuals—will have to participate in this effort if it is to succeed. To reduce GHG emissions, all stakeholders will have to examine the practices that affect energy use, transportation, land use, and waste management and make changes.

Burlington, Vermont offers one potential model for Cambridge to use in motivating the entire community to get involved. Burlington's 10 Percent Challenge campaign asks everyone to pledge to reduce their emissions by 10 % by 2005. The Alliance for Climate Action, a group of local stakeholder organizations, was formed to coordinate the campaign. The project includes a website on which people can report and track GHG reductions, assistance with identifying reduction opportunities, and a recognition program for participants.

Community-based social marketing provides a model that has had promising results in achieving actual behavior change. It uses the results of social science research to promote behavior change. This research indicates that in general, providing information to people by itself does not affect behavior. Personal contact is required. Careful identification of barriers and benefits to change is the first step in the process. The next step is to select appropriate tools.

The tools, which are typically used in combination with one another, include:

- Commitment
- Prompts
- Norms
- Communication
- Incentives
- Removing external barriers

Once a campaign is developed, it is tested; the results are evaluated before a large-scale campaign is launched. Monitoring results is a key part of every CBSM project.[1]

An individualized marketing program called, developed in Germany and based on similar principles, has successfully changed personal travel behavior through direct contact with households. The program which offers personalized travel information and incentives to use transit, walk, or bicycle, has had remarkable success in Europe and Australia.[2]

1. See Doug McKenzie-Mohr and William Smith, *Fostering Sustainable Behavior: An Introduction to Community-Based Social Marketing* (Gabriola Island, BC, Canada: New Society Publishers, 1999) or www.cbsm.com.

2. See www.sustrans.co.uk.

Build on Existing Efforts

A number of efforts already underway in Cambridge and the Greater Boston area can serve as the foundation for a community-wide climate protection campaign. These existing projects and activities offer an obvious way to establish and build partnerships and to link stakeholders across different sectors.

Businesses

Many Cambridge businesses have an interest in environmental sustainability. A number of new developments are using green building designs, which will be highly energy efficient. Companies such as Gravestar and Oaktree Development have made commitments to environmental responsibility as evidenced in their local projects. Gravestar follows a "green bible" of practices in its development projects. Oaktree has been an early adopter of the LEED green building standards. These businesses offer a model to other developers.

Businesses also have an inherent interest in energy efficiency. Efficiency upgrades reduce operating costs. While energy efficiency may not be the largest area of potential cost savings for some businesses, it is a cost-effective way for companies to demonstrate an environmental commitment. Companies such as Genzyme have undertaken extensive energy efficiency upgrades throughout their facilities.

Wainwright Bank, which has branches in Cambridge, has made social responsibility a centerpiece of its corporate philosophy. In partnership with Solar Boston, it offers a green loan package that provides a 1% lower interest rate than the standard home equity loan to finance solar installations.

As described in the plan's energy section, Cambridge Savings Bank and Source One have both received state grants to plan for fuel cell installations in Cambridge.

Many businesses and institutions are members of the Charles River Transportation Management Association, through which they fund and support programs to reduce single occupancy vehicle trips.

The Universities

Both Harvard and MIT have programs and projects involving facilities management, education, and research that are either working directly on climate change issues or in related areas.

Harvard launched its Green Campus Initiative to utilize its resources to build an environmentally sustainable institution. The initiative is staffed and has undertaken an inventory of the campus' GHG emissions and researched options for alternative fuel vehicles, environmental preferable product and

Gravestar's "Green Bible"

Gravestar, the local developer and owner of the Porter Square Shopping Plaza, has adopted sustainable development goals for its properties. To achieve these goals, it developed the Gravestar Protocol, which it describes as "a comprehensive 'green bible' of principles, practices, techniques, and decision analysis steps used to ensure environmental sustainability in all of its projects. The Gravestar Protocol is an expanding reservoir of information and specifications that enables architects, engineers and subcontractors to plan and execute environmentally responsible building projects. Included in the protocols are planning and community involvement strategy, design considerations, and recommendations for execution and facilities management. Detailed site-specific protocols are generated from the large reservoir of environmental specifications."

service procurement, energy efficiency opportunities, and use of organic food in dining halls. To carry out actions, a best practices exchange has been formed and an environmental loan fund has been established. The fund operates as a revolving account to support energy upgrades and other improvements in campus facilities.

At MIT, the Environmental Programs Task Force has been formed; it has worked on expanding the campus' recycling and environmental purchasing efforts. A Green Buildings Task Force is developing sustainable design guidelines for campus construction projects. MIT has adopted the U.S. Green Building Council's LEED Silver Standard with additional MIT-specific criteria as its interim performance goal. The Laboratory for Energy and Environment seeks to use its academic resources to make contributions to environmental sustainability. At the local level, MIT is collaborating with the Cambridge Public Schools to bring three high school and middle school teachers to campus to participate in research and develop environmental projects to take back to their classrooms, with the help of MIT graduate students.

The Faith Community

Many of the religious denominations in the United States have taken a position of concern about climate change and moral obligation for environmental stewardship. Some have undertaken action to express their faith.

The Massachusetts Episcopal Diocese has formed Massachusetts Interfaith Power and Light (MIPL) to foster energy efficiency and support renewable energy among places of worship. MIPL has engaged Conservation Services Group (CSG), an energy services company, to provide energy audit services to congregations, plan for conservation investments, facilitate utility conservation program payments, plan for the purchase of renewable energy, develop a discount heating oil program, and provide a heating and cooling system maintenance plan. CSG will provide similar services to individual congregation members. The program is open to the entire Massachusetts faith community.

The Committee on Environment and Jewish Life (COEJL) actively works to promote more sustainable practices in synagogues and among their members. The Greater Boston Chapter of COEJL sponsored "Eight Days, Eight Actions" in 2001, which urged members to take an energy saving action on each day of Hanukkah to save energy and slow global climate change. COEJL also sponsors Jewish Ecoteams (based on the Global Action Plan process); partnered with Solar Boston to bring technical assistance on solar energy projects to the Jewish community; joined the Green Building Coalition, which is advocating a state green building tax credit; and organized a campaign to urge President Bush to deal with climate change.

The U.S. Council of Catholic Bishops issued a statement on June 15, 2001 called "Global Climate Change: A Plea for Dialogue, Prudence, and the Common Good," which calls for immediate action to mitigate the effects of global climate change. The bishops approved the statement unanimously.

Community Interest Groups

Cambridge Climate Action is a citizen group that is part of the Massachusetts Climate Action Network (MCAN). In May 2000, CCA organized a forum with the Cambridge Center for Adult Education called "Climate Protection: What You and U.S. Cities Can Do," which about 140 people attended. The group has an obvious interest in the goals of this plan.

The Cambridge Tree Project works with the DPW Urban Forestry Program to promote and advocate on behalf of the city's tree resources. Efforts to maintain and expand the urban forest canopy are an important objective of this plan.

The Boston Solar Energy Association, a chapter of the Northeast Sustainable Energy Association, includes practitioners and advocates of solar energy, some living and working in Cambridge. It presents monthly lectures in Cambridge.

Many community groups have missions that are compatible with the plan. These include groups concerned with preserving particular places, neighborhood associations, and social action groups, among others.

Network with Other Communities and Organizations

Currently 18 Massachusetts cities and towns belong to Cities for Climate Protection. Eleven are in Greater Boston. Staff from these communities have formed an ad hoc group that meets bi-monthly to share information and collaborate on projects.

ICLEI organizes national and regional meetings and maintains a listserve. Through the City's association with ICLEI, staff are able to communicate with local government staff in other parts of the country and learn about environmental initiatives. ICLEI is also organizing a "twinning" project to build relationships between local governments in developed and developing countries. Participation in this project would provide a way for Cambridge to magnify its climate protection work.

Numerous organizations and agencies in the Boston area are working on climate change, including the Massachusetts Energy Consumers Alliance, Union of Concerned Scientists, Conservation Law Foundation, Northeast States Coordinating for Air Use Management (NESCAUM), and the Metropolitan Area Planning Commission. These organizations can provide technical assistance and opportunities to partner.

Monitor Progress

To sustain this effort, a program is needed to monitor trends in community-wide GHG emissions in the areas of energy, transportation, and waste. It is relatively easy to collect some community-wide data on an annual basis. *The following data could be collected:*

Parameter	Source
Electricity Consumption	NSTAR
Natural Gas	NSTAR
Fuel Oil Consumption	City *(estimate based on DOE & CDD statistics)*
Vehicle Miles Traveled	Central Transportation Planning Staff & City
Waste Generated & Recycled	DPW

In addition, it is important to compile the results of actions taken. A reporting format could be used based on forms ICLEI has developed for local governments. The City could serve as a repository for these reports.

With this information, the City could produce an annual report on trends and actions. The report would provide a way for stakeholders to put their actions into context and for the community to judge the effectiveness of the effort.

Establish a Coordinating Committee

A standing committee, appointed by the City Manager or organized as a collaboration between the City and community stakeholders, will be important for carrying out the plan. A standing committee should include interested residents, people with technical expertise, and members of the business and institutional communities. The committee would provide a forum to discuss progress, advise on needed actions and changes in approach, assess progress, be a liaison with the community, and conduct outreach. Without such a committee, the effort would likely lose its focus.

While carrying out the plan will be the responsibility of every segment of the community, the City has a key role. It can provide information, incentives and rewards; convene groups; initiate projects; and, by reducing its own GHG emissions, serve as a role model.

This effort will require both staff and funds. Staffing requirements include staff to carry out community outreach and to monitor energy use and carry out energy efficiency projects related to City operations. These positions are likely to pay for themselves in direct and indirect savings to the City. Some funding for materials, for creating a campaign, and for special projects will also be needed.

PROPOSED IMPLEMENTATION ACTIONS

Outreach to Businesses and Institutions

- Develop a flyer for businesses listing the most important things they can do and distribute it widely. Feature brief descriptions of successful efforts by local businesses. Follow up with personal contact.
- Involve the largest employers by requesting voluntary pledges to take action through the EPA Energy Star Program or a local climate protection program. Develop technical assistance programs and information on financial assistance.
- Recognize local institutions' best practices on the City website and during Go Green Month.
- Work with NSTAR to develop effective outreach to businesses and institutions.
- Explore a City contract with an energy services company to facilitate services to commercial buildings.
- Develop a free or inexpensive consulting program for local businesses.
- Develop a pilot program focused on a representative block of small businesses to introduce more sustainable practices in waste management, energy efficiency, and transportation. The program would take advantage of opportunities for cooperation and economies of scale.

Outreach to City Departments

- Form a permanent staff committee to develop policies and action priorities for the City and to coordinate work.
- Do outreach to citizen regulatory boards.
- Develop City government policies to guide purchasing decisions, construction practices, waste management, vehicle use, and other activities with the aim of reducing energy use, vehicle miles traveled and fuel consumption, and waste disposal.
- Develop a mechanism to inform City employees about climate protection activities and resources and a recognition program for outstanding employee efforts.
- Work with the public schools to incorporate environmental principles into the curriculum at all levels and to develop student projects that help carry out some of the actions in the plan.

Green Teams Help Hoseholds

Several cities have sponsored "green teams" or "ecoteams" to encourage sustainable practices in households. Typically, a green team program involves joining a group of 5 or 6 neighborhood households; using a step-by-step workbook with a coach to review energy, water, waste, and transportation activities; and providing mutual support to reduce waste, inefficiency, and environmental impact. The effort has resulted in measurable progress.

Local governments that have funded programs include Kansas City, Missouri; Rockland County, New York; Philadelphia, Pennsylvania; Columbus, Ohio; and Madison, Wisconsin.

Santa Monica, California has invested $80,000 a year in a residential green team program and has started a business pilot program as well. The program has involved 124 teams and 840 individuals. The City reported the following results in 2001:

Green actions completed
23

Waste diverted
2420 lbs per person

Toxic household chemicals replaced or eliminated
4.5 per person

CO_2 emission reduction
2,777.6 lbs per person

Annual driving miles reduced
1,327 miles per person

Annual water savings
1,302 gallons per person

Outreach to Residents

Investigate the possibility of sponsoring a green team project to engage residents in sustainable household practices. Santa Monica, California and Madison, Wisconsin have initiated such programs.

- Work with NSTAR to develop effective community awareness about energy conservation services.
- Develop displays and informational materials and take every opportunity to have a presence at community events.
- Celebrate resident efforts through a public recognition program.
- Create a comprehensive environmental citizens' guide that has both general guidelines and Cambridge-specific information (e.g., how to obtain energy services; where to buy Massachusetts-grown food, both at stores and at restaurants; where the nearest environmentally sound dry cleaners are; how to dispose of old appliances). The major focus should be on the most important actions. This could be circulated both in print and on the City website.

Appendices

Appendix I

CCM-101

City of Cambridge

Agenda Item #1

IN CITY COUNCIL

May 24, 1999

WHEREAS: Based on scientific evidence that carbon dioxide (CO_2) and other greenhouse gases (ghg) released into the atmosphere are having a profound effect on the Earth's climate, the United States joined with 160 countries and signed the United Nations Framework Convention on Climate Change which calls on nations to reduce greenhouse gas emissions; and

WHEREAS: Energy consumption, specifically the burning of fossil fuels, e.g. coal, oil and gas, accounts for more than 85% of U.S. greenhouse gas emissions; and

WHEREAS: Local governments greatly influence their community's energy usage by exercising key powers over land use, transportation, building construction, waste management, and, in many cases, energy supply and management; and

WHEREAS: Local government actions taken to reduce greenhouse gas emissions and increase energy efficiency provide multiple local benefits by decreasing air pollution, creating jobs, reducing energy expenditures, and saving money for the City government, its businesses and its citizens; and

WHEREAS: The Cities for Climate Protection Campaign, sponsored by the International Council for Local Environmental Initiatives and the U.S. Environmental Protection Agency, has invited the City of Cambridge to become a partner in the Campaign;

RESOLVED: That the Cambridge City Council hereby resolves that the City of Cambridge pledges to join with jurisdictions from all over the world in the Cities for Climate Protection Campaign and, as a participant in the Cities for Climate Protection Campaign, Cambridge pledges to:

1. Take a leadership role in increasing energy efficiency and reducing greenhouse gas emissions from municipal operations;

2. Develop and implement a local action plan which describes steps Cambridge will take to reduce both greenhouse gas and air pollution emissions; the plan will include:

   - a greenhouse gas emissions analysis and forecast to determine the source and quantity of ghg emissions within the City;
   - A CO_2 or green house gas emission reduction target;
   - The strategy for meeting the City's ghg reduction target.

In City Council May 24, 1999.
Adopted by the affirmative vote of eight members.
Attest:- D. Margaret Drury, City Clerk.

A true copy;

ATTEST:-

D. Margaret Drury

D. Margaret Drury
City Clerk

Appendix 11: Climate Protection Task Force Guiding Principles

The work of the Cambridge Climate Protection Task Force is conducted under a set of guiding principles. The guidelines were drafted at the outset of the Task Force's work and are to be adapted based on the work and discussions of the task force and its subcommittees with various stakeholders invited into the process.

The Principles serve three main functions:

1) ***Common framework***—as a common framework within which the Task Force and each of its subcommittees conducts their work;

2) ***Linkage to other community goals and efforts***—as an imperative for the Task Force to link any proposed action to reduce the city's greenhouse gas emissions with other goals and strategies previously identified to maintain and enhance the quality of life in Cambridge; and

3) ***Guide for readers***—as a guide for the readers of the action plan to better understand the choices, preferences and priorities given to various actions and strategies from among a broader set of possible choices.

As·cend—*1. to go up, move upward, rise; 2. to proceed from a lower to a higher level; 3. to lead upward; 4. to succeed to (a throne)*
Webster's New World Dictionary

Achieve Real Reductions in Greenhouse Gas Emissions and Total Fossil Fuel Use

1. ***Create immediate results***—To begin reducing greenhouse gas (GHG) emissions quickly, actions likely to yield the most immediate results shall be given priority. By harvesting the "low-hanging fruit" first, the community and its various sectors can begin to achieve successes and build a foundation for more complex actions.

2. ***Biggest polluters first***—To achieve the greatest reductions, sectors and actions producing the greatest amount of GHG shall be given priority when examining reduction opportunities for the community.

3. ***Short-term feasibility***—To increase the acceptability and to facilitate the implementation of measures, those actions with the greatest short-term feasibility shall be given priority without diminishing the need to pursue measures that require long-term effort.

4. ***Public-private partnerships***—Public-private partnerships shall be sought to accomplish emission reduction goals wherever possible and useful.

5. ***Wider application of best practices***—In other communities, including ICLEI participants, a range of "best practices" are already being implemented that reduce greenhouse gas emissions. These best practices, measures and programs shall be adapted for Cambridge wherever feasible. Existing best practices in Cambridge which provide greenhouse gas reduction benefits shall be assessed for broader application.

6. ***Incentive-based approaches***—To increase the feasibility, acceptability, and adoption of proposed actions, incentive-based approaches shall be given preference over rule-based approaches (including possible changes to the city building code, zoning ordinance, land use plan, etc.); although neither approach shall be excluded from consideration.

7. ***Assurance of accountability***—To assure implementation of measures, actions that can be monitored and accounted for shall be given preference. Suggested actions and strategies should include a specification of indicators or measures of success to facilitate accountability.

8. ***Behavior change***—To truly reduce Cambridge's total GHG emissions, everyone in the community needs to be involved in the emission reduction effort. Awareness raising and education that every person's behavior has an impact shall be integral to the suite of proposed actions.

Strive for equitable outcomes

1. ***Affordability***—To improve the political and financial feasibility of measures, proposed actions shall be examined as to their economic affordability across sectors and socioeconomic classes. Costs and benefits for various sectors/parties/individuals shall be quantified to the extent possible.

2. ***Reduce social disparities***—To avoid creation or enhancement of inequity throughout our community, actions likely to reduce existing social disparities shall be given preference. At the very least, no proposed action shall entrench social inequities further.

Create and assure multiple benefits

1. ***Quality of life***—To increase the acceptability of proposed measures, actions enhancing the quality of life in Cambridge shall be given preference.

2. ***Avoid negative environmental consequences***—To avoid or hedge against unintended consequences, any proposed action shall be examined for potential negative environmental consequences. The Task Force will seek to achieve multiple environmental goals (e.g., air quality enhancement, water conservation, water quality improvement, habitat creation, waste reduction).

3. ***Avoid negative social consequences***—To avoid unintended social consequences, any proposed action shall be examined for potential negative social, cultural, or aesthetic consequences, and preferably achieve multiple social goals (e.g., improve neighborhood image, produce public meeting places, assure public safety and health).

4. ***Enhanced coping ability***—Based on the scientifically supported understanding that some climate change is inevitable even if worldwide GHG emissions were to be reduced immediately, the actions proposed to mitigate climate change (i.e., reduce GHG emissions) should be examined

as to their feasibility under changed climate conditions. Those actions that also provide benefits in light of adaptation (coping with climate changes), shall be given preference. Mitigation actions taken should not hinder the city's ability to cope with future climate changes.

5. ***Sustainable development and growth***—The Task Force aims to promote environmentally and socially sustainable development, and thus, to redefine the meaning of development and growth for Cambridge.

Engage in a participatory process

1. ***Stakeholder involvement***—Experience shows that programs built on a broad base of supporters are more successful than exclusively top-down approaches. To begin building this broad support, the Task Force and its sub committees will involve stakeholders, i.e., key leaders from the community, key players in various sectors/industries, and all city departments, in its work.

2. ***Community-wide implementation***—The implementation of the action plan should involve the entire community. The reduction of GHG emissions should become a community-wide project integral to everything else the city and its residents do.

3. ***Diversity***—During the planning and implementation processes, all members of the community shall be engaged to assure participation from people of different faiths, race, lifestyle, gender, class etc.

4. ***Building on strengths***—Bank on the institutional and professional strengths and skills available throughout the community (e.g., in universities, existing neighborhood groups, churches etc.).

Nourish and leverage leadership

1. ***Promotion of individual leaders***—The Task Force understands that leadership is critical to achieving its goals. Existing programs and actions producing GHG emission reductions and the people who initiate or execute them shall be championed as models to the community, and wherever the potential exists, novel leadership shall be promoted in the action plan.

2. ***Opportunities and constraints assessment***—The Task Force will look beyond the boundaries of the City for opportunities and constraints on the action plan (e.g., in state or federal programs and legislation). All actions should be strategically examined in the broader context of programs or institutions that may affect their adoption.

3. ***Become a model community***—Through the combined efforts of this Task Force, Cambridge's community leaders and its residents, we strive to make Cambridge a model community and leader on GHG reductions and sustainable, livable community design in the state.

Develop a long-term commitment

1. ***Recognition of long-term problem***—Climate change is a long-term global problem and cannot be solved by one community alone, nor through any short-term action plan. The nature of the problem demands a long-term commitment on behalf of the city government, the business community, educational institutions, and individuals.

2. ***Adaptive, learning-oriented approach***—Measures and actions to be adopted should be designed in such a way to be flexible and adaptable as new knowledge, needs or opportunities arise. An explicitly adaptive and learning-oriented process (which includes periodic review of outcomes and adjustments if necessary) will increase the likelihood that problems are identified in the early stages, and appropriate changes are made in a timely and effective manner. An adaptive approach also helps to address unfore seen and unintended consequences, should they manifest at some point.

3. ***Commitment of city leaders and departments***—The community leadership and city departments will be most effective as leaders and models to the rest of the community, if they commit through words and actions to a long-term engagement on the climate problem. GHG emission abatement should become a normal consideration in all of the community's decisions and operations.

4. ***Commitment of educational institutions***—To build support for climate mitigation actions, the City's diverse educational institutions have a special responsibility to facilitate a greater understanding for the complex impacts our everyday activities have on the local and global environment. Programs and actions that promote education at all levels about climate change and its connections to other environmental challenges and community activities shall be promoted through this action plan.

5. ***Public outreach and constituency building***—While it is beyond the scope and abilities of the Task Force to launch a major public relations campaign in support of the city's commitment to climate mitigation, some public outreach and constituency building during and after the work of the Task Force on issues related to climate change and sustainable development is essential. The development of the action plan, as well as its acceptability once finished, is likely to be much enhanced through some degree of public involvement.

Appendix III: Proposed Actions By Sector

Actions that involve more than one sector are listed under each sector.

G=City government
B=Business community
I=Institutions
R=Residents

CITY GOVERNMENT

Energy

Short-term

- Establish a municipal working group on energy management with representatives from the public works, electrical, school, library, community development, and other departments to track energy use in City buildings. Based on the data, set a municipal goal on reducing energy use. [G]
- Replace incandescent traffic signals with light emitting diode (LED) lights, which are 80 to 90% more efficient and rated to last 100,000 hours compared to 8,000 hours for incandescents. Take advantage of available utility rebates. [G]
- Recruit businesses and organizations into the federal Energy Star program with the goal of reducing energy use. Utilize pledges, peer exchanges, and public recognition programs to sustain involvement. [G,B,I]
- Work with local stores to promote Energy Star products and educate consumers about the Energy Star label. [G,B]
- Organize "green teams" to promote household practices that reduce GHG emissions. [G,R]
- Organize "green teams" within City departments to promote more sustainable practices in municipal operations. [G]
- Publicize utility energy efficiency programs. [B,G]
- Promote the use of ESCOs and performance contracting, where appropriate, to facilitate energy efficiency improvements when initial financial costs are a barrier. [B,I,G]
- Implement a City purchasing policy favoring Energy Star products. [G]
- Explore options to increase efficiency of City street lighting. [G]
- Assess condition of existing buildings to understand the inefficiencies prevalent in the building stock and design appropriate programs to increase efficiency. [G]

- Evaluate possible green power purchasing options. [G,B,I,R]
- Join Solar Boston, a partnership of the U.S. Department of Energy, solar energy businesses, and local community organizations, to promote and facilitate solar energy installations. [G]
- Pursue funding of solar energy installations through the Massachusetts Renewable Energy Trust. [B,G,I]

Medium-term

- Implement an energy management program for municipal facilities to evaluate use patterns, identify opportunities for energy efficiency improvements and renewable energy installations, pursue utility and other outside funding sources, manage contract work, and evaluate options for the energy supply. Consider establishment of an energy management position. [G]
- Install solar energy and other renewable energy systems on City facilities. [G]
- Integrate energy efficiency upgrades and renewable energy installations into the City capital planning process. [G]
- Support state action including a strong Renewable Portfolio Standard and implementation of the Clean Air Act regulations on older power plants. [G,R]
- Develop funding sources for solar energy installations in partnership with NSTAR to address system bottlenecks and RPS requirements. [B,G]
- Develop one or more projects with schools to install solar energy systems and conduct associated classroom activities. [G]
- Extend the steam distribution system to the North Point area, which is slated for development. [B,G]

Long-term

- Support federal action on lowering power plant emissions of CO_2 and conventional air pollutants. [G,R]

Transportation

Short-term

- Expand City outreach to businesses to increase participation in voluntary PTDM programs. [G,B]
- Expand incentives and increase participation in the City TDM program for municipal employees. [G]
- Expand the pedestrian program to further improve intersections and increase year-round sidewalk maintenance, provide public restroom access and benches, and make aesthetic improvements, e.g., trees, flowers, buildings with windows, fences that are low and transparent. [G,B,I,R]
- Install additional bicycle parking and look for new opportunities to install bicycle lanes or guidelines and improve intersections for cyclists. [G]
- Install signs with schedule and route information at bus stops in Cambridge. [G]
- Install shelters or benches at busy bus stops where there is room on the sidewalk. [G]
- Investigate traffic measures to expedite bus travel. [G]
- Continue to develop and distribute promotional material and hold promotional events. [G]
- Continue the work of Cambridge Walks, including Walk your Child to School Day. [G,B]
- Work with community groups to promote walking and biking for health. [G,R]
- Adopt a City green fleets policy that incorporates energy efficiency criteria for acquiring municipal vehicles, including sizing of vehicles appropriate to their tasks, giving preferences to alternative fuels and hybrid vehicles where possible and promotion of using the smallest vehicle necessary for jobs (including City bikes). [G]
- Establish a municipal work group to coordinate implementation of alternative fuel vehicle acquisition and infrastructure installation. [G]
- Provide a program on driving and maintenance practices that reduce fuel use and emissions for employees who use City vehicles and for the community. [G]
- Publicize the health and environmental costs of motor vehicle emissions. [G,I]
- Reduce the number of nonresident citywide stickers. [G]

Short and medium-term

- Lobby for additional federal and state transit funding. [G,B,I,R]
- Work with other communities to create new MBTA services, including an Orange Line stop at Assembly Square, Somerville; a Green Line extension from Lechmere to Medford, and the Urban Ring line. [G,B,I,R]
- Lobby for low-emissions buses. [G,B,I,R]
- Encourage state and federal elected officials to shift federal funds from high ways to transit. [G,B,I,R]

Medium-term

- Monitor results of PTDM program and investigate increasing the requirements. [G]
- Investigate lowering further the minimum parking standards for new development, especially near T stations. [G]
- Create and improve off-road bicycle and pedestrian paths, e.g., a new path along the Grand Junction railroad right-of-way, improvements along the Charles River, and paths connecting to Belmont and Watertown. [G]
- Establish a "walking bus" program in 3 schools. [G,R]
- Undertake an anti-idling campaign, with education and enforcement. [G,B,R]
- Work with the city's congressional delegation to advocate for higher CAFE standards. [G,R]
- Work with state agencies to more closely tie vehicle insurance costs to vehicle miles traveled. [G,R]
- Develop stickers on tire pressure for optimum energy efficiency to install at service station air pumps. [G,B]

Long-term

- Investigate possible shared-use very low-speed neighborhood streets. [G]
- Establish infrastructure for alternative fuel vehicles, including a CNG fueling station for City vehicles; free public access refueling stations, partly solar-powered, for electric vehicles; and reserved spaces for zero emission vehicles and low emission vehicles in municipal garages and parking lots. [G, B]
- Install emission controls on heavy-duty City trucks and construction vehicles; investigate requiring emissions mechanicals on trucks doing business with the City. [G]

- Investigate possible programs to encourage taxis to switch to CNG. [G,B]
- Link parking sticker fees to engine size and put a cap on the tonnage of vehicles eligible for residential parking permits. Increase fees for second, third cars. [G]
- Establish a parking maximum for residential units. [G]
- Study possible creation of neighborhood-zoned parking. [G]
- Encourage federal and state officials to begin planning an interstate transportation system that does not include large trucks on roadways other than limited access highways. [G,B,I,R]

Land Use, Buildings, and Vegetation Management

Short-term

- Through zoning, continue to encourage pedestrian-scaled mixed-use development, with residential infill throughout the city. Strengthen orientation toward denser development near public transportation. [G]
- Provide developers, citizens, and City staff with information to help them apply LEED standards. [G]
- Design and construct durable City buildings that use LEED principles and have flexible re-use options. [G,B,I,R]
- Conduct consistent open space review during the permitting process for development projects to incorporate public open space into project design. [G]
- Provide incentives for planting trees and creating additional green space open to the public as part of new development and major renovations. [G]
- Carry out the recommendations in the Green Ribbon Report. [G]
- Provide developers and property owners with information about using green roofs or high reflectance roofs on buildings and other reflectance and shading techniques. [G]
- Use GIS or other computer imaging, such as the CITYgreen software developed by American Forests, to accurately determine current canopy cover, assess environmental benefits, and plan plantings. [G]
- Increase public education efforts on stormwater management practices, especially those that complement GHG emission reductions. [G]

Medium-term

- Develop green standards for renovation of City-owned properties. Utilize the City energy management workgroup to coordinate department implementation. [G]
- Strengthen zoning incentives to include LEED in project review and Planned Unit Development (PUD) processes. [G]
- Reuse materials from existing structures during renovation or redevelopment projects (See LEED Materials Credit 1). [G,I,B,R]
- Work with legislators and other public officials toward creating a regional land use plan with teeth. [G,R,I,B]
- Develop and carry out policies and programs to maximize the tree canopy cover, with special attention to parking lots and other heat-absorbing locations, and to shading air-conditioning units. This should include attention to soils, water retention, and appropriate species. [G,B,I,R]
- Reuse materials from existing structures during renovation or redevelopment projects (See LEED Materials Credit 1). [G,I,B,R]
- Provide incentives for new construction and renovations to meet LEED standards for reflectance and shading. [G]
- Incorporate LEED standards for reflectance and shading in all City and private parking lots and in new construction and major renovations. [G,B,I,R]

Waste Management

Short-term

- Implement a waste prevention program for City government. [G]
- Carry out projects to increase participation in existing recycling programs using community-based social marketing techniques, starting with a pilot project. (See Section 8 for a description of community-based social marketing.) [G]
- Facilitate construction and demolition waste recycling. Help contractors prepare for 2003 state ban on disposal of construction and demolition waste by requiring a construction and demolition debris recycling plan as a condition of receiving a building permit. [G]

Medium-term

- Conduct waste composition studies every two years to develop information about which new portions of the waste stream to target for recycling or reduction and to evaluate the success of the current program. Include all sectors of the community across all seasons of the year. [G]
- Expand electronics recycling to include printers and other computer peripherals, as well as old phones, VCRs, stereos, and other electronic equipment. [G,B]

Medium and Long-term

- Promote waste prevention measures in the commercial and residential sectors. [B,I,G]

Long-term

- Develop a program to ensure that commercial waste paper is being recycled. The program should be based on a monitoring program and application of the Recycling Ordinance requirements. [G,B]
- Facilitate commercial food waste collection in anticipation of a state ban on food waste disposal that should go into effect soon under the Solid Waste Master Plan. Identify appropriate disposal facilities. [G,B,I]
- Conduct a thorough composition study of the residential waste stream to assess the feasibility of a residential food waste collection program. Picking up food waste, yard waste, and cardboard in the same packer trucks should be considered. [G]
- Develop a program to pick up used clothing for recycling at the curb. [G]
- Reevaluate the City's system for tracking recycled and non-recycled paper and plastic purchases to ensure accurate recording of the quantities purchased and set goals for increasing the percentage. Work with the school department to accomplish the same steps. [G]
- Work with stores to develop and use point-of-sale reminders to customers to purchase recycled products. [G,B]

BUSINESS SECTOR

Energy

Short-term

- Take advantage of available utility rebates. Join the federal Energy Star program with the goal of reducing energy use. Take advantage of pledges, peer exchanges, and public recognition programs to sustain involvement. [G,B,I]
- Promote Energy Star products in local stores and educate consumers about the Energy Star label. [G,B]
- Publicize utility energy efficiency programs. [B,G]
- Use ESCOs and performance contracting, where appropriate, to facilitate energy efficiency improvements when initial financial costs are a barrier. [B,I,G]
- Evaluate feasibility of purchasing green power. [G,B,I,R]
- Install renewable energy systems and fuel cells. [G,B,I,R]
- Pursue funding of solar energy installations through the Massachusetts Renewable Energy Trust. [B,G,I]

Medium-term

- Connect to the East Cambridge steam system and increase annual steam use by 200 million pounds. [B]
- Extend the steam distribution system to the North Point area, which is slated for development. [B,G]
- Develop funding sources for solar energy installations in partnership with NSTAR to address system bottlenecks and RPS requirements. [B,G]

Transportation

Short-term

- Undertake or continue aggressive TDM measures and monitor the results. [G,B,I]
- Expand the pedestrian program to further improve intersections and increase year-round sidewalk maintenance, provide public restroom access and benches, and make aesthetic improvements, e.g., trees, flowers, buildings with windows, fences that are low and transparent. [G,B,I,R]

- Promote the work of Cambridge Walks, including Walk your Child to School Day. [G,B]
- When giving directions to businesses, events, and institutions, include directions by T. [G,B,I]

Short and medium-term

- Lobby for additional federal and state transit funding. [G,B,I,R]
- Work with other communities to create new MBTA services, including an Orange Line stop at Assembly Square, Somerville; a Green Line extension from Lechmere to Medford, and the Urban Ring line. [G,B,I,R]
- Lobby for low-emissions buses. [G,B,I,R]
- Encourage state and federal elected officials to shift federal funds from high ways to transit. [G,B,I,R]

Medium-term

- Continue aggressive TDM measures and monitoring. [G,I,B]
- Consider creating a bicycle commuter station. [B]
- Publicize proximity to transit as a reason to shop in local stores, distribute free subway tokens to customers where parking vouchers are provided, and offer discounts to cyclists. [B]
- Make sure vehicles engaged in business do not idle unnecessarily. [G,B,I]
- Develop stickers on tire pressure for optimum energy efficiency to install at service station air pumps. [G,B]

Long-term

- Examine the feasibility and logistics of establishing a citywide bicycle-sharing program. [B]
- Establish car-free celebrations in Cambridge. [B,R]
- Establish infrastructure for alternative fuel vehicles, including a CNG fueling station; free public access refueling stations, partly solar-powered, for electric vehicles; and reserved spaces for zero emissions vehicles and low emission vehicles in garages and parking lots. [G,B]
- Investigate possible programs to encourage taxis to switch to CNG. [G,B]
- Encourage federal and state officials to begin planning an interstate transportation system that does not include large trucks on roadways other than limited access highways. [G,B,I,R]

Land Use, Buildings, and Vegetation Management

Short-term

- Design and construct durable buildings based on LEED principles with flexible re-use options. [G,I,B,R]

Medium-term

- Create appealing small-scale public gathering spaces with well-adapted vegetation as part of development and redevelopment projects. [B,I]
- Reuse materials from existing structures during renovation or redevelopment projects (See LEED Materials Credit 1). [G,I,B,R]
- Work with legislators and other public officials toward creating a regional land use plan with teeth. [G,R,I,B]
- Develop and carry out policies and programs to maximize the tree canopy cover, with special attention to parking lots and other heat-absorbing locations, and to shading air-conditioning units. This should include attention to soils, water retention, and appropriate species. [G,B,I,R]

Medium and long-term

- Incorporate LEED standards for reflectance and shading in all parking lots and in new construction and major renovations. [G,B,I,R]

Waste Management

Medium-term

- Work with the City to develop and carry out a program to ensure that commercial waste paper is being recycled. [G,B]
- Work with the City to facilitate commercial food waste collection in anticipation of a state ban on food waste disposal that should go into effect soon under the Solid Waste Master Plan. [G,B,I]
- Work with the City to develop and use point-of-sale reminders to retail customers to purchase recycled products. [G,B]

Medium and long-term

- Promote and carry out waste prevention measures. [B,I,G,R]
- Expand electronics recycling to include printers and other computer peripherals, as well as old phones, VCRs, stereos, and other electronic equipment. [G,B]

INSTITUTIONS

Energy

Short-term

- Take advantage of available utility rebates. Take part in the federal Energy Star program with the goal of reducing energy use. Take advantage of pledges, peer exchanges, and public recognition programs to sustain involvement. [G,B,I]
- Use ESCOs and performance contracting, where appropriate, to facilitate energy efficiency improvements when initial financial costs are a barrier. [B,I,G]
- Look for green power purchasing options. [G,B,I,R]
- Install renewable energy systems and fuel cells. [G,B,I,R]
- Pursue funding of solar energy installations through the Massachusetts Renewable Energy Trust. [B,G,I]

Transportation

Short-term

- Undertake or continue aggressive TDM measures and monitor the results. [G,B,I]
- Expand the pedestrian program to further improve intersections and increase year-round sidewalk maintenance, provide public restroom access and benches, and make aesthetic improvements, e.g., trees, flowers, buildings with windows, fences that are low and transparent. [G,B,I,R]
- When giving directions to events, include directions by T. [G,BI]
- Publicize the health and environmental costs of motor vehicle emissions. [G,I]

Medium-term

- Make sure vehicles engaged in university business do not idle unnecessarily. [G,B,I]

Short and medium-term

- Lobby for additional federal and state transit funding. [G,B,I,R]
- Work with other communities to create new MBTA services, including an Orange Line stop at Assembly Square, Somerville; a Green Line extension from Lechmere to Medford; and the Urban Ring line. [G,B,I,R]

- Lobby for low-emissions buses. [G,B,I,R]
- Encourage state and federal elected officials to shift federal funds from high ways to transit. [G,B,I,R]

Long-term

- Encourage federal and state officials to begin planning an interstate transportation system that does not include large trucks on roadways other than limited access highways. [G,B,I,R]

Land Use, Buildings, and Vegetation Management

Short-term

- Design and construct durable buildings that incorporate LEED principles and have flexible re-use options. [G,I,B,R]

Medium-term

- Create appealing small-scale public gathering spaces with well-adapted vegetation as part of development and redevelopment projects. [B,I]
- Reuse materials from existing structures during renovation or redevelopment projects (See LEED Materials Credit 1). [G,I,B,R]
- Work with legislators and other public officials toward creating a regional land use plan with teeth. [G,R,I,B]
- Work with legislators and other public officials toward creating a regional land use plan with teeth. [G,R,I,B]
- Develop and carry out policies and programs to maximize the tree canopy cover, with special attention to parking lots and other heat-absorbing locations, and to shading air-conditioning units. This should include attention to soils, water retention, and appropriate species. [G,B,I,R]
- Incorporate LEED standards for reflectance and shading in parking lots and in new construction and major renovations. [G,B,I,R]

Waste Management

Medium-term

- Implement and promote waste prevention measures. [B,I,G]
- Undertake or continue commercial food waste collection in preparation for a state ban on food waste disposal that should go into effect soon under the Solid Waste Master Plan. [G,B,I]

RESIDENTS

Energy

Short-term

- Organize "green teams" to promote household practices that reduce GHG emissions. [R,G]
- Support state action including a strong Renewable Portfolio Standard and implementation of the Clean Air Act regulations on older power plants. [G,R]
- Support federal action on lowering power plant emissions of CO2 and conventional air pollutants. [G,R]
- Participate in utility programs to reduce energy use. Take advantage of available utility rebates. [G,B,I,R]

Medium-term

- Take advantage of green power purchasing options where feasible. [G, B,I,R]
- Install renewable energy systems and fuel cells. [G,B,I,R]

Transportation

Short-term

- If driving alone to work, discuss with employer ways to make it easier to ride-share, take transit, walk, or bike. [R]
- Support the City's bicycle and pedestrian programs. [G,B,I,R]
- Work with community groups to promote walking and biking for health. [G, R]

Short and medium-term

- Lobby for additional federal and state transit funding. [G,B,I,R]
- Work with other communities to create new MBTA services, including an Orange Line stop at Assembly Square, Somerville; a Green Line extension from Lechmere to Medford, and the Urban Ring line. [G,B,I,R]
- Lobby for low-emissions buses. [G,B,I,R]
- Encourage state and federal elected officials to shift federal funds from high ways to transit. [G,B,I,R]

Medium-term

- Establish a "walking bus" program in 3 schools. [G,R]
- Participate in an anti-idling campaign. Do education about idling through signs, targeted mailings to schools, parents, bus companies, shipping destinations. [G, R]
- Work with the city's congressional delegation to advocate for higher CAFE standards. [G,R]
- Work with state agencies to develop a system to more closely tie vehicle insurance costs to vehicle miles traveled. [G,R]

Long-term

- Establish car-free celebrations in Cambridge. [B,R]
- Switch to alternative fuel and minimum-sized vehicles. [R]
- Encourage federal and state officials to begin planning an interstate transportation system that does not include large trucks on roadways other than limited access highways. [G,B,I,R]

Land Use, Buildings, and Vegetation Management

Short-term

- Design and construct durable buildings that meet LEED standards and have flexible re-use options. [G,I,B,R]

Medium-term

- Reuse materials from existing structures during renovation or redevelopment projects (See LEED Materials Credit 1). [G,I,B,R]
- Become involved in regional land use planning activities. [G,B,I,R]
- Incorporate LEED standards for reflectance and shading in all City and private parking lots and in new construction and major renovations. [G,B,I,R]

Waste Management

Short-term

- Initiate and support waste prevention measures in the residential and other sectors. [G,B,I,R]