

Town of Arlington, Massachusetts

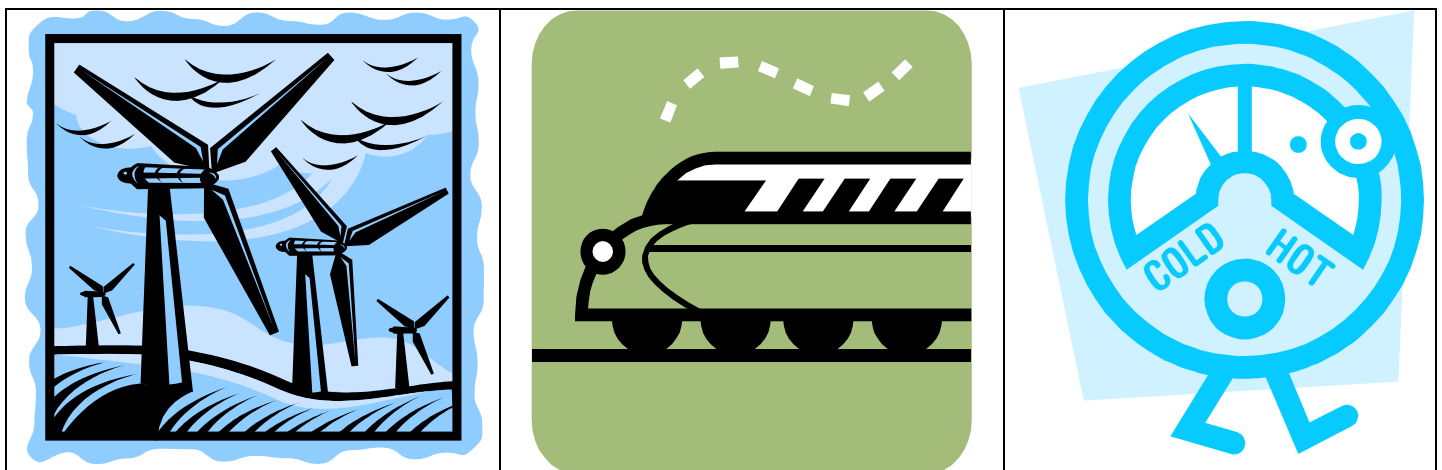


Arlington Sustainability Action Plan

Volume 1: Climate Action Plan

How the Arlington Community can do its part to improve air quality and the global climate by reducing CO₂ emissions

May 2005



Arlington Sustainability Action Plan

May 2005

Prepared by: Jessica Erickson, Benjamin Lee, Tara Santimauro, and Sinan Seyhun in cooperation with Sustainable Arlington members Marc Breslow, Ryan Katofsky, Michael Roach, and Maria Simoneau.

Acknowledgements

Arlington Board of Selectmen:

Kevin Greeley, Liason to Sustainable Arlington
John Hurd, Chairman
Kathleen Kiely Dias, Vice Chairman
Annie Lacourt
Diane Mahon

Sustainable Arlington:

Peter Allison
Marc Breslow, Ph.D., Director, Mass. Climate Action Network
Gene Benson
Chris Granda
Sarah Hill
Ryan Katofsky, Associate Director, Energy Practice, Navigant Consulting, Inc.
Jim Marzilli
Mick Rickwood
Michael Roach, Lexington Energy Partners
Maria Simoneau
Lisa Weil
Tim Woolf

Arlington Town Employees:

Jack Collins, Menotomy Weatherization
Domenic Lanzillotti, Purchasing Officer
Kevin O'Brien, Planning Director
John Sanchez, Head of the Department of Public Works
Brian Sullivan, Town Manager
Richard Vallerelli, Building Inspector

Arlington Transportation Advisory Committee:

Elisabeth Carr Jones, Scott Smith, and Ed Starr

Arlington Bicycle Advisory Committee:

Jack Johnson

Tufts University:

Jessica Erickson
John Larsen
Benjamin Lee
Molly Mead
Rusty Russell
Tara Santimauro
Sinan Seyhun
Kelley Whitmore

Executive Summary



10 Percent by 2010, 20 Percent by 2020

Recognizing that its own greenhouse gas emissions had a negative impact on the global environment, Arlington became a part of the Cities for Climate Protection Campaign (CCP) in May 2000. By joining this campaign, the Board of Selectmen declared Arlington's commitment to reduce its contribution to climate change and to developing a climate action plan. As part of Arlington's Sustainable Action Plan, Sustainable Arlington is proposing that the commitment the Town makes is to reduce its carbon dioxide emissions by 10 percent by 2010 and 20 percent by 2020. In order realize the vision of a more healthy and vibrant future, this document outlines pertinent information regarding necessary steps for the implementation of these realistic goals.

ENERGY EFFICIENCY

Background

Arlington has ample opportunity to become more energy efficient that will facilitate saving money while at the same time benefiting the environment. The residential, municipal, and commercial sectors all can utilize modern efficient technologies and practices that can reduce the amount of energy needed to provide necessary services. By minimizing our impact through efficiency, innovation, and creativity, we can create a more vibrant and healthy community. Utilizing thoughtful planning tools and forward-thinking public policy, the triple bottom line for creating sustainable communities can be achieved—a sound economy, a healthy environment, and social equity. The beginnings of such alternatives that produce these positive results are now being realized in Arlington.

Energy in Arlington is generated by fossil fuels that contribute to poor air quality and climate change. A 1997 Greenhouse Gas Emission Survey found that the town of Arlington produced a total of 335,063 tons of carbon dioxide. In order to meet the goal of reducing emissions 10 percent below 1997 levels by 2010, and 20% reductions by 2020, it is necessary for Arlington to promote significant energy efficiency measures. Examples include changing out old inefficient appliances, the use of efficient light bulbs, and increasing insulation.

When the Board of Selectmen when chose to join the Cities for Climate Protection Campaign, they committed to reducing emissions. This document contains suggestions that can greatly reduce emission levels, *while saving the Town, residents, and businesses money.*

Existing Measures

Arlington already saves an annual \$130,000 due to the streetlight and stoplight efficiency retrofits completed in July 2004. This is equivalent to 1,220,000 kilowatt hours, 875 tons of carbon dioxide, and is enough electricity to power 137 families in Arlington. In addition, approximately \$9,175 is saved annually due to the 2003 Robbins Library efficiency retrofits.

The town already has commitments and programs in place. At Town Meeting in May 2003, Arlington passed Sustainable Arlington's proposal that established the goal of LEED (Leadership in Energy and Environmental Design) silver certification for new and substantial renovations of town-owned buildings. Further, programs to increase efficiency already exist for the Arlington community, such as the Arlington Home Rehabilitation Program, and the Menotomy Weatherization Service.

Key Recommendations

- Establish a Sustainability Program Manager position, funded by current savings due to the energy efficient streetlights/stoplights (See section 2.4.2 for detailed responsibilities)
- Establish an Energy Management Work Group, modeled after the existing inter-departmental group in Cambridge, MA, whose goal is to conduct an emissions inventory, evaluate the performance of city-owned facilities, and identify and implement energy efficiency measures. The Sustainability Program Manager would oversee this group
- Create SustainArlington.org. Provide an information clearinghouse on current rebates and opportunities available to the Arlington community to increase participation in energy efficiency programs. This would include a regularly updated, and heavily marketed website—SustainArlington.org, as described in detail in Chapter 5
- Have all municipal buildings and energy consuming activities undergo a comprehensive energy efficiency audit

ENERGY SOURCING

Background

The Arlington community has great opportunity to reduce its greenhouse gas emissions at the source by utilizing renewable energy sources. ‘Clean power’ or ‘clean electricity’ is generated through the use of renewable sources and not from the burning of fossil fuels. Therefore, it does not produce greenhouse gases and releases less smog-forming (NO_x), acid rain-forming (SO₂) pollutants, carbon dioxide (CO₂) and particulate emissions. The Town can utilize renewable energy either by installing renewable energy applications or by purchasing clean power.

Presently, residential and commercial structures are the major contributors to the town’s CO₂ emissions in terms of energy sourcing. Hence, the Town should give priority to the proposed ‘residential and commercial’ measures, especially clean power purchasing. Currently, clean power purchasing through renewable energy certificates seems to be the most cost effective method in reducing the CO₂ emissions resulting from electricity consumption in Arlington.

Existing Measures

Currently, the town of Arlington is installing a 2.6 kW photovoltaic system at Arlington High School with financial support from Massachusetts Technology Collaborative’s Solar to Market Initiative. Given the energy needs of the high school and the low energy output of the system, this is considered a Photo Voltaic (PV) system for educational purposes. It is strongly recommended that an appropriately sized PV installation be installed for the high school’s true energy requirements. As of January 31, 2005, there were 6 residential solar PV Systems installed with Massachusetts Renewable Energy Trust (MRET) funding in Arlington.

Arlington’s Board of Selectmen approved the installation of a meteorological tower within the town in order to gather data on wind speed and availability, during its meeting on February 28th, 2005. The data will be used to assess the feasibility of installing a wind turbine to generate clean power for domestic use and sale in the market.

At this time, the town of Arlington is not purchasing clean power. The Town currently has a contract with Trans Canada Power to supply electricity to the municipal buildings which will expire in September 2006. As of April 14, 2005, there are 14 households in Arlington that participate in the clean energy choice program to purchase clean power through the Massachusetts Energy Consumers Alliance.

Key Recommendations

- The Town should periodically investigate the opportunities for purchasing clean power from clean power marketers.
- The Town should continue to search for possible sites and funding opportunities to install a wind turbine in Arlington.
- The Town should make use of the available grants for the installation of PV systems on municipal buildings.
- The Town should undertake educational and promotional initiatives to encourage Arlington residents to purchase clean power and/or install clean power sources in order to offset the CO₂ emissions of their electricity consumption.

TRANSPORTATION

Background

Americans have become increasingly dependent on their vehicles for almost every trip that they make. In the past couple of years, the size of the vehicles on the road has increased and their efficiency has decreased. There is evidence of vehicle dependence even in Arlington among those residents that commute to work.

Transportation is a major contributor to the amount of carbon dioxide emissions that are released in Arlington each year. The Town of Arlington annually emits approximately 168,000 tons of carbon dioxide. In order to meet the goal of reducing emissions 10 percent below 1997 levels by 2010, it is necessary for Arlington to promote the use of alternate forms of transportation and to encourage residents to walk, bicycle, and carpool. By implementing the proposals outlined in this document, it is possible to reduce the emissions resulting from transportation by 34,200 tons per year. This would meet the goal passed by the Board of Selectmen when they chose to join the Cities for Climate Protection Campaign. If these programs were rigorously followed, this plan allows for an even greater amount of carbon dioxide reduction.

Existing Measures

Present measures to reduce the amount of carbon dioxide emitted include the procurement policy of fuel-efficient town vehicles, crosswalk improvement, programs generated by “Walking in Arlington,” and the Safe Routes to School program. The procurement policy of fuel-efficient town vehicles began as a result of Warrant 22, which requires Arlington to purchase motor vehicles that are the most fuel-efficient, reliable and practical model available to fulfill the intended municipal use. Carbon dioxide emissions are being reduced as each increasingly fuel-efficient vehicle substitutes for an older, less efficient model. Crosswalk improvements, programs by “Walking in Arlington” and the Safe Routes to School program all improve pedestrian safety. With improved pedestrian safety in Arlington, residents are able to use alternate forms of transportation and reduce their carbon dioxide contribution.

Key Recommendations

For a summary of the transportation recommendations, please refer to the table at the end of the Executive Summary. The full explanation of all the existing and proposed transportation measures can be found in Chapter 4.

- Arlington should encourage its residents to make more energy efficient choices when buying new vehicles. There is a substantial variation in the miles per gallon between models in the same vehicle class or between classes. If Arlington residents purchased more fuel efficient vehicles, there could be a savings of 336 tons of carbon dioxide per year.

- The Commonwealth of Massachusetts has mandated a 5-minute maximum idling time for vehicles. To be consistent with this state mandate, Arlington should implement a No-Idling Policy for municipal vehicles, school vehicles, and for parents dropping their children off at school.

COMMUNITY BASED SOCIAL MARKETING

The successful implementation of Arlington's Sustainability Action Plan (ASAP) is dependent upon support from the community. Community Based Social Marketing (CBSM) efforts will encourage residents, businesses, and municipal departments to reduce their greenhouse gas emissions (GHG) through a combination of energy efficiency, renewable energy, and transportation programs.

CBSM is built upon the belief that education and outreach are essential components of influencing sustainable behavior. For example, the use of compact fluorescent light bulbs (CFL's) can be encouraged when the benefits are conveyed, including energy cost savings, greenhouse gas emissions reduction, and the fact that some bulbs last up to seven years reduces the number of times that it is necessary to replace bulbs. A CBSM campaign that encourages CFL usage may include educational information along with a free sample bulb for residents to use in their homes. By educating consumers on the benefits and encouraging the behavior by providing a sample, CBSM can be proven to be results oriented.

Recommendations

The goal for Arlington's overall carbon dioxide emissions reduction plan is 10 percent from the 1997 level of 474,000 tons to the level of 426,000 tons by 2010, and by 20 percent to the level of 379,000 tons by 2020. This reduction will improve air quality and environmental health while reducing energy costs for residents, businesses, and town departments. Several recommended CBSM campaigns have been created to target these three sectors of Arlington's community, encouraging them to implement the changes necessary to reduce carbon dioxide emissions.

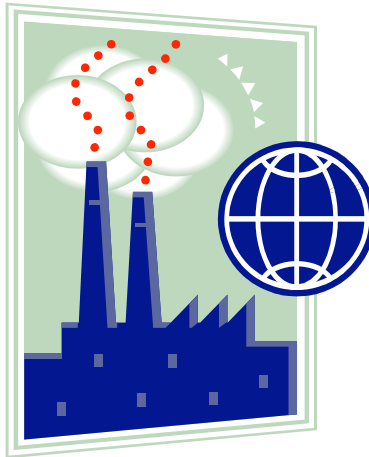
The development of the SustainArlington.org website will be instrumental in communicating opportunities for involvement in Arlington's sustainability initiative. The website will include information specific to Arlington's three target communities, including information for residents on low-interest loans available for energy efficient household remodeling, opportunities for businesses to purchase renewable energy credits, and information for alternative transportation.

The Arlington Alliance of Sustainable Businesses (AASB) is a CBSM recommendation designed to encourage participation in the ASAP by the business community. The central idea of the AASB is the development of a network of Arlington businesses that have implemented GHG reduction practices into their business plan. Participating businesses could be recognized through the Arlington Advocate newspaper, window placards if they have a storefront, and through the SustainArlington.org website.

An educational recommendation of CBSM includes a series of workshops for town employees, residents, and businesses, informing them of opportunities to adopt energy efficient practices, invest in renewable energy sources, and utilize alternative forms of transportation. Workshops, targeted to specific sectors of Arlington's community, will be designed to facilitate the implementation of the ASAP by identifying and acknowledging barriers to sustainability and using collective knowledge to create innovative solutions to overcome barriers.

Volume one of the ASAP is designed to help Arlington reduce its contribution to climate change, improve air quality and health, and reduce energy usage and costs within the Arlington community. The potential benefits are long-lasting as the Arlington community works together to address climate change, improve environmental conditions, save money, and build a healthy and strong community.

The following "Road Map to 10 percent by 2010 and 20 percent by 2020" describes the CO₂ reductions necessary for Arlington to begin to reach its goals set forth in this sustainability action plan.



10 percent by 2010 and . . .

Arlington's Total CO₂ emissions

1997 level: **473,540 tons**

10 % reduction: 47,354 tons

DESIRED 2010 level: 426,186 tons

**ARLINGTON'S ROAD MAP TO 2010:
CO₂ REDUCTION GOALS**

MUNICIPAL

1997 level: **19,003 tons**

10% reduction: 1,900 tons

Desired 2010 level: **17,103 tons**

COMMERCIAL BUILDINGS

1997 level: **72,888 tons**

10% reduction: 7,289 tons

Desired 2010 level: **65,599 tons**

RESIDENTIAL BUILDINGS

1997 level: **213,575 tons**

10% reduction: 21,358 tons

Desired 2010 level: **192,217 tons**

TRANSPORTATION

1997 level: **168,074 tons**

10% reduction: 16,807 tons

Desired 2010 level: **151,267 tons**

. . . 20 percent by 2020.

Arlington's Total CO₂ emissions

1997 level: **473,540 tons**

20 % reduction: 94,708 tons

DESIRED 2020 level: 378,832 tons

**ARLINGTON'S ROAD MAP TO 2020:
CO₂ REDUCTION GOALS**

MUNICIPAL

1997 level: **19,003 tons**

20% reduction: 3,801 tons

Desired 2020 level: **15,202 tons**

COMMERCIAL BUILDINGS

1997 level: **72,888 tons**

20% reduction: 14,578 tons

Desired 2020 level: **58,310 tons**

RESIDENTIAL BUILDINGS

1997 level: **213,575 tons**

20% reduction: 42,715 tons

Desired 2020 level: **170,860 tons**

TRANSPORTATION

1997 level: **168,074 tons**

20% reduction: 33,615 tons

Desired 2020 level: **134,459 tons**

Table 1. Emission reduction measures in the action plan

Measures	Status	Estimated Annual CO₂ Reduction (tons)
Energy Efficiency		
Municipal Measures		
Enforce existing building codes	Proposed	4.7
Enhance existing building codes	Proposed	17.1
Participate in green construction	Proposed	23.6
Purchase of Energy Star products	Proposed	8.5
Participate in audit program	Proposed	15.9
Efficient lighting retrofits (non streetlight)	Proposed	31.8
Residential Measures		
Participate in utility home audit program	Proposed	343
Enforce existing building codes		1
Enhance existing building codes	Proposed	1
Participate in Energy Star Homes	Proposed	1
Adopt weatherization measures	Proposed	11
Adopt efficient appliances	Proposed	57
Adopt efficient lighting measures	Proposed	485
Adopt boiler and programmable thermostat retrofits	Proposed	274
Commercial Measures		
Enforce existing building codes	Proposed	4.1
Enhance existing building codes	Proposed	14.7
Participate in green construction	Proposed	24
Participate in audit program	Proposed	204
Adopt boiler and programmable thermostat retrofits	Proposed	114
Energy Efficiency Total		1635.4
Energy Sourcing		
Municipal Measures		
Installation of a 200kW Wind Turbine in Arlington.	Proposed	186.0
Installation of PV Systems on Municipal Buildings.	Proposed	11.8
Town Demonstration House	Proposed	1.7
Purchase of Clean Electricity (Municipal)	Proposed	306.0
Become a “Solar Boston” Partner	Proposed	N/A
Residential and Commercial Measures		
Installation of PV Systems in Residential and Commercial Buildings	Proposed	293.0
Residential Use of Solar Hot Water Heating	Proposed	41.4
Purchase of Clean Electricity (Community)	Proposed	4890.0
Business Challenge Program	Proposed	N/A
Sustainable Arlington Website	Proposed	N/A
Energy Sourcing Total		5729.9

Transportation		
Municipal Measures		
Municipal No-Idling Policy	Proposed	27.4
Trip-Reduction Programs for Municipal Employees	Proposed	321.7
Police Units On Bicycle	Proposed	7.3
Converting DPW Fleet to Biodiesel	Proposed	95.4
State and Federal Funding	Proposed	N/A
Clean Cities Program	Proposed	N/A
Residential and Commercial Measures		
Federal Tax Incentive for Clean Fuel and Electric Vehicles	Proposed	N/A
Infrastructure Improvements for Bicycles	Proposed	16.7
Traffic Calming and Improvements in Pedestrian Safety	Proposed	163.1
Enforcement of Traffic Laws	Proposed	114.3
School Wide No Idling Policy	Proposed	95.9
Encourage Non Motorized Transport to School	Proposed	67.5
Need for More Crossing Guards	Proposed	16.4
Trip-Reduction Programs	Proposed	106.1
Ride Share Program	Proposed	78.3
Transportation Options Center	Proposed	11.3
Commuter Challenge	Proposed	112.6
Use of Car Sharing	Proposed	78.3
Campaign Challenge to Reduce Emissions	Proposed	114.3
Fuel Efficient Car Choice Campaign	Proposed	336.1
Support and Lobby for State Government Policies to Improve Fuel Efficiency and Reduce Vehicle Miles Traveled	Proposed	13277.8
Lobbying for Federal Corporate Average Fuel Economy Standards	Proposed	3202.1
Transportation Total		18242.7
TOTAL CO₂ Reductions		25353.1

Table of Contents

Chapter 1: Introduction

1.0 Introduction

1.1 Definitions

Chapter 2: Energy Efficiency

2.1 Introduction

- 2.1.1 Major Municipal Successes to Date
- 2.1.2 Key Policy Recommendations for Immediate Action
- 2.1.3 Barriers to Implementation

2.2 How to Implement Efficiency in Arlington

2.3 Municipal Programs and Opportunities

2.4 Proposed Municipal Measures

- 2.4.1 Establishment of a Sustainability Program Manager, and Municipal Energy Efficiency Program
- 2.4.2 Enforce and Enhance Green Design and Construction for Municipal Buildings
- 2.4.3 Conduct Audit of All Town Buildings, Implement Energy-Saving Changes

2.5 Residential Programs and Opportunities

- 2.5.1 Establishment of a Residential Energy Efficiency Program
- 2.5.2 Enforcement of Massachusetts State Building Code
- 2.5.3 Information Sessions for Builders
- 2.5.4 Establishment of a Residential Recognition Program
- 2.5.5 Energy Efficiency Home Improvement Loan Program

2.6 Commercial Programs and Opportunities

- 2.6.1 Establishment of a Commercial Energy Efficiency Program
- 2.6.2 Creation of a Green Business Organization
- 2.6.3 EcoStar
- 2.6.4 Establishment of Commercial Recognition Program
- 2.6.5 Municipal Tax Incentives

2.7 Conclusion

Chapter 3: Energy Sourcing

3.1 Introduction

3.2 Summary of Findings and Recommendations

3.3 Installing Renewable Technologies in Arlington

- 3.3.1 Existing Measures
- 3.3.2 The Options
- 3.3.3 Proposed Municipal Measures
 - 3.3.3.1 Installation of a Wind Turbine
 - 3.3.3.2 Installation of PV Systems on Municipal Buildings
 - 3.3.3.3 Becoming a of “Solar Boston” Partner
 - 3.3.3.4 The Town Demonstration House
 - 3.3.3.5 Other Recommendations
- 3.3.4 Proposed Residential and Commercial Measures
 - 3.3.4.1 Installation of Residential PV Systems
 - 3.3.4.2 Installation of PV Systems in Commercial Buildings
 - 3.3.4.3 Purchasing Renewable Energy Credits
 - 3.3.4.4 Residential Use of Solar Hot Water Heating
 - 3.3.4.5 The Website: SustainArlington.org

3.4 Purchasing Clean Power

- 3.4.1 Existing Measures
- 3.4.2 The Options
- 3.4.3 Proposed Municipal Measures
 - 3.4.3.1 Municipal Purchase of Clean Power
 - 3.4.3.2 Other Recommendations

3.5 Conclusion

Chapter 4: Transportation

4.1 Introduction

4.2 Recommendations

4.3 Existing Municipal Measures

- 4.3.1 Fuel-Efficient Procurement Policy for Town Vehicles

4.4 Proposed Municipal Measures

- 4.4.1 Municipal No-Idling Policy
- 4.4.2 Trip-Reduction Programs for Municipal Employees
- 4.4.3 Police Units on Bicycle
- 4.4.4 Conversion of DPW Fleet Vehicles to Biodiesel
- 4.4.5 State and Federal Funding
- 4.4.6 Clean Cities Program

4.5 Existing Residential and Commercial Measures

- 4.5.1 Crosswalk Improvement
- 4.5.2 Walking in Arlington
- 4.5.3 Safe Routes to School Program

4.6 Proposed Residential and Commercial Measures

- 4.6.1 Federal Tax Incentive for Clean Fuel and Electric Vehicles
- 4.6.2 Infrastructure Improvements for Bicycles
- 4.6.3 Traffic Calming and Improvements in Pedestrian Safety
- 4.6.4 Enforcement of Traffic Laws
- 4.6.5 School-wide No-Idling Policy
- 4.6.6 Encourage Non-Motorized Transport to School
- 4.6.7 Need for more Crossing Guards, Crosswalks and Sidewalks
- 4.6.8 Trip-Reduction Programs
- 4.6.9 Ride Share Program
- 4.6.10 Transportation Options Center
- 4.6.11 Commuter Challenge
- 4.6.12 Use of Car Sharing
- 4.6.13 Campaign Challenge to Reduce Emissions
- 4.6.14 Fuel-Efficient Car Choice Campaign
- 4.6.15 Support and Lobby for State Government Policies to Improve Fuel Efficiency and Reduce Vehicle Miles Traveled
- 4.6.16 Lobbying for Federal Corporate Average Fuel Economy Standards
- 4.6.17 Lobby in support of the MBTA's Urban Ring Project

4.7 Conclusion

Chapter 5: Outreach and Community Based Social Marketing (CBSM)

5.1 An Introduction to the CBSM approach

5.2 SustainArlington.org: Town-wide outreach

- 5.2.1 Energy Efficiency Web Resources
- 5.2.2 Energy Sourcing Web Resources
- 5.2.3 Transportation Web Resources
- 5.2.4 Miscellaneous Web-based Outreach

5.3 Targeted Outreach: Arlington's Residential Sector

- 5.3.1 Research Methodology
- 5.3.2 Household Related Findings
- 5.3.3 Residential Energy Efficiency and Energy Sourcing

5.4 Transportation Related Findings and Recommendations

- 5.4.1 2000 US Census Findings
- 5.4.2 Survey Findings

5.5 Targeted Outreach: Arlington's Commercial Sector

5.6 Targeted Outreach: Arlington's Municipal Sector

5.7 Conclusion

1 Introduction

1.0 Introduction

A group of graduate students at Tufts University have collaborated with Sustainable Arlington to produce a series of recommendations in the form of a local action plan such that Arlington can have a more sustainable future. We define sustainability as:



The need to ensure a better quality of life for all, now and into the future, in a just and equitable manner while living within the limits of supporting ecosystems.¹

In order to realize the vision of a more healthy and vibrant future, this document outlines pertinent information regarding necessary steps for the implementation of these realistic goals. A common method of measuring progress is through the use of indicators, specifically measuring the equivalent tons per year of carbon dioxide, a greenhouse gas that leads to climate change. Recognizing that its own greenhouse gas emissions were contributing to this global problem, the Town joined the Cities for Climate Protection Campaign (CCP) in May 2000. In joining this campaign, the Board of Selectmen voted in favor of a proclamation declaring Arlington's commitment to reduce its contribution to climate change and develop a climate action plan. The CCP Campaign is designed to reduce the greenhouse gas emissions and negative environmental impacts. In Massachusetts, 21 communities have joined the CCP Campaign and have written action plans.

The CCP Campaign: Milestones of the Campaign

Arlington's commitment to join the CCP Campaign requires the town to identify sources and quantities of greenhouse emissions (particularly carbon dioxide) and then implement measures that reduce these emissions. There are five milestones in the campaign:

Milestone 1: Conduct a Greenhouse Gas Emissions Analysis: Baseline Inventory and Forecast of Emissions Growth

The inventory is an analysis of activities in the commercial, municipal, and residential sectors of the community compared to the baseline year 1997. The inventory reveals the quantity of greenhouse gases released from each sector. However, an updated emissions inventory for all of these reductions has not been calculated in several years, and knowing exact levels of reduction cannot happen until such an inventory is realized. To ensure that the monitoring of these policies occurs, it is necessary for emissions to be inventoried and forecasted every three years.

Milestone 2: Set a Reduction Target

The reduction target is the local government's goal for emission reduction. It usually specifies how much the government would like to reduce emissions by a selected year. In the case of Arlington, the goal is to reduce carbon dioxide emissions 10 percent below 1997 levels by 2010.

Milestone 3: Develop a Local Action Plan

The Arlington Sustainability Action Plan (ASAP) is a document that lists and describes the actions that the local government, residents, and businesses should take to meet its target. Sustainable Arlington and its team of graduate students from Tufts University have generated Volume One of this plan. The document specifically deals with the topics of Energy Efficiency, Energy Sourcing, Transportation, and Outreach/Community Based Social Marketing. In the future, a second volume of the plan will be designed and implemented that includes topics on waste management, recycling, composting, and other methods to encourage sustainability.

¹ Agyeman, Julian. Lecture at Tufts University, February 2005.

Milestone 4: Implement the Local Action Plan

This entails making sure that the policies and programs of the ASAP are carried out.

Milestone 5: Monitor Progress and Report Results

Throughout the entire process of Arlington becoming more sustainable, there will be monitoring and reporting of achievements made.

Arlington's Milestone Implementation

Milestone 1: The Greenhouse Gas Emissions Inventory

In 2000, a greenhouse gas emissions inventory for baseline year 1997 was conducted and forecasted for the year 2010. The key sectors researched for the inventory were residential, commercial, and municipal sources of energy use (electricity, natural gas, heating oil), transportation, and waste. Detailed results can be more easily observed by dividing the results into municipal and community inventory results.

The *municipal* government accounted for 4 percent of total community emissions with 19,003 tons of CO₂ released. The *transportation* inventory results show that community sources emitted 168,074 tons of CO₂, accounting for 36 percent of Arlington's total emissions.² The *commercial buildings* inventory results show that Arlington sources emitted 72,888 tons of CO₂, accounting for 15 percent of Arlington's total emissions. The *residential buildings* inventory results show that community sources emitted 213,575 tons of CO₂, accounting for 45 percent of Arlington's total emissions. The breakdown of responsible carbon dioxide sources is featured in the pie chart and table below.

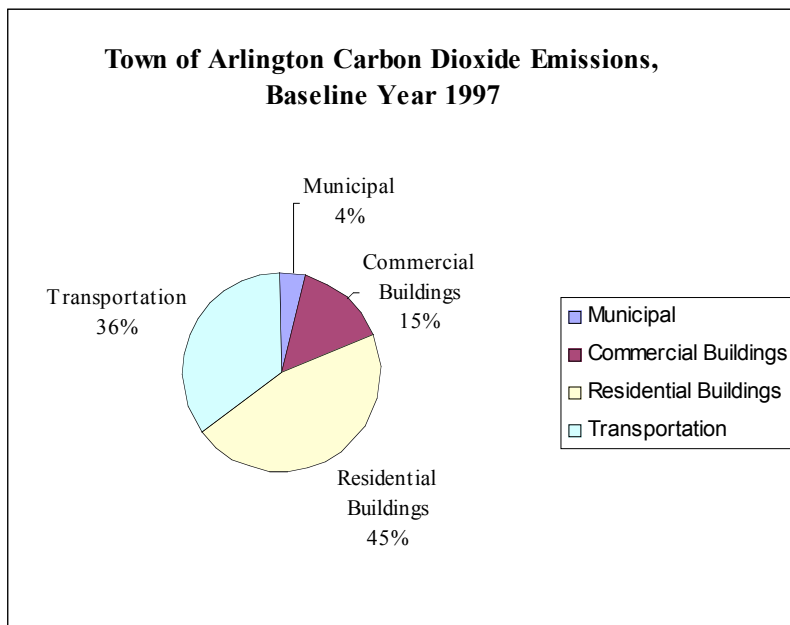


Figure 1: Town of Arlington Carbon Dioxide Emissions (Baseline Year = 1997).

² The data for this source is from 2005 Sustainable Arlington calculations due to erroneous 1997 baseline values.

Table 2: Arlington Carbon Dioxide Sources, from 1997 Inventory

Municipal	Btu	CO₂ Tons	% CO₂ within sector	Sectors as % of total
Buildings	113,998	13,667	71.9%	2.9%
Vehicles	16,202	1,345	7.1%	0.3%
Water/Sewer	8,321	1,862	9.8%	0.4%
Streetlights	9,510	2,129	11.2%	0.4%
Total	148,031	19,003	100.0%	4.0%
Transportation	Btu	CO₂ Tons	% CO₂ within sector	Sectors as % of total
Cars	585,906	70,591	42.0%	14.9%
Trucks	809,108	97,483	58.0%	20.6%
Total	1,395,014	168,074	100.0%	35.5%
Commercial	Btu	CO₂ Tons	% CO₂ within sector	Sectors as % of total
Natural Gas	206,800	12,217	16.8%	2.6%
Fuel Oil	133,983	10,589	14.5%	2.2%
Electric	223,745	50,082	68.7%	10.6%
Total	564,528	72,888	100.0%	15.4%
Residential Buildings	Btu	CO₂ Tons	% CO₂ within sector	Sectors as % of total
Natural Gas	1,001,800	59,183	27.7%	12.5%
Fuel Oil	2,327,344	77,666	36.4%	16.4%
Electric	342,779	76,726	35.9%	16.2%
Total	3,671,923	213,575	100.0%	45.1%
Grand Totals	5,779,496	473,540		100.0%

Milestone 2: The Emissions Reduction Target

Arlington has established a reduction target of lowering emissions in 2010 to 10 percent below 1997 levels and 20 percent by 2020. This translates to CO₂ reductions of 427,000 tons by 2010, and 379,000 tons by 2020. Since municipal emissions in 1997 totaled 19,003 tons CO₂, a reduction of 10 percent would require that municipal emissions reach no more than 17,100 tons of CO₂. As described in the energy efficiency chapter the Town has already witnessed significant cost savings of \$130,000.³

The target goal requires transportation emissions to reduce to 151,000 tons of CO₂ compared to the 168,000 tons of CO₂ that were emitted in 1997. As seen, steps towards achieving a reduction of 10 percent by 2010 and 20 percent by 2020 have been implemented with Warrant 22.

A 10 percent decrease in commercial building emissions would require a reduction to 65,599 tons of CO₂, compared to the 72,900 tons of CO₂ that were emitted in 1997. The target goal requires residential emissions to reduce to 192,000 tons of CO₂ compared to the 214,000 tons of CO₂ that were emitted in 1997.

³ Lee, Benjamin. "Interview with George Woodbury, Energy consultant from Light Smart Energy Consulting Services." (1 April 2005).

Methods

Properly accounting for greenhouse gas reductions from various measures implemented in Arlington is an important element in the climate action plan. For most measures this is relatively straightforward. For others, it is important to define criteria to determine what counts towards Arlington's goals. The five sources of emissions reductions are as follows. Each is discussed in more detail below.

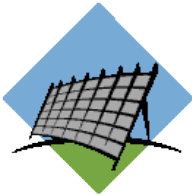
1. **Reductions in energy use within the Town**
2. **Renewable energy generation in Town**
3. **Renewable energy (“clean power”) purchases**
4. **Changes to emissions associated with electricity generation in the New England region**
5. **Reduction of transportation emissions**

1. Reductions in energy use within the Town



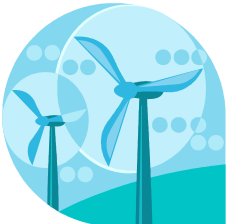
Any reduction in energy use within the Town, either by residents, businesses, or municipal operations, results in CO₂ emissions reductions. For direct fuel use (natural gas, fuel oil), the CO₂ reductions are simply the product of the energy savings and the carbon content of the fuel. For electricity savings, there are a variety of ways to measure the CO₂ avoided. Throughout this action plan we have used the marginal emissions rate as established by the New England Independent System Operator (NE-ISO). The marginal emissions rate is an established figure used throughout New England for various environmental compliance programs and represents the emissions avoided “on the margin”, i.e., by avoiding the next kWh of generation. For 2003, the value was 1,179 lb/MWh.⁴ Reductions in energy use are discussed in detail in Chapters 2.

2. Renewable energy generation in Town



The way to treat emissions reductions from the application of renewable energy generation within the Town of Arlington is more complicated. Strictly speaking, one must follow the attributes of the renewable energy generation to see who “owns” the emissions reductions.⁵ Even if the Town or one of its residents or businesses owns a project, it is now possible to sell the attributes to another entity. In such a case, the entity buying the attributes would actually be able to claim the emissions reductions. However, for the purposes of this action plan, we have assumed that any renewable energy project within the Town that is developed, owned, or facilitated by Arlington's local government, its residents, or its businesses, should count towards the CO₂ reduction target, regardless of the fate of the attributes. This approach recognizes the role played by the community in “making the project happen”. Renewable energy generation options are discussed in detail in Chapter 3.

3. Renewable energy (“clean power”) purchases

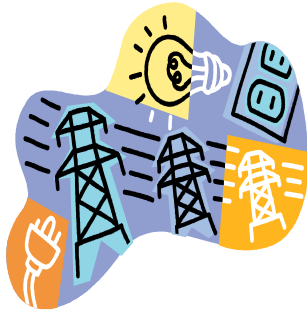


Decisions by the Town, its residents and its business to pay a premium for buying clean power also result in emissions reductions, even if the source of this clean power is distant. Since it is the Town taking this leadership role, this represents a real reduction in carbon dioxide based on the community's actions. Detailed clean power purchase options are discussed in Chapter 3.

⁴*Marginal Emissions Analysis*. [online]. [Cited 27 April 2005]. Found on World Wide Web: <http://www.iso-ne.com/Planning_Reports/Emissions/Marginal_Emissions_Analysis_2003.pdf>.

⁵ The concept that attributes of renewable generation are separate and severable from the power itself is a powerful concept that is facilitating the development of renewable energy. The sale of the attributes, via so-called “green tags” or “renewable energy certificates” provides an important, new revenues stream for renewable energy project owners.

4. Changes to emissions associated with electricity generation in the New England region



The mix of fuels used to generate electricity in New England has been changing over time, as has the efficiency of conversion. Specifically, New England has become increasingly reliant on natural gas-fired gas turbine combined cycle (GTCC) power plants. These plants have displaced older natural gas and oil burning plants, with two effects. First, natural gas contains less carbon per unit energy than fuel oil. Second, GTCC plants are nearly twice as efficient as the plants they displace. As a result, the marginal CO₂ emissions rate has fallen from 1,653 lb/MWh in 1996 to 1,179 lb/MWh in 2003. Although it is unlikely that there will be significant additional construction of gas-fired GTCC plants, one can expect there to be incremental improvements in the CO₂ emissions rate over time. Another

development is the fact that most states in New England (including Massachusetts) and throughout the Northeast have implemented *renewable portfolio standards* (RPS), which require that a certain percentage of electricity sold be generated from renewable energy resources. Generally, the percentages increase over time such that renewables become a larger and larger fraction of the mix. For example, in Massachusetts the RPS requirement was 1 percent in 2003 and will reach 4 percent by 2009 and increase by 1 percent each year thereafter.

For the purposes of this action plan, we have chosen to include the effects of these changes on Arlington being able to meet its CO₂ reduction targets. First, Arlington receives its electricity from the regional mix (unless it chooses to purchase clean power – see Chapter 3 for details) and second, it pays its share of the costs associated with implementation of the RPS. For these reasons, we find it reasonable for Arlington to be able to include changes to the marginal emissions rate in meeting its GHG goals. Note that the marginal emissions rate has fallen from 1,484 lb/MWh to 1,179 lb/MWh from 1997 (the baseline year) to 2003, a reduction of 20.6 percent. This should be factored in by the town when computing current GHG emissions relative to the baseline, along with any changes in total electricity consumption (up or down).

5. Reduction of transportation emissions



Determining the amount of carbon dioxide emissions resulting from transportation in Arlington is difficult to quantify. There are many factors that have to be considered when calculating the amount of carbon dioxide in town because there are emissions from vehicles that travel through Arlington to arrive at their destination and there are the emissions from the vehicles owned by Arlington residents themselves. These recommendations focus solely on the reductions of carbon dioxide emissions that are related to individuals living in Arlington. Using information from the United States Census about transportation in Arlington as well as from other sources, an estimate was

generated that describes the change in behavior towards alternate forms of transportation for residents, businesses and the municipality. This methodology helped to provide the information necessary to calculate carbon dioxide reductions and can be found in greater detail in Chapter 4.

Summary

This climate action plan exemplifies Arlington's strong dedication to sustainability and the effort to mitigate the impacts climate change. The measures outlined in this document demonstrate the leadership role Arlington has taken and can take an increasing efficiency and reducing greenhouse gas emissions.

1.1 Definitions

***Biomass:** the total dry organic matter or stored energy content of living organisms in a given area. Biomass refers to forms of living matter (e.g. grasses, trees, animals).

***Carbon dioxide (CO₂):** is the major gas released into the atmosphere when fossil fuels are burned. The amount of CO₂ in the atmosphere has increased by about 25% since the burning of coal and oil began on a large scale, following the industrial revolution (1850).

***Climate:** the average weather conditions for a specified area during a specified time interval (usually decades or longer).

***Equivalent CO₂ (eCO₂):** also known as Global Warming Potential weighted greenhouse gas emissions (GWP), is a unit that allows emissions of greenhouse gases of different strengths to be added together. For carbon dioxide itself, emissions in tons of CO₂ and tons of eCO₂ are the same thing, whereas for methane, an example of a stronger greenhouse gas, one ton of methane emissions has the same GWP as 21 tons of CO₂. Thus 1 ton of methane emissions can be expressed as 21 tons eCO₂.

***Global warming:** the recent trend of increasing world-surface and tropospheric temperatures that scientists believe is caused by increased emissions of human-induced greenhouse gases. The greenhouse gases are emitted into the atmosphere and increase the atmosphere's "entrapment" of heat.

Greenhouse gas (GHG)¹⁷: some occur naturally, and some result from human activities. Naturally occurring greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide, and ozone.

Hydro power: the most widely used renewable in New England and elsewhere in the US. River water is diverted by a dam through a turbine that extracts some of the energy in the flowing water and converts it to electricity.

***Methane:** produced by anaerobic decomposition of solid waste in landfills and sewage treatment facilities, wetlands, and rice paddies, as a byproduct of fossil fuel energy production and transport and also from out gassing in livestock. It is also the principal constituent of natural gas and can leak from natural gas production and distribution systems and is emitted in the process of coal production. The methane concentration in the atmosphere has been rising steadily for several centuries, keeping pace with the increase in the world population and expansion of the world economy.

***Nitrous oxide:** a potent greenhouse gas. Main sources for this GHG are nitrogen fertilization of agricultural soils, and from motor vehicles equipped with catalytic converters.

Renewable Energy: energy extracted from natural earth processes, excluding burning of fossil fuels, natural gas and nuclear energy. The energy harnessed from flowing water, solar irradiation, geothermal sources, wind, and biomass (including wood burning, methane generated from agricultural and/or municipal waste,) are the most commonly used renewables. Tidal or wave energy and ocean thermal energy are renewables that are in the early research stages.

Solar energy: the most ubiquitous of the renewable resources currently in use. Sunlight that provides both light and heat allowing us to reduce the conventional electricity and fuel we use for these purposes. A clothesline is basically a simple wind and solar-powered clothes dryer. In addition to these familiar but often overlooked solar resources in our homes and offices, there are more advanced technologies like photovoltaic panels (PV) and solar water heaters that can provide electricity and hot water (respectively) for our use. Today in the US, solar energy systems are most commonly used in facilities that are as little as 1/4 of a mile from the existing electric utility grid. In these situations, the cost to install the power lines bringing the electricity from the existing grid to the customer, are higher than the costs of installing and operating solar technologies like photovoltaics.

* taken directly from ICLEI Toolkit "Glossary of Terms"

¹⁷ *Environmental Protection Agency Global Warming Site:Emission.* [online]. [Cited 30 April 2005]. Available at World Wide Web: <<http://www.epa.gov/globalwarming/emissions/index.html>>.

Worldwide, PV is in very wide use bringing electricity to areas where there is no existing utility grid for purposes like medical refrigerators, micro-industries, village schools etc.

Wind energy: the fastest growing source of electricity in the world today. This technology has developed considerably in the past 20 years, spurred on by thoughtful environmental policies in Europe and a rash of recent strong policy initiatives in the US. At the present time, wind development is booming in states like Texas, Kansas, Oregon, and Washington where winds are strong, land is relatively inexpensive, and where farmers and ranchers can benefit greatly from wind development.

Wood-fired energy: Wood fired power plants account for a few percent of the total electricity generating capacity in New England. The City of Burlington, VT, with its McNeal plant obtains about 25% of its electricity from this renewable resource.

Wood can also be an efficient and relatively clean source of heating energy in the winter. This is evidenced by the dozens of schools in Vermont heated by advanced, high-efficiency, low-emission wood-fired boilers. This is also demonstrated by the heavy use of wood waste as a process fuel in the lumber and pulp and paper industry.

Wood stoves can deliver heat to homes and small businesses during the heating season but these units are often criticized for their relatively high emissions of particulate matter into the air.

2 Energy Efficiency

2.1 Introduction

The Arlington community has significant untapped energy efficiency potential. Exploiting this potential will not only help the community achieve its greenhouse gas (GHG) reduction goals, but it offers significant economic benefits through energy cost savings. Energy efficiency is often the most cost-effective means of achieving emissions reductions. The residential, municipal, and commercial sectors all can take advantage of modern efficient technologies and practices that can reduce the amount of energy needed to provide necessary services. This section outlines the actions the Town of Arlington can take to promote energy efficiency across all sectors of the community. It also provides an estimate of the energy savings potential and the associated GHG emissions reductions. Additional details on different types of energy efficiency measures and further background information can be found in Appendix A.



2.1.1 Major Municipal Successes to Date

- The Town of Arlington is already saving an estimated \$130,000 per year in electricity costs from a handful of highly successful energy efficiency retrofits. This is equivalent to 1,220,000 kilowatt hours, 875 tons of carbon dioxide, and is enough electricity to meet the needs of 137 average households in Arlington (annually). The projects are:
 - Incandescent traffic signals were replaced with LED signals (2001)
 - The Robbins library underwent a major lighting retrofit (2003)
 - Mercury vapor streetlights were replaced with high-pressure sodium (completed July 2004)
- The Town is now in the process of replacing pedestrian crossing signals with LEDs
- In addition, the new Peirce Elementary School has a high-efficiency boiler, resulting in an approximate 10% fuel cost savings

In all cases, the Town received utility rebates covering the majority of costs, resulting in very rapid paybacks such that these projects have for the most part already paid for themselves.

2.1.2 Key Policy Recommendations for Immediate Action

- Establish a Sustainability Program Manager position, funded by current savings due to the energy efficient streetlights/stoplights (See Section 2.4.2 for detailed responsibilities)
- Establish an Energy Management Work Group, modeled after the existing inter-departmental group in Cambridge, MA, whose goal is to conduct an emissions inventory, evaluate the performance of city-owned facilities, and identify and implement energy efficiency measures. The Sustainability Program Manager would oversee this group
- Create a Website. Provide an information clearinghouse on current rebates and opportunities available to the Arlington community to increase participation in energy efficiency programs. This would include a regularly updated, and heavily marketed website—SustainArlington.org, as described in detail in Chapter 5
- Adopt more efficient construction regulations: change Arlington’s building code to require more stringent energy efficiency measures, and enforce the 2003 Arlington Green Building Law for municipal buildings
- Create recognition programs for residences, municipal offices, and green businesses
- Have all municipal buildings and energy consuming activities undergo a comprehensive energy efficiency audit that is facilitated by the Sustainability Program Manager

2.1.3 Barriers to Implementation

To implement energy efficiency measures in Arlington, several barriers have been identified:

- A need for leadership in implementation of cost-saving efficiency measures
- Lack of education and awareness – of what energy costs, of the availability of various programs and rebates, of new technologies and bad associations with “old” technology
- Perceived long-payback times for efficiency related capital investment

Frequent lack of concern due to small financial incentive for those who do not pay for utilities (renters, office workers, public housing, etc)

For a more detailed discussion of specific energy efficiency measures described in this table, see Appendix D. The following calculations are based on conservative estimates.

Table 3: Potential CO₂ Reductions from Energy Efficiency Actions

Sector	Energy Efficiency Actions	Participation in Activity	Total Electricity Savings	Annual CO2 Savings: One Year	Annual net cost savings
		(#units)	(kWh)	(tons)	(thousands)
Residential	Enforce existing building codes	4	1,050	1	\$116
	Enhance existing building codes	1	1,330	1	\$133
	Participate in Energy Star Homes	3	1,960	1	\$157
	Participate in home audit program	971	582,330	343	\$64,056
	Adopt weatherization measures	19	19,411	11	\$2,169
	Adopt efficient lighting measures	971	97,055	57	\$10,676
	Adopt efficient appliance measures	388	77,644	46	\$7,221
	Total			780,780	460
Commercial & Industrial	Enforce existing building codes	1	7,000	4	\$630
	Enhance existing building codes	1	25,000	15	\$2,000
	Participate in green building construction	1	40,000	24	\$3,880
	Participate in utility C&I audit program	23	346,500	204	\$32,918
	Total			418,500	247
Municipal	Enforce existing building codes	1	8,000	5	\$800
	Enhance existing building codes	1	29,000	17	\$2,610
	Participate in green building construction	1	40,000	24	\$4,280
	Participate in audit program	2	27,000	16	\$2,835
	Efficient street light retrofits	3,624	1,092,000	644	\$95,000
	Efficient pedestrian Crossing signals	N/A	172,000	101	\$15,000
	Efficient lighting retrofits	2	54,000	32	\$5,724
	Purchase of Energy Star products	4	14,400	8	\$1,152
Total			1,436,400	847	\$127,401
Total			3,834,960	2,261	\$375,311
Total cumulative 10 Years			38,349,600	22,608	\$3,753,114

- Notes:
- CO₂ emission rate: efficiency (lb/MWh). This is based on the marginal New England CO₂ emission rate, averaged across the entire year for 2003
 - All these rates are based on Synapse Energy Economics estimates, adjusted by Sustainable Arlington in conjunction with Tufts University graduate students, in April 2005⁶
 - For emissions rate estimates, see footnote⁷
 - Pedestrian Crossing Efficiency Measure is currently in progress (April 2005)
 - Efficient streetlight retrofits have already occurred, these are actual savings reported
 - Boiler and thermostat retrofits will for residential and commercial will save a combined additional 388 tons of carbon dioxide, saving 10 percent of fuel costs (1997 Baseline fuel costs not available). These data are included in the total figures elsewhere in this plan.

2.2 How to Implement Efficiency in Arlington

Arlington has an abundance of opportunities to reduce its greenhouse gas emissions and utility expenditures through energy efficiency measures. These opportunities exist and will be described in this chapter under the sub-headings of municipal, residential, and commercial sectors. Programs, including a range of utility rebates, are available to all members of the Arlington community, especially low-income residents.

The most important tools for the implementation of greater energy efficiency are education, ease of access to programs, changes in building codes and other relevant Town rules and regulations. Leadership in the form of a Sustainability Program Manager can facilitate the success of efficiency-related programs.

As discussed in the Outreach and Community Based Social Marketing chapter, a website describing all of the opportunities and events available to the Arlington community will facilitate the implementation of many sustainability-related goals. Detailed information relating to efficiency will describe how all community members, whether they are in the residential, municipal, or commercial sectors can participate in energy saving actions and programs. Up-to-date rebate information from various sources will be presented along with contact information to facilitate energy savings for Arlington community members.

2.3 Municipal Programs and Opportunities

Table 4- Municipal Emissions below shows that municipal activities account for a relatively small portion (4.0 percent in the 1997 baseline survey) of total GHG emissions in Arlington. Nevertheless, they should be a primary target of energy efficient measures, if the Town is to achieve its overall GHG reduction targets.

Table 4: Municipal Emissions, Baseline Year 1997

	British Thermal Units (Btu)	Carbon Dioxide Tons	Co2 % within Municipal Emissions	CO2 as % of Total Arlington Emissions
Buildings	113,998	13,667	72	2.9%
Vehicles	16,202	1,345	7	0.3%
Water/Sewer	8,321	1,862	10	0.4%
Streetlights	9,510	2,129	11	0.4%
Total	148,031	19,003	100	4.0%

⁶ Predith, Ashley, and Tim Woolf. 2004. CO₂ Reduction Workbook: A Method for Calculating CO₂ Reductions From Electricity Measures in Municipal Climate Change Action Plans. Synapse Energy Economics, Inc.

⁷ ISO New England Website. [Cited March, 2005] Available from the World Wide Web: http://www.iso-ne.com/Planning_Reports/Emissions/Marginal_Emissions_Analysis_2003.pdf

The Town of Arlington spends approximately \$2.7 million annually on electricity, natural gas, and heating oil, leading to approximately 15,500 tons of GHG emissions⁸. The greatest source of municipal emissions comes from energy used in Town buildings. This energy is used to power lighting, heating, ventilation and air conditioning (HVAC) systems, appliances, and other equipment. The Town buildings that produce the most emissions include: Housing Authority facilities, Town Hall, the Public Works Yard, and the public schools. The 1997 inventory indicates that building emissions accounted for 71.9 percent of all municipal CO₂ emissions.

Improving the energy efficiency of Town buildings is one of the most cost-effective ways to reduce emissions. Significant improvements in energy efficient technology provide opportunities for lucrative efficiency investments, even in relatively new buildings. These investments can often be financed from the energy cost savings. Both utilities which serve the Town, NSTAR (electricity) and KeySpan (natural gas) offer substantial rebates and incentives that the Town can take advantage of to reduce the cost of efficiency improvements. See Appendix C for an expanded list of similar programs and opportunities, and a case study of a resident who took advantage of such programs. As discussed in section 2.4.2, the Sustainability Program Manager is responsible for seeking out and implementing these opportunities in conjunction with the Energy Management Work Group.

Electricity consumed for street lighting (which includes both streetlights and traffic signals) was the second largest source of municipal emissions in Arlington in 1997, which accounted for 11.2 of municipal emissions and 23 percent of total municipal energy and fuel costs. As described in the beginning of this chapter, streetlight emissions have been reduced significantly. Carbon dioxide emissions were reduced by 644 tons (reducing streetlight emissions by 30 percent) while saving the Town \$130,000 annually⁹.

As part of this action plan, we have made an initial assessment of the remaining potential for GHG reductions through energy efficiency. The estimate is made using a tool developed by Synapse Energy Economics.¹⁰ A summary of the potential savings is given in Table 1, and elaborated on in Appendix D. In order to achieve this potential, the remainder of this subsection provides suggested programs that could be implemented by the Town to municipal energy efficiency.

2.4 Proposed Municipal Measures

Although Arlington has already shown that energy efficiency projects can create significant cost savings while reducing emissions, many similar programs remain waiting for implementation.

2.4.1 Establishment of a Sustainability Program Manager, and Municipal Energy Efficiency Program

The Sustainability Program Manager, in conjunction with the Energy Management Work Group (and in addition to residential responsibilities), should also be responsible for carrying out the following activities.

Responsibilities include but are not limited to:

- Expand on the 1997 baseline emissions data by creating a modified comprehensive emissions inventory; maintain the Arlington emissions inventory on Cities for Climate Protection (CCP) software and update the inventory annually
- Have all municipal buildings and energy consuming activities undergo a comprehensive energy efficiency audit and execute the cost-effective measures via an energy savings performance contract with an energy service company (see section 2.4.4)

⁸ Town of Arlington 1997 Carbon Dioxide Emissions Baseline Survey

⁹ Lee, Benjamin. "Interview with George Woodbury, Energy consultant from Light Smart Energy Consulting Services." (1 April 2005).

¹⁰ Predith, Ashley, and Tim Woolf. 2004. CO₂ Reduction Workbook: A Method for Calculating CO₂ Reductions From Electricity Measures in Municipal Climate Change Action Plans. Synapse Energy Economics, Inc.

- Monitor all electricity and heating bills from each Town department and keeping track of building energy rates
- Conduct training in energy efficiency for relevant municipal employees
- Organize and apply for any applicable utility programs, rebates, or grants

2.4.2 Enforce and Enhance Green Design and Construction for Municipal Buildings

At Town Meeting in May 2003, Arlington passed Sustainable Arlington's proposal that established the goal of LEED (Leadership in Energy and Environmental Design) silver certification for new and substantial renovations of Town-owned buildings.

New and renovated buildings can score points on the LEED scale by incorporating a variety of technologies and design approaches that include:

- Converting from oil heat to gas heat (less carbon per Btu in fuel)
- Weatherization & insulation
- Lighting retrofits of all kinds
- High efficiency water heating (including solar)
- High Efficiency windows (low E)
- Use of Energy Star appliances (washers, dryers, dishwashers, refrigerators), office equipment and computers
- Planting trees to reducing energy requirements of buildings (e.g. by providing shade in summer and blocking wind in winter)
- High efficiency HVAC systems
- Light-colored roofing materials to reflect heat and use less air conditioning

A full list of sustainable building guidelines may be in found in Appendix B.

The Massachusetts State Building Code requires that all new building construction be 5 percent to 10 percent above the minimum energy efficient thresholds set by the U.S Department of Energy. The Town of Arlington's building code is the same as the State's and also applies to the Town's public and private sectors. The Town should not only enforce the State's standards, but it should also consider developing its own voluntary green building standard in conjunction with the LEED requirements.

Currently, Massachusetts has building codes that require that new construction or renovation is compliant with health, fire, and safety standards. Building inspectors ensure that this occurs. In agreement with Arlington building inspectors, it is suggested that code for new/addition construction is more stringent for energy efficiency measures.

Interviews with Arlington's Building Inspector led to a discussion of how a re-evaluation of Code J—insulation requirements—could significantly reduce building energy costs and emissions. Further discussion to facilitate further efficiency-related code requirements would be a project of the Sustainability Program Manager.

2.4.3 Conduct Audit of All Town Buildings, Implement Energy-Saving Changes

Under the auspices of the Sustainability Program Manager, the Town should conduct a comprehensive energy audit of all municipal buildings using the services of an Energy Services Company (ESCO). The Town should then rank each building according to its level of efficiency so that buildings with lower levels of efficient technology are prioritized. In order to ensure that efficiency programs are instituted in remodeled or new buildings, it is essential that these programs be included in the overall construction plans from the earliest stages.

Arlington has a great opportunity to implement efficiency measures in its schools. In 2000, the Town initiated green school designs with the purchase and installation of a high efficiency boiler for the Peirce School. The

Stratton and Thompson schools, and the Park Circle Fire Station provide the Town with opportunities for further efficiency measures, as they are all slated for reconstruction within the next few years and have yet to begin the design process. Arlington High School and other fire stations are other municipal buildings present opportunities for cost savings and emission reductions.

2.5 Residential Programs and Opportunities

Table 5 below shows that residential buildings account for a major portion of total greenhouse gas emissions in Arlington. They should be a primary target of energy efficiency measures if the Town is to achieve its overall GHG reduction targets.

Table 5: Residential Building Greenhouse Gas Emissions in Arlington, Baseline Year 1997

Residential	Btu	CO2 Tons	Co2 % within sector	Sectors as % of total
Natural Gas	1,001,800	59,183	28	12.5%
Fuel Oil	2,327,344	77,666	36	16.4%
Electric	342,779	76,726	36	16.2%

The roughly 42,000 residents of Arlington live in houses and apartments that all have the potential to be more energy efficient. Many live in older houses and apartments that were built in an era when fuel costs were less expensive, and thus did not have as much of an incentive to have good insulation. Many programs from various agencies and utilities are available for homeowners to utilize (see Appendix C). Thus, a major role for the Town is to help make residents aware of these opportunities, as opposed to directly funding residential energy efficiency programs. Greater effort in presenting pre-existing programs could significantly improve both Arlington residents' energy efficiency and expenses. Chapter 5, on Outreach and Community Based Social Marketing, discusses a wide variety of strategies to engage Arlington community members to live more sustainable lifestyles.

Because several years have passed since carbon dioxide emissions baseline assessment, Sustainable Arlington strongly suggests that a second comprehensive emissions inventory be calculated. This way, a clearer picture of trends in energy use can be identified, and plans can be developed accordingly. The use of such indicators has been instrumental for communities to have a deeper understanding and a more strategic method of directing their efforts.

As part of this action plan, we have made an initial assessment of the potential for emissions reductions through energy efficiency. The estimate is made using a tool developed by Synapse Energy Economics Inc.¹¹ A summary of the potential opportunities is given in the introduction to this chapter, and a more full description is in Appendix D. In order to achieve this potential, the remainder of this subsection provides suggested programs that could be implemented by the Town to support its residents in implementing energy efficiency.

2.5.1 Establishment of a Residential Energy Efficiency Program

The Town's Sustainability Program Manager will run this educational program funded by money saved from the implementation of energy efficiency programs (such as the annual \$130,000 savings from the streetlights program). The program is designed to educate residents on how greater efficiency and cost savings are easy to achieve with municipal leadership.

¹¹ Predith, Ashley, and Tim Wolfe. 2004. CO2 Reduction Workbook: A Method for Calculating CO2 Reductions from Electricity Measures in Municipal Climate Change Action Plans. Synapse Energy Economics inc.

The activities for this program entail the following:

- Provide educational opportunities and forums for residents on the multiple benefits of efficiency, including financial savings, improved lighting and comfort, cleaner air, and reduced exposure to energy price volatility.
- Assist residents in the measurement of their emissions and provide guidance on methods to reduce these emissions through energy efficiency efforts.
- Promote programs that target specific behaviors, including the benefits associated with lighting efficiency, renewable energy, and green buildings.
- Educate residents on how to assure they are in compliance with the Massachusetts Building Energy Code. Training sessions, similar the one conducted in 2003, could be funded through NSTAR or with funds set aside to assist the running of the Energy Efficiency Program
- Advertise the availability of existing programs, such as the Arlington Home Rehabilitation Program, and the Menotomy Weatherization Service.
- Disseminate efficiency opportunities and tips via Town mailings, such as those for the census, tax forms, and voter information.
- Write a weekly article for the *Arlington Advocate* about household energy efficiency tips.

2.5.2 Enforcement of Massachusetts State Building Code

Nationally buildings are accountable for 65 percent of electricity use, and 30 percent of greenhouse gas emissions.¹² Therefore, it is imperative to ensure that new buildings and major renovations/additions incorporate the most recent energy efficiency related code. The Sustainability Program Manager should set training requirements for the Arlington building inspector in the relevant residential efficiency code and require that he/she is able to properly review the installation of high efficiency residential HVAC equipment and other similar upgrades.

Enforcement of pre-existing code is a time-consuming process. To better serve the Arlington community, and in consideration of the expanded duties of the building inspectors more building inspector staff should be made available.

2.5.3 Information Sessions for Builders

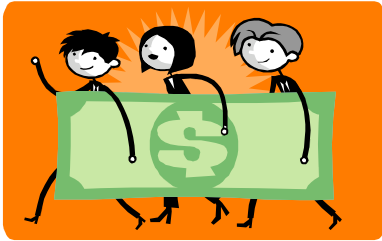
In October 2002, an energy seminar was conducted at Arlington Town Hall for local builders. Topics of discussion included code compliance, common energy problems with insulation, heating, and A/C systems, air quality, and other related topics. The seminar was well attended, and many builders stayed afterwards for a continued dialogue. This reflects both the consumer demand and builder willingness to construct buildings with higher energy efficiency. The Sustainability Program Manager should be responsible for conducting and/or organizing such an information session for builders and contractors every six months.

2.5.4 Establishment of a Residential Recognition Program

The Town should consider running a recognition program for residents who are able to reduce their emissions in 2010 by 10 percent, and 20 percent by 2020. This program would also encourage residents who are remodeling or building homes to utilize energy efficient measures by offering building permit incentives such as lower fees and expedited review. Those residents, businesses, and municipal offices with the most efficient use of energy will be featured in the *Arlington Advocate*, as well as receiving prizes such as gift certificates from local restaurants.

12 United States Green Building Council [online]. [Cited March 2005]. Available from World Wide Web: <<http://www.usgbc.org/DisplayPage.aspx?CMSPageID=38&>>.

2.5.5 Energy Efficiency Home Improvement Loan Program



Arlington should work with a local lender to set up a program where community members who are interested in investing in efficiency-related projects in their homes can do so using low-interest rate loans. The ability to roll more capital intensive, longer-payback energy efficiency measures (e.g., wall insulation and windows) into mortgages or low-interest loans can help offset high up-front costs and lead to significant energy and emissions savings.

2.6 Commercial Programs and Opportunities

Table 6 shows that commercial buildings account for a small but significant portion of total GHG emissions in Arlington. These buildings represent an important target for energy efficiency measures if the Town is to achieve its overall emissions reduction targets. Energy efficiency also makes for good business – helping small business cut costs helps them stay competitive. Ecologically minded residents are also more likely to shop locally, knowing that these businesses are being proactive in helping protect the environment.

Table 6: Commercial Building Greenhouse Gas Emissions in Arlington, Baseline Year 1997

Commercial	Btu	CO2 Tons	Co2 % within sector	Sector as % of Total
Natural Gas	206,800	12,217	17	2.6%
Fuel Oil	133,983	10,589	15	2.2%
Electric	223,745	50,082	69	10.6%
Total	564,528	72,888	100	15.4%

As part of this action plan, we have made an initial assessment of the potential for emission reductions through energy efficiency. The estimate is made using a tool developed by Synapse Energy Economics, summarized in Table 1, and expanded in Appendix D. In order to achieve this potential, the remainder of this subsection provides suggested programs that could be implemented by the Town to support local businesses in implementing energy efficiency.

2.6.1 Establishment of a Commercial Energy Efficiency Program

Similar in scope to the residential and municipal programs, the Sustainability Program Manager would also oversee this program. This program, being specifically tailored to commercial interests, will provide information regarding efficiency opportunities for these businesses. Applicable aspects of the residential and municipal energy efficiency programs will be replicated for this program. In addition, the following actions are incorporated into this program:

2.6.2 Creation of a the Arlington Alliance of Sustainable Businesses

The Sustainability Program Manager will facilitate the organization of a group of local businesses that are committed to reducing their emission and waste levels. This organization of businesses can share knowledge gained from experiences in retrofitting their industries and workspaces to become more energy efficient. More detail on this concept is presented in Chapter 5. The United States Green Building Council has shown that green buildings are more competitive in the market place. The workers in these buildings are more productive due to more natural light and air quality with fewer toxins, resulting in less worker absenteeism, and less worker turnover.

2.6.3 EcoStar

Another aspect of the Commercial Energy Efficiency Program is to facilitate the possibility of more efficient utilization of resources. Termed ‘Eco-industrial parks,’ greater efficiencies for industries can be realized through better planning and organization. One industry’s waste can be another’s raw material. EcoStar is a program recently developed by the Devens Enterprise Commission, based in Central Massachusetts that creates these cost-effective environmental programs. Businesses in Arlington should be linked with each other, or in nearby communities, allowing for synergies of resource and energy use to occur.

2.6.4 Establishment of Commercial Recognition Program

The Town can offer incentives to businesses that are constructing or remodeling buildings that compel them to utilize energy efficient features. Such incentives include a reduced cost of building permits, and expedited review by the planning board and building inspectors.

The Town should consider recognizing businesses that have taken steps to be energy efficient. Recognition could be in the form of an article in the *Arlington Advocate* or at Town gatherings and events. Such recognition would be attractive to the business itself because it can be used as a positive advertising tool.

2.6.5 Municipal Tax Incentives

Because green buildings place less of a burden on local infrastructure, local tax incentives for green buildings should be explored in order to determine if such incentives could save Arlington money while reducing emissions.

2.7 Conclusion

As demonstrated in this chapter, many ideas are presented that can significantly save the Town money while protecting the environment. It is now in the hand of citizens and leaders within the Arlington community to determine whether or not the measures contained herein will be realized. Sustainable Arlington and the writers of this report strongly suggest these suggestions are taken seriously to facilitate a responsible stewardship of resources for tomorrow’s generations while creating a more healthy community today.

3 Energy Sourcing

3.1 Introduction

The Arlington community has great opportunity to restrict the emission of greenhouse gases at the source by utilizing renewable energy sources. The electricity generated through the use of renewable sources is known as clean power, or clean electricity. “Renewable” or “clean” power is not generated from the burning of fossil fuels; therefore, it does not produce greenhouse gases and releases less smog-forming (NO_x), acid rain-forming (SO₂) pollutants, carbon dioxide (CO₂) and particulate emissions. Every unit of electricity (kilowatt-hour) that is shifted from conventional fossil fuel and nuclear electricity generation to renewable generation spares damage to the environment and lessens health related problems including respiratory illnesses.



Water, solar, wind, and biomass¹³ are the most commonly used forms of renewable energy. Presently, hydro energy and biomass are the only existing renewable resources providing a significant amount of power to the New England Power Pool (NEPOOL) and even they supply less than 5 percent of the total electricity production.¹⁴

Renewable energy is currently more expensive to consume compared to conventional energy resources. However, it offers price stability and will not be impacted by rising natural gas, oil and coal prices. In addition, Northeastern States are establishing a Regional Greenhouse Gas Initiative (RGGI) that will most likely start with measures to reduce the CO₂ emissions by electric utilities. If such measures (e. g. ‘Carbon Tax’) that raise the cost of using carbon-based fuels were ever to be imposed, renewable energy consumers would be further insulated from these cost increases by using more efficient and carbon-neutral options.

The opportunity to start producing or purchasing renewable energy is growing. Currently, deregulation of the electricity market provides an opportunity to negotiate not only the attributes of electricity supply, but also the price. Towns can become municipal aggregators and negotiate for more clean power as well as for lower prices for their citizens. Arlington's efforts to shift to clean energy sources can be supported, financially and otherwise, through various state programs. The Massachusetts Technology Collaborative (MTC) is the State’s development agency for renewable energy. MTC has started providing grants and other financing for clean energy products through Massachusetts Renewable Energy Trust. In collaboration with communities, municipal governments, academia and industry, the MTC seeks to invest in initiatives to develop energy from renewable resources and reduce the state's reliance on coal, oil, and other fossil fuels. The Massachusetts Renewable Energy Trust (MRET), through the MTC, seeks to fund projects and studies in the areas of green buildings, clean power, solar energy, consumer energy awareness, and fuel cells in order to initiate a sustained shift toward the increased use of renewable energy.¹⁵ MTC/ MRET programs are presented in section 1.3.

This chapter considers initiatives that enable Arlington to satisfy municipal, residential and commercial power needs with sources that reduce pollution, carbon dioxide (CO₂) emissions or byproducts that cause health problems and environmental damage. Measures considered include:

¹³ As defined earlier, some forms of biomass are renewable because when plants grow they reabsorb the CO₂ released when the biomass is converted to energy.

¹⁴ Massachusetts Energy Consumers Alliance Home Page [online]. [Cited 10 March 2005]. Available from World Wide Web: <www.massenergy.com>.

¹⁵ Massachusetts Technology Collaborative Home Page [online]. [Cited 10 March 2005]. Available from World Wide Web: <www.masstech.org>.

- Installing Renewable Energy Technologies
- Purchasing Clean Power

Below, recommended actions are proposed for Arlington. Energy sourcing strategies and options are considered for the Town's power requirements as well as residential and commercial initiatives when applicable.

3.2 Summary Findings and Recommendations

Currently, residential and commercial units are the major contributors to the Town's CO₂ emissions in terms of energy sourcing. Therefore, it is necessary for the Town to give priority to the proposed Residential and Commercial measures, particularly clean power purchasing. The current state of energy sourcing in Arlington along with the targeted reductions in CO₂ emissions for municipal, residential and commercial electricity is presented in Appendix E.¹⁶ As it has previously been explained in the introduction section, the marginal CO₂ emissions rate has fallen from 1,484 lb/MWh to 1,179 lb/MWh between 1997 (the baseline year) and 2003.¹⁷ This already accounts for a reduction of 20.6% (21,000 tons) in CO₂ emissions resulting from electricity consumption. The measures proposed in this section will add to these reductions accomplished through decreases in the marginal emissions rate. The Town is currently purchasing its electricity from Trans Canada Power Inc. The contract will expire in September 2006.¹⁸

The following table presents an overview of the measures discussed in this section of the plan. Further information regarding the proposed measures, CO₂ emissions reduction figures, and the calculations made can be found in the following chapters of this section and in Appendix F.

Table7: Proposed CO₂ Reduction Measures.

Measure:	Status:	Estimated Annual CO₂ Reduction: (tons)
Municipal Measures:		
Installation of a 200kW Wind Turbine in Arlington.	Proposed	186
Installation of PV Systems on Municipal Buildings.	Proposed	11.8
Town Demonstration House	Proposed	1.7
Purchase of Clean Electricity (Municipal)	Proposed	306
Become a "Solar Boston" Partner	Proposed	N/A

¹⁶ Predith, Ashley, and Tim Woolf. 2004. CO₂ Reduction Workbook: A Method for Calculating CO₂ Reductions From Electricity Measures in Municipal Climate Change Action Plans. Synapse Energy Economics, Inc..

¹⁷ ISO New England Inc. 2004. 2003 NEPOOL Marginal Emission Rates Analysis [online]. [Cited 8 April 2005] Available from World Wide Web: <http://www.isone.com/Planning_Reports/Emissions/Marginal_Emissions_Analysis_2003.pdf>

¹⁸ Seyhun, Sinan. "Interview with Domenic Lanzillotti, Purchasing Manager for the town of Arlington." (10 March 2005).

Residential and Commercial Measures:		
Installation of PV Systems in Residential and Commercial Buildings	Proposed	293
Residential Use of Solar Hot Water Heating	Proposed	41.4
Purchase of Clean Electricity (Community)	Proposed	4,890
Sustainable Arlington Website	Proposed	N/A
TOTAL	---	5,730

3.3 Installing Renewable Energy Technologies in Arlington

Renewable energy installation on municipal buildings, businesses, and homes has been limited due to lack of knowledge about clean energy and high start-up costs. However, programs and funding opportunities, available through the MTC and MRET, have been working to break down these barriers and increase the use of renewable energy throughout Massachusetts.

Wind power and photovoltaic panels (PV) are the most suitable clean energy sources for Arlington to consider and/or install. PV and domestic solar water heating systems can be installed directly on existing homes and businesses to reduce reliance on systems that are dependent on fossil fuels.

3.3.1 Existing Measures

Currently, the Town of Arlington is installing a 2.6 kW photovoltaic system at Arlington High School with financial support from Massachusetts Technology Collaborative's Solar to Market Initiative (see description in section 3.3.2). Given the energy needs of the high school, this is considered merely a PV system for educational purposes. It is strongly recommended that an appropriately-sized PV installation be installed for the high school's true energy requirements.

Arlington's Board of Selectmen approved the installation of a meteorological tower within the Town in order to gather data on wind speed and availability, during its meeting on February 28th, 2005. The data will be used to assess the feasibility of installing a wind turbine to generate clean power for domestic use and sale in the market.

As of January 31, 2005, there were 6 residential solar PV Systems installed with MRET funding in Arlington.¹⁹ A table that lists these residential PV applications and their size can be found in Appendix G.

3.3.2 The Options

While MTC funding opportunities are continually in flux and subject to change, they represent the state's commitment to clean energy development. New programs are also being added. Grants awarded are influenced by merit, commitment by elected officials, breadth of community support and availability of resources. The following are current programs available to the Town²⁰:

¹⁹ Seyhun, Sinan. "Interview with Maria Simoneau, Sustainable Arlington group member." (5 April 2005).

²⁰ Massachusetts Technology Collaborative Home Page [online]. [Cited 10 March 2005]. Available from World Wide Web: <www.masstech.org>.

Table 8: MRET funding opportunities

MRET funding opportunity	Amount/type of funds	Description	Current deadlines
Commercial, Industrial & Institutional Initiative Feasibility Study and Design & Construction Grants	Feasibility grants are available up to a maximum of \$40,000. The <u>Design phase</u> award and <u>Construction phase</u> award not exceed \$150,000 and \$500,000, respectively.	Eligible projects must employ renewable energy technologies with a capacity greater than 10kw (25kw for wind). Also at least half of the renewable power produced must be used onsite.	Ongoing
Green Schools	An Alternative Energy Feasibility Study for Arlington Thompson School was awarded.	Provides information, services and funding for feasibility studies, design, construction and education activities of green public schools employing renewable technologies	Ongoing
Solar to Market Initiative Massachusetts Photovoltaic (PV) Industry Loan Fund (aka MIT Cluster Program)	This fund is making available \$5.3 million in debt financing. Also includes rebates of \$4-5/Watts for solar installations	The purpose of this fund is to provide strategic debt financing to eligible corporations for business development and expansion activities, and to leverage funds from other financial institutions. As such, it could be an opportunity to attract Green Business Development to Arlington	This program is no longer accepting applications. (See Small Renewables Initiative)
Solar to Market Initiative Administered by MIT Cluster Program	50 percent of capital costs for solar installations. 38 cents / kWh is paid to the grant receiver for the first 3 years.	Arlington or MIT-connected residents and small businesses can apply for grants to install PV systems under 60 kW.	Ongoing
Small Renewables Initiative Rebates for Small Scale Renewable Applications	Rebates up to \$50,000	Municipal buildings and schools; commercial, industrial, or institutional facilities; and residential properties including single family homes may apply for rebates for installing renewable energy applications. For this initiative, projects are limited to 10 kilowatts.	Ongoing
Community Wind Collaborative	Funding for capital costs.	This Initiative assists communities with wind potential explore their options for municipal wind energy development.	Ongoing

Service Contracts to Municipalities		Wind maps are available for municipalities on the MTC web site to determine initial feasibility of municipal wind power generation.	
Community Planning Community Outreach, Planning and Siting Initiative	No grants available at this time	This grant assists regional entities, municipalities and non-profits to create tools to assist renewable energy siting.	This grant is currently closed. It is anticipated that when it re-opens it will be for regional planning entities to create specific tools for municipalities

3.3.3 Proposed Municipal Measures

The Town has several options for installing renewable energy technologies:

3.3.3.1 Installation of a Wind Turbine:

The Town should search for possible sites and funding opportunities to install a wind turbine in Arlington. Locations suitable for an installation could be next to communication towers, utility poles, flag poles, water towers and other similar existing structures to avoid aesthetic concerns. An option is for the Town to work with a wind power developer to construct a utility scale or smaller turbine somewhere in Town. McKenzie Bay International is one company that builds wind turbines for communities on a Build – Own – Operate basis where the company covers the initial costs and sells the electricity generated through the facility to the local consumers at a negotiated price. Carbon dioxide emission reductions and the price of electricity depend on location of the turbine, its size and wind availability.

CO₂ Emissions Reduction: 186 tons of CO₂ per year.

3.3.3.2 Installation of PV Systems on Municipal Buildings:

The Town should make use of the available grants for the installation of photovoltaic (PV) systems on municipal buildings. Specifically, the Town should expand the solar project underway at Arlington High School to provide a larger portion of the buildings electricity, conduct associated classroom activities to raise awareness and engage students in the process. The Town should also consider similar systems for other schools. These initiatives can be supported via MTC’s **Small Renewables Initiative (SRI)**, which offers rebates for up to \$50,000 and also through MTC’s **Commercial, Industrial & Institutional Initiative** which offers grants for feasibility studies, design and construction.

CO₂ Emissions Reduction: 11.8 tons per year.

3.3.3.3 Becoming a of “Solar Boston” Partner:

The Town should become a partner of “Solar Boston”, a collaboration of the United States Department of Energy, solar energy businesses, and local community organizations, to promote and facilitate solar energy installations. In order to become a partner, a letter needs to be submitted to the organization explaining the intentions and expectations of the subscribing party for participation.

3.3.3.4 The Town Demonstration House:

The Town of Arlington should consider options to convert an existing municipal property into a Demonstration House to educate residents and businesses about renewable energy. The house should be equipped with a 2.6 kW PV system and a solar hot water heating system. The Tufts Climate Initiative at Tufts University in Medford, MA has a green demonstration house that was renovated in 1999.

CO₂ Emissions Reduction: 1.69 tons per year.

3.3.3.5 Other Recommendations:

The Town of Arlington has saved \$130,000 in FY2004 due to a number of measures taken to increase energy efficiency in Town buildings, streetlights and traffic signals.²¹ The Town should allocate some of those savings to be used in renewable energy applications on municipal buildings.

Additional funds may be available through the MTC/MRET Commercial, Industrial & Institutional Initiative, which is appropriate for non-school municipal buildings undergoing construction, such as the Park Circle Fire Station.

3.3.4 Proposed Residential and Commercial Measures

3.3.4.1 Installation of Residential PV Systems:

Residents can take advantage of some of the funds and technical assistance offered by the Small Renewables Initiative. In addition to the MTC's facilitation, there is a program in Massachusetts, called net metering, for those installing renewable energy systems smaller than 60 kW in size (the typical home uses 4-6 kW; local businesses may range from this to beyond 100 kW). If the electricity generated exceeds consumption at any time the electricity meter runs backward. If the customer is a net provider of electricity at the end of the month, the net energy generated for the month is credited at the average monthly market rate to the next month's bill.²²

CO₂ Emissions Reduction: 285 tons.

For PV systems installed under the MIT Cluster Program funded by MTC, keeping track of surplus power generated is easy with the tools provided through the program.

A sample 2.6 kW PV system could:

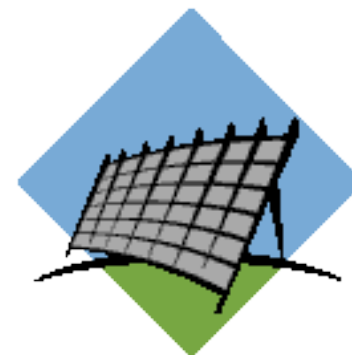
- Reduce monthly electric costs by about 30 percent (based on \$1,200 / year electric bill)
- Produce 2,500 kWh of electricity annually (based on a system in Wrentham MA, calculated using NREL PVWatts2 modeling software and conservative estimates for module and inverter efficiency)
- Prevent emissions of 2,950 lbs CO₂, 4.95 lbs SO₂, and 1.83 lbs of NO_x, annually. (Based on ISO New England's Marginal emissions rates for 2003)¹
- Produce a net positive cash flow of ~\$20/month (5c/kWh REC sales, if financed as part of mortgage at 6 percent over 30 years, \$11,166 MTC up-front grant, 15 percent Mass Income Tax credit).

²¹ Lee, Benjamin. "Interview with George Woodbury, Energy consultant from Light Smart Energy Consulting Services." (1 April 2005).

²² Database for State Incentives for Renewable Energy Home Page [online]. [Cited 8 April 2005]. Available from World Wide Web: <<http://www.dsireusa.org>>.

3.3.4.2 Installation of PV Systems in Commercial Buildings:

Business owners can take advantage of the funds and technical assistance offered by the Small Renewables Initiative and the Commercial, Industrial & Institutional Initiative through the MTC. The Town of Arlington should create and publicize an “Arlington Alliance of Sustainable Businesses” program that encourages local businesses, such as supermarkets, auto dealerships, and other commercial buildings, to take advantage of the rebates and tax deductions that are available for residents who install renewable technologies. The extent of and additional information on “Arlington Sustainable Businesses Program can be found in section 5.4.



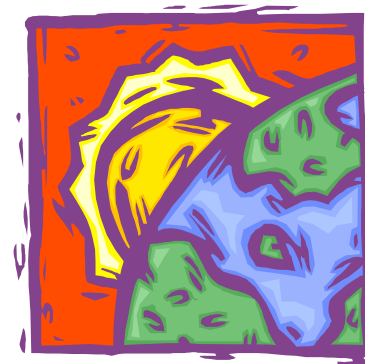
CO₂ Emissions Reduction: 7.4 tons.

3.3.4.1 Purchasing Renewable Energy Credits:

Residents can also help to develop new sites for renewable energy by purchasing Renewable Energy Credits. Currently, all power added to the New England electricity grid is registered and tracked by the New England Power Pool (NEPOOL) through a Generation Information System (GIS). For each unit of electricity added to the grid, NEPOOL issues a GIS certificate attesting this. Those certificates associated with electricity from renewable energy are commonly referred to as “Renewable Energy Certificates” (RECs).²³ At this time, state law requires all utility companies to purchase RECs to match 1.5 percent of the total load they deliver. MTC currently has a Clean Energy Choice Program where consumers pay a premium and the money goes to purchase some of these scarce RECs and take them out of circulation in order to increase pressure on utilities to build new solar, wind facilities. Residential and Commercial options for purchasing ‘Renewable Energy Credits’ will be discussed in section 3.4.4.

3.3.4.4 Residential Use of Solar Hot Water Heating:

Water heating accounts for approximately 14 percent of the average family's home energy consumption in the USA.²⁴ Solar hot water heating systems can help residents cut water heating energy use by 40 to 60 percent. A solar hot water heating system collects thermal energy from the sun to heat the water used to take showers, wash dishes and clean laundry. The Town can start initiatives for the installation of residential use of solar hot water heating systems. Over 1.5 million Americans have invested in solar hot water systems for their homes and businesses, to date, with over 94 percent of these customers considering the investment a wise decision. Prices for a complete solar water heating system range from \$2,000 to \$4,000. On the other hand, the life-cycle cost of a solar water heating system is at least 20 percent lower than a conventional water heater.



CO₂ Emissions Reductions: 41.4 (tons per year).

If a solar hot water heating system is included in the financing for a new home, the typical cost of the system ranges from \$13 to \$20 per month and because the system is included in the home's mortgage, the homeowner can take advantage of a federal income tax interest rate deduction.¹

²³ Massachusetts Technology Collaborative Home Page [online]. [Cited 10 March 2005]. Available from World Wide Web: <www.masstech.org>.

²⁴ US Department of Energy. Small Wind Electric Systems: A Massachusetts Consumer's Guide.

3.3.4.5 The Website: SustainArlington.org

The Town should also collaborate with the Sustainable Arlington group for the creation and maintenance of a website (e.g. www.sustainarlington.org) which will provide information on all clean energy programs available to the residents of Arlington. Further information on the website can be found in the Community Based Social Marketing section.

3.4 Purchasing Clean Power

It is now possible for the Town and community members to purchase renewable energy without necessarily installing renewable technologies in Arlington. By purchasing renewable energy, or clean power, to meet electricity needs, Arlington can displace the CO₂ emissions that would otherwise be produced to provide its electricity. Purchasing clean power is currently the most cost-effective way of mitigating CO₂ emissions from the Town's electricity consumption.

3.4.1 Existing Measures

The Town of Arlington is not purchasing clean power at this time. The Town currently has a contract with Trans Canada Power to supply electricity to the municipal buildings which will expire in September 2006.²⁵ On the other hand, there are currently 14 households in Arlington that participate in the clean energy choice program through the Massachusetts Energy Consumers Alliance.²⁶

3.4.2 The Options

The deregulation of the Massachusetts electricity industry in 1998 has given all electricity customers the option of choosing their electricity supplier. Customers can now purchase electricity from competitive generation companies instead of NSTAR, the local distribution company serving Arlington. Some of these competitive generation companies offer clean power products, which include different amounts and different types of renewable energy as the source of electricity.²⁷ While there are few clean power products available in Massachusetts today, the number and type of products is expected to increase in the next few years. Furthermore, with the establishment of a Generation Information System (GIS) at the New England Power Pool (NEPOOL), clean power purchases can be facilitated through purchases of renewable energy certificates from renewable generators in New England. There are currently four options that can be used to purchase clean power in order to offset CO₂ emissions from electricity consumption:

1. Purchase clean power directly from a competitive electricity supplier:

There are currently very few retail electricity suppliers in Massachusetts, especially for smaller customers. However, more competition is expected in the future, which should include clean power offerings. The Town can issue Request for Proposals (RFP) in order to assess both the financial and environmental implications of direct purchasing from the various competitive generation companies. In the future, community members may also have more opportunities for selection among clean power electricity providers. Other utility companies, such as Massachusetts Electric, Nantucket Electric and Narragansett Electric, are offering clean power products which provide customers with the opportunity to reduce their CO₂ emissions without having to change their supplier.

²⁵ Seyhun, Sinan. "Interview with Domenic Lanzillotti, Purchasing Manager for the town of Arlington." (10 March 2005).

²⁶ Seyhun, Sinan. "Interview with Chad Laurent, Program Coordinator for Massachusetts Energy Consumers Alliance." (14 April 2005).

²⁷ The Clean Energy Choice Program Home Page [online]. [Cited 15 March 2005]. Available from World Wide Web: <www.cleanenergychoice.org>.

²⁷ It is important to note that there are many different types of green power products, and some have greater environmental benefits than others. Those with the greatest amount of benefits include those that meet the following conditions: the renewable generator is new, the renewable generator is located in Massachusetts or New England, there is little or no air emissions, and there is little or no community opposition to the renewable project.

2. Purchase Renewable Energy Credits through a clean power marketer:
It is also possible to purchase clean power by buying renewable energy certificates (RECs), without switching to a different electricity supplier. Clean power marketers can facilitate this sort of clean power purchase. By purchasing large amounts of renewable energy certificates, power marketers are better able to negotiate deals with renewable energy developers. There are currently several companies or organizations that are offering renewable energy certificate sales in New England, including Sun Power Electric, the Mass Energy Consumers Alliance, Native Energy, Sterling Planet, and Community Energy. In addition, NSTAR has proposed a clean power product that customers can purchase without switching off its default service. One of the best examples to date is the City of Newton which purchases \$20,000 per year of clean energy from Mass Energy and therefore receives \$20,000 per year in matching grants from the Massachusetts Technology Collaborative.²⁸

3. Become a municipal aggregator and purchase energy from renewable developers. The Massachusetts Restructuring Act allows towns and cities to become municipal aggregators, which allows the municipality to establish a pool of all electricity customers within the community.²⁹ The main advantage of aggregation is that it allows the municipality to act as an agent for the town residents and negotiate with the electricity supplier to reduce costs for all customers. It also allows the municipality to negotiate for higher shares of clean power in the electricity that its residents receive. To become a municipal aggregator, a municipality must get local authorization via a majority vote at town meeting, town council, or city council. The municipality must also develop an aggregation plan for review by its citizens and for approval by Department of Telecommunications and Energy. The Massachusetts Municipal Association (MMA) has received a grant of \$75,000 to research MMA members' interest in becoming a clean power aggregator.

4. Become a municipal electric company and develop or purchase renewable energy. Historically, 40 Massachusetts municipalities have established their own electric utilities. These municipal electric companies own power plants, purchase their electricity from other community's power plants, or purchase power from other participants in the New England power market. Municipal utilities also set their own electricity rates. They are not subject to rules created by the Massachusetts Restructuring Act, and their activities do not have to be approved by the Department of Telecommunications and Energy. Though becoming a municipal utility provides a municipality with the most control over its power purchases, it is also a long and difficult task to establish the financial, political, and structural requirements.³⁰

These four options are available to the Town with regard to its own electricity purchases. Community members, on the other hand, only have the option of purchasing clean power directly from competitive suppliers or from clean power marketers. Currently, consumers are free to change their electricity provider. However, there are currently no competitive electric suppliers from which residential consumers can choose. Massachusetts Energy Consumers Alliance predicts that by 2010 electricity providers will be able to sell clean energy options that draw electricity from renewable energy sources such as wind power, small hydro or biomass, and that approximately 20 percent of the state's population will opt to purchase the cleaner energy.³¹ If the Town were to become either a municipal aggregator or a municipal electric company, then it could purchase clean power on behalf of all community members, in addition to buying such power for itself.

²⁸ Seyhun, Sinan. "Interview with Chad Laurent, Program Coordinator for Massachusetts Energy Consumers Alliance." (14 April 2005).

²⁹ Though all customers within the community will automatically have access to the electricity purchased by the municipal aggregator, any customer may exit the program at any time to choose their own electricity supplier.

³⁰ Massachusetts Municipal Wholesale Electric Company Home Page. [online]. [Cited 20 April 2005]. Available from World Wide Web: <www.mmwec.org>.

³¹ Town of Brookline. 2002. Local Action Plan on Climate Change [online]. [Cited March 2005] Available from the World Wide Web: <<http://www.townofbrooklinemass.com/Conservation/PDFs/ClimateActionPlanTOB.pdf>>.

3.4.3 Proposed Municipal Measures

The Town should investigate the opportunities available in the short-term for purchasing clean power for its own electricity consumption. The Town should also make sure that it is prepared, and has the flexibility to purchase clean power in the medium- to long-term future, as the Massachusetts electricity market becomes more competitive and the opportunities for clean power expand. To these ends, it is recommended that the Town take the following steps:

3.4.3.1 Municipal Purchase of Clean Power:

The Town should periodically investigate the opportunities for purchasing clean power from clean power marketers. This option is likely to be the most flexible, least risky and most low-cost way of offsetting the CO₂ emissions associated with the Town's electricity consumption, and thus should play a key role in achieving climate change goals. The Town should commit to purchasing 1-3 percent of its power through clean power marketers starting in 2006 and increase this commitment to 5 percent or more by 2010.

CO₂ Emissions Reduction: 306 tons per year.

3.4.3.2 Other Recommendations:

1. Whenever the Town solicits proposals for new generation companies to provide its electricity, it should explicitly request proposals for different levels of clean power, as well as regular undifferentiated power. Such proposals will provide valuable information about the costs and benefits of clean power options.
2. When entering into negotiations for new power supplies, the Town should avoid long-term contracts that would preclude the purchase of clean power products that may become available in the short to medium-term future.
3. The Town should investigate the advantages and disadvantages of becoming a municipal aggregator. This option has important implications for reducing the cost of electricity in general, for promoting energy efficiency within Arlington, and for purchasing clean power. It also has important implications for efficiency and clean power opportunities available to residential and commercial consumers. It therefore requires considerable scrutiny.
4. Purchasing clean power typically costs more than buying undifferentiated electricity. In order to reduce the cost of clean power purchases, the Town should consider subsidizing it by utilizing energy efficiency savings. The Town of Arlington has saved \$130,000 in FY2004 due to a number of measures taken to increase energy efficiency in Town buildings, street lights and traffic signals.³² As the amount of efficiency savings increase over time with increased activities, the amount of clean power purchases could also be increased accordingly.
5. The Town should lobby N-Star to establish a "green check-off program" where the residents can check a box in their utility bill to enroll in a clean energy program offered by the company. Massachusetts Electric currently has a similar "green-up" program.³³

³² Lee, Benjamin. "Interview with George Woodbury, Energy consultant from Light Smart Energy Consulting Services." (1 April 2005).

³³ Massachusetts Climate Action Network Home Page [online]. [Cited 13 April 2005]. Available from World Wide Web: <<http://www.massclimateaction.org/>>.

6. As it was previously proposed, the Town should collaborate with the Sustainable Arlington group for the creation and maintenance of a website which will include information on all clean energy purchasing programs available to the residents of Arlington. Further information on the website can be found in the Community Based Social Marketing Section.

3.4.4 Proposed Residential and Commercial Measures

3.4.4.1 Residential and Commercial Purchase of Clean Power:

The Town should undertake educational and promotional initiatives to encourage Arlington residents to purchase clean power and/or install clean power sources in order to offset the CO₂ emissions of their electricity consumption and to help reach reduced CO₂ goals for the community. The website project that was mentioned in the previous section has the potential of raising public awareness and support for sustainable energy options, by making it easier to learn about available programs. A list of available voluntary clean power products that Arlington residents can purchase is presented in Appendix H.

CO₂ Emissions Reduction: 4890 tons per year.

3.5 Conclusion

As it has been previously mentioned in section 3.2, residential and commercial units are the major contributors to the Town's CO₂ emissions. Residential and commercial buildings are responsible for over 90 percent of the electricity consumption, and therefore the related CO₂ emissions, in Arlington. For this reason, it is necessary for the Town to give priority to the proposed Residential and Commercial measures. The target for the Town has been set to reduce emissions by 10 percent, with respect to 1997 values, by 2010.

Purchasing Clean Power through renewable energy credits seems to be the most promising option available to the Town. As it has been previously explained in sections 3.4.2 and 3.4.3; residential, commercial and municipal consumers can offset 5 percent of the CO₂ emissions resulting from electricity consumption by buying RECs. The total annual costs associated with this measure are \$166,000 for the residential and commercial consumers and \$10,400 for the municipality (See Appendix F).

In addition, as explained earlier in 3.4.1 and 3.4.3, the Town of Arlington is eligible for grants from the MRET, matching its expenditure on RECs. Hence, the Town will be eligible for a grant of up to \$10,000 from the MRET. We have also proposed in this section that the money saved through energy efficiency measures be used in installing renewable energy applications and purchasing clean power. These measures have the potential to create over \$140,000 of annual funding to be used for the installation of renewable technologies and clean power purchases.

Although residential and commercial sources are responsible for a high percentage of the CO₂ emissions, it is essential that the Town take an initiative on incorporating renewable energy into Arlington and lead by example. For this reason, the Town should also consider the proposed municipal measures to be implemented by 2010. As it was proposed in the previous section, the Town should appoint a "Sustainability Program Manager" and establish an "Energy Management Workgroup", whose task will include preparing an emissions inventory and coordinating the Town's efforts in installing renewable energy applications and purchasing clean electricity.

4 Transportation

4.1 Introduction

Americans have become increasingly dependent on their vehicles for almost every trip that they make each and every day. In the past couple of years, the size of the vehicles on the road has increased and their efficiency has decreased. There is evidence of vehicle dependence even in Arlington among the residents that commute to work. For example, on average, 68 percent of residents in Arlington commute to work in a car by themselves and 6.8 percent of residents carpool to work. Of the remaining residents that commute using alternate forms of transportation, 6.7 percent take the bus, 11 percent ride the train, 1.7 percent walk, 0.87 bicycle, and 0.37 use an alternate form of transportation.



Transportation is a major factor affecting the amount of carbon dioxide emissions in the Town of Arlington. With a population of 42,389, there are an estimated 24,900 cars and 33,900 trucks in Arlington. These vehicles use approximately 16,800,000 gallons of gasoline per year. For every gallon of gasoline that is used in an automobile, approximately twenty pounds of carbon dioxide and other pollutants are emitted into the atmosphere. This means that the Town of Arlington emits approximately 336,000,000 pounds of carbon dioxide per year, or the equivalent of 168,074 tons per year. It would prove to be extremely difficult to decrease the amount of carbon dioxide released into the atmosphere in Arlington without reducing transportation emissions. To meet the goal of reducing carbon dioxide emissions 10 percent below 1997 levels by 2010 and 20 percent by 2020, it is necessary to make a 10 percent reduction in the carbon dioxide emissions resulting from residential transportation usage. By implementing the proposals outlined below, it would be possible to reduce the emissions that are caused by transportation by 18,300 tons per year. If these programs were approached rigorously, a much larger savings of carbon dioxide could be achieved by 2010.

4.2 Recommendations

For methodology behind calculations, please refer to Appendix I.

Table 9: Proposed CO₂ Emissions Reduction Measures.

Measures	Status	Estimated Annual CO ₂ Reduction (tons) in 2010
<i>Municipal Measures</i>		
Fuel-Efficient Procurement Policy for Town Vehicles	Existing	35.4
Municipal No-Idling Policy	Proposed	27.4
Trip-Reduction Programs for Municipal Employees	Proposed	321.7
Police Units On Bicycle	Proposed	7.3
Converting DPW Fleet to Biodiesel	Proposed	95.4
State and Federal Funding	Proposed	N/A
Clean Cities Program	Proposed	N/A
<i>Residential and Commercial Measures</i>		
Crosswalk Improvement	Existing	16.5
Walking In Arlington	Existing	16.5
Safe Routes to School	Existing	0.4
Federal Tax Incentive for Clean Fuel and Electric Vehicles	Proposed	N/A
Infrastructure Improvements for Bicycles	Proposed	16.7
Traffic Calming and Improvements in Pedestrian Safety	Proposed	163.1
Enforcement of Traffic Laws	Proposed	114.3
School Wide No Idling Policy	Proposed	95.9
Encourage Non Motorized Transport to School	Proposed	67.5
Need for More Crossing Guards	Proposed	16.4
Trip-Reduction Programs	Proposed	106.1
Ride Share Program	Proposed	78.3
Transportation Options Center	Proposed	11.3
Commuter Challenge	Proposed	112.6
Use of Car Sharing	Proposed	78.3
Campaign Challenge to Reduce Emissions	Proposed	114.3
Fuel Efficient Car Choice Campaign	Proposed	336.1
Policy Measures in Arlington		1,831.5
Support and Lobby for State Government Policies to Improve Fuel Efficiency and Reduce Vehicle Miles Traveled	Proposed	13,277.8
Lobbying for Federal Corporate Average Fuel Economy Standards	Proposed	3,202.1
State and Federal Policy Measures		16,480.0
Total		18,311.5

4.3 Existing Municipal Measures

4.3.1 Fuel-Efficient Procurement Policy for Town Vehicles

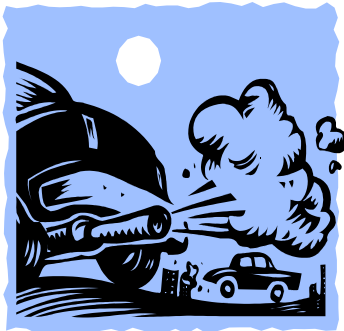
Warrant Article 22, the Fuel-Efficient Procurement for Town Vehicles, was passed at the 2002 Annual Town Meeting. For the text of Warrant Article 22, please refer to the Appendix J. The objective of the Fuel-Efficient Procurement for Town Vehicles is to ensure that when Arlington purchases motor vehicles for its municipal use,

each vehicle is the most fuel-efficient, reliable, and practical model available to fulfill the intended municipal function.³⁴ Although the municipal vehicle fleet is only a small fraction of the community's total number of vehicles, the Town can significantly reduce its greenhouse gas (GHG) emissions and act as an example for Arlington residents and commercial establishments by purchasing more fuel-efficient vehicles, such as the Toyota Prius. The Prius requires 49 percent less gasoline to operate than a regular, midsize vehicle.³⁵ For further information about the Prius, please refer to the Appendix K. The Purchasing Department should continue to consult with Sustainable Arlington on currently available efficient-vehicle choices.

CO₂ Emissions Reduction: 35.4 tons per year

4.4 Proposed Municipal Measures

4.4.1 Municipal No-Idling Policy



Idling is an unnecessary waste of money and fuel and an irrational contributor to air pollutants and GHGs in the atmosphere. Any gasoline or diesel vehicle idling for two hours burns two gallons of gas and emits approximately 44 pounds of CO₂ into the atmosphere.³⁶ In addition to the emissions, an idling vehicle affects engine life. A diesel vehicle that idles for one hour a day has comparable engine wear to an engine that drives 64,000 miles and uses over 500 gallons of fuel annually.³⁷ Idling creates significant maintenance and fuel costs for the town. Without so much wear on the engine, municipal vehicles could have a longer life.

The Commonwealth of Massachusetts has mandated a 5-minute maximum idling time for vehicles.³⁸ The Town of Arlington should consider establishing an Idling Enforcement Program for municipal operations, which will enforce the 5-minute idling time prescribed by State regulations. The primary method of enforcement should be through an educational program and through incentives. Arlington can provide incentives in the form of public recognition for Town employees who obey the idling policies of the State and local government. By reducing the amount of time that Town vehicles idle, there would be an annual reduction equal to 27.4 tons of carbon dioxide.

CO₂ Emissions Reduction: 27.4 tons per year

4.4.2 Trip-Reduction Programs for Municipal Employees

The town of Arlington should engage in the following actions:

- Encourage the use of public transit by offering transit passes pretax to municipal employees
- Charge full market rates for daily parking on public property and on the streets in town
- Educate town employees about the option of walking, bicycling, the use of public transportation, and rideshare options for employees commuting to work

³⁴ 2002. *Warrant Article #22: Procurement of Fuel-Efficient Town Vehicles* [online]. [cited 25 April 2005]. Available from World Wide Web: <<http://www.massclimateaction.org/MCANdocs/pdf/ArlFuelEfficSummary2.pdf>>

³⁵ *Driving the Prius Hybrid* [online]. [cited 22 April 2005]. Available from the World Wide Web: <www.1800arkansas.com/energy/index.cfm?page=transportation-driving_the_prius>

³⁶ *Truck and Bus Operators to Study Idle Emissions Controls* [online]. [cited 12 March 2005]. Available from World Wide Web: <<http://www.enn.com>>.

³⁷ American Trucking Association. 1989. *Document #1419, Diesel Idling* [online]. [cited 11 March 2005]. Available from World Wide Web: <http://www.greentuck.com/air_emissions/1419.html>.

³⁸ *Massachusetts General Law, Chapter 90, Section 16A*, [online]. [cited 28 February 2005]. Available from World Wide Web: <<http://www.mass.gov/legis/laws/mgl/90-16a.htm>>.

- Promote flexible hours policies and enable 25 percent of City employees to telework or work compressed schedules at least one day every two weeks by 2010
- Expand the participation of Town departments in vehicle-sharing programs
- Promote on SustainArlington.org the idea of a Town Employee carpooling program

CO₂ Emissions Reduction: 321.7 tons per year

4.4.3 Police Units on Bicycle³⁹

The Arlington Police Department should implement the use of bicycles for their regular patrols of the Minute Man Bike Trail during the months of April through November. A police bicycle program can result in many benefits for the Town. Moving police out of cars and onto bicycles can reduce municipal fuel use and expenditures and can also provide visible evidence that bicycling is a legitimate option for transportation. Bike police can also have a positive impact on crime as bicycles are more difficult for criminals to spot than cruisers or motorcycles and they can also access areas that are inaccessible to cars. In addition, the patrols are good for public relations, as they make the police more approachable and can be used for special events, such as Town Day.

Police cyclists lead by example - promoting helmet use and bike safety to the community and its children.

In the past, there has been a police presence on bicycles in Arlington. Due to funding and personnel loss, the program has been eliminated. The reinstatement of such a program would be very cost effective because the police department already owns bicycles. Thus, the cost of purchasing bicycles would be zero. The costs that would be incurred in reinstating police patrols on bicycles include maintenance of the bicycles and mountain bike training courses to train those using the bicycles to effectively apply them to patrols. As a result of decreased use of police cruisers, the amount of carbon dioxide emitted into the atmosphere by Arlington will be reduced by 2 tons per bicycle per year. Arlington should replace four vehicular patrols with bicycles each day to contribute to the overall municipal effort to reduce carbon dioxide.

CO₂ Emissions Reduction: 7.3 tons per year

4.4.4 Conversion of DPW Fleet Vehicles to Biodiesel⁴⁰

The Town of Arlington should convert the heavy trucks used by the DPW to use biodiesel fuel. Biodiesel is a clean, renewable diesel fuel substitute produced from agricultural resources such as soybeans, rapeseed or waste vegetable oil. It can be burned in any standard, unmodified diesel engine. Current biodiesel fleets have reported operational consistency over extended periods of use in terms of engine performance, payload power and range, which remain completely unaltered. If the town's heavy trucks and equipment vehicles currently running on diesel were fueled with biodiesel for eight months each year, by 2010 477 tons of CO₂ could be eliminated.

CO₂ Emissions Reduction: 95.4 tons per year

4.4.5 State and Federal Funding⁴¹

Arlington should apply for funding through the Transportation Equity Act for the 21st Century, known as TEA-21, which is the federal authorizing legislation for surface transportation. The funds are allocated and

³⁹ Town of Brookline. 2002. Local Action Plan on Climate Change [online]. [Cited March 2005] Available from the World Wide Web: <<http://www.townofbrooklinemass.com/Conservation/PDFs/ClimateActionPlanTOB.pdf>>.

⁴⁰ Town of Brookline. 2002. Local Action Plan on Climate Change [online]. [Cited 3 March 2005] Available from the World Wide Web: <<http://www.townofbrooklinemass.com/Conservation/PDFs/ClimateActionPlanTOB.pdf>>.

⁴¹ Cambridge Climate Protection Plan. [online]. [Cited 20 April 2005]. Available from World Wide Web: <http://www.cambridgema.gov/~CDD/et/env/clim_plan/clim_plan_full.pdf>.

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.

4.4.6 Clean Cities Program⁴²

Arlington should take advantage of the Clean Cities Program. Under this federal program, Arlington can be reimbursed for the difference in cost between a conventional and an alternative fuel vehicle. The Division of Energy Resources (DOER) offers \$2,000 grants to offset the incremental cost of purchasing each additional alternative fuel vehicle. The program also provides assistance for creating the infrastructure needed for alternative fuel vehicles.

4.5 Existing Residential and Commercial Measures

4.5.1 Crosswalk Improvement

In 2003, the Arlington Transportation Advisory Committee began a pilot program to improve crosswalks in Arlington. A working group was created to determine the crosswalks that were most in need of repair. Seven crosswalks located on Massachusetts Avenue were selected as the most critical. The Transportation Advisory Committee (TAC) used their own budget to redo these crosswalks. Since then, the working group has continued to identify more crosswalks in need of repair each year. The Department of Public Works (DPW) is in charge of annual repainting of the town's crosswalks. A portion of their budget has been set aside so that more crosswalks in town can be redone using thermoplastic.⁴³ Each year, the DPW repairs fifteen or more crosswalks using thermoplastic. Eventually, they hope to have all crosswalks completed in this new, long-lasting method. As the number of clearly visible crosswalks increases, it becomes increasingly likely that Arlington residents will alter their behavior and walk to their destination instead of riding in their automobile alone. For further information about crosswalks in Arlington, please refer to the Appendix L.



CO₂ Emissions Reduction: 16.5 tons per year

4.5.2 Walking in Arlington

“Walking in Arlington” is a pedestrian advocacy and walking safety group that works with residents, community groups, and Town officials to make walking safer in Arlington. The mission of Walking in Arlington involves four campaigns: a campaign to reclaim sidewalks and pedestrian space, a campaign to promote walking, a campaign to improve Arlington's streets and paths for pedestrian use, and a campaign to advocate

⁴² Cambridge Climate Protection Plan. [online]. [Cited 20 April 2005]. Available from World Wide Web: <http://www.cambridgema.gov/~CDD/et/env/clim_plan/clim_plan_full.pdf>.

⁴³ Thermoplastic- a compound extruded or mechanically sprayed on the pavement that cools to pavement temperature. When combined with glass spheres, it produces a reflectorized pavement marking. *Thermoplastic Traffic Stripe*[online]. [cited 26 April 2005]. Found on World Wide Web: <<http://tomcat2.dot.state.ga.us/thefsource/pdf/specs/ss653.html>>.

for fair enforcement of state laws and local bylaws.⁴⁴ Carbon dioxide reductions will occur as the result of decreased dependence on automobiles and an increase in the amount of walking in Arlington because of the actions of “Walking in Arlington.”

CO₂ Emissions Reduction: 16.5 tons per year

If every resident in a city of 100,000 people replaced one car trip with a bicycle trip once a month, CO₂ emissions would drop by 3,764 tons a year.

4.5.3 Safe Routes to School Program

Safe Routes to School (SRS) is a program implemented by WalkBoston that looks to increase the number of children walking or bicycling to school. Arlington was chosen as a demonstration project for SRS during the 2000 school year. The program was carried out at Dallin and Thompson Elementary Schools, as well as Ottoson Middle School. The major component of the SRS program is the “walking bus.” It was made up of a group of children walking to school escorted by two trained parent volunteers. The “bus” follows a designated walking route and picks up children at established points in the neighborhood.

Immediately following the program in 2000, 217 more students began walking to school. Moreover, there has been a daily decrease of 287 vehicle trips and 951 miles traveled by automobiles that would have otherwise driven these children to and from school⁴⁵

CO₂ Emissions Reduction: 0.4 tons per year

4.6 Proposed Residential and Commercial Measures

4.6.1 Federal Tax Incentive for Clean Fuel and Electric Vehicles⁴⁶

Arlington should publicize to its residents the availability of tax credits for ownership of both clean fuel and electric vehicles. For further information about these tax credits, please refer to the Appendix M.

4.6.2 Infrastructure Improvements for Bicycles

Arlington’s Bicycle Advisory Committee (ABAC) is presently working with TAC on bicycle accommodation for the proposed redesign of Massachusetts Avenue between the Cambridge line and Arlington Center. Other proposals that ABAC is currently working on include placing signs on the Minuteman Bicycle Path before entering Arlington center that contain town information, such as businesses, the location of restrooms, the best directions across town to continue on the bike path, etc. They would also like to see efficient and clearly marked walking and bike routes across Arlington center, which may include stenciling on sidewalks to help guide pedestrians and assist bicyclists as they maneuver across Massachusetts Avenue and continue on the Minutemen Bike Path. ABAC should continue to work with TAC and Sustainable Arlington to promote the safe use of bicycles throughout town and to influence residents who commute alone to work each day to alter their behavior by bicycling to work on a more frequent basis. For more information about Bicycling in Arlington please see Appendix N.

CO₂ Emissions Reduction: 16.7 tons per year

⁴⁴ *Walking in Arlington* [online]. [Cited 5 March 2005]. Available from World Wide Web: <http://walking_in_arlington.tripod.com/complete.htm>.

⁴⁵ Safe Routes to School. 2002. *Final Report of the Arlington Demonstration Project*. p.4-6.

⁴⁶ Cambridge Climate Protection Plan. [online]. [Cited 20 April 2005]. Available from World Wide Web: <http://www.cambridgema.gov/~CDD/et/env/clim_plan/clim_plan_full.pdf>.

4.6.3 Traffic Calming and Improvements in Pedestrian Safety

Pedestrian safety is of serious concern to Arlington residents. 63 percent of residents who mailed in the Vision 2020 Survey felt that studies examining pedestrian safety are “very important”. Locations of particular concern include Massachusetts Avenue, Lake Street, Pleasant Street, the Route 16/Massachusetts Avenue intersection and Downing Square.⁴⁷

The town of Arlington should consider installing traffic calming devices in dangerous intersections throughout town. Depending upon the situation, speed humps, chokers, traffic circles, raised crosswalks, raised median islands, crosswalk refuges or chicanes are the most effective choice to slow traffic and promote pedestrian safety. Calming options, an explanation and the costs are outlined in the table below.

Table 10: Traffic Calming Measures and Implementation Costs⁴⁸

Traffic Calming Measure	Explanation	Cost
Speed hump	A narrow, slightly raised area crossing travel lanes.	\$2,000-\$3,000
Choker	A physical curbside constriction narrowing a travel lane.	\$7,000-\$10,000
Traffic circle	An elevated area in the middle of an intersection; provides counterclockwise traffic flow.	\$3,500-\$15,000
Raised crosswalk	A raised hump with a 10-foot-wide flat top.	\$2,500-\$8,000
Raised median island	An elevated area in the middle of a roadway.	\$5,000-\$15,000
Crosswalk refuge	A raised median in the middle of a roadway, with a cut for the crosswalk.	\$5,000-\$15,000
Chicane	Alternating curbside constrictions channel travel in a snake-like fashion.	\$5,000-\$15,000

CO₂ Emissions Reduction: 163 tons per year

4.6.4 Enforcement of Traffic Laws

Traffic laws need to be enforced so that residents feel safe when they are bicycling, walking, running, etc. on the streets of Arlington. Rules that particularly need to be enforced include those involving speeding, crosswalk violations and reckless driving. If Arlington residents felt safer when walking, bicycling, etc., they may be more inclined to use these as alternate forms of transportation.

CO₂ Emissions Reduction: 114.3 tons per year

⁴⁷ Downing Square consists of the intersection of Park Avenue, Park Avenue Extension, Lowell Street, Bow Street, and Westminster Avenue

⁴⁸ *Traffic Calming*. [online]. [Cited 15 March 2005]. Available from World Wide Web: <<http://www.virginiadot.org/infoservice/faq-traffic-calming.asp>>

4.6.5 School-wide No-Idling Policy

In order to be consistent with the Municipal No-Idling Policy, the Town of Arlington should also implement a No-Idling Policy for School Vehicles and also a for Parents dropping their children off at school each day. For further information about the Municipal No-Idling Policy, please refer to section 4.4.1. By reducing the amount of time spent idling at schools in Arlington, 95.9 tons of carbon dioxide will be decreased each year.

CO₂ Emissions Reduction: 95.9 tons per year

4.6.6 Encourage Non-Motorized Transport to School

The Town of Arlington and the Board of Education should encourage children to walk, bicycle or use public transportation to travel to school and also provide education to them about how to do this safely. Changing this behavior will have multiple effects. First, it will reduce the number of automobile trips taken each day in the town of Arlington and will ultimately reduce carbon dioxide emissions. Using alternate forms of transportation to commute to school teaches children that walking and bicycling are legitimate transportation alternatives to driving.

CO₂ Emissions Reduction: 67.5 tons per year

4.6.7 Need for more Crossing Guards, Crosswalks and Sidewalks



Despite the efforts to promote pedestrian safety in Arlington, there are not enough sidewalks, crosswalks and crossing guards in areas surrounding schools. To promote safety for children crossing the streets on their way to school, there should be increased numbers of crossing guards located on major routes to school more crosswalks and improved sidewalks. During the winter months, there should also be an improved enforcement of snow removal from sidewalks such that school children can navigate safely throughout town.

CO₂ Emissions Reduction: 16.4 tons per year

4.6.8 Trip-Reduction Programs

Arlington should assist local businesses and residents by creating the following trip-reduction programs:

- Businesses should offer a matching program for individuals interested in carpooling.
- Employers should encourage the use of public transit by offering transit passes pretax.
- Businesses in Arlington should consider cost-effective alternatives to purchasing company vehicles, such as the use of car sharing programs.
- Support expanded transit lines and increased frequency of service.
- Encourage shared parking opportunities such as movie theaters with primary parking needs in evenings and churches or other facilities with weekend-only parking needs. This would free space for community gardens, bicycle lanes, etc.
- Publicize and participate in campaigns to promote alternatives to single-occupancy vehicle travel.
- Work with businesses to encourage all employers who offer subsidized parking to employees also to offer a parking “cash out”—an equivalent payment to employees who do not require vehicle parking.

CO₂ Emissions Reduction: 106 tons per year

4.6.9 Ride Share Program

In Arlington, there should be an internet-based rideshare program on SustainArlington.org that would encourage the use of carpools and vanpools on trips and commutes to work on a daily basis. Throughout Vermont, the Public Transportation Association maintains a ride share and carpooling website that enables increased mobility, the reduction of air pollution, a decrease in fuel consumption, a decrease in the amount of traffic congestion, and offers alternatives to the single occupant vehicle.⁴⁹ In addition to the internet-based rideshare program there could also be a corkboard with some thumbtacks placed either in town hall, the library, or some local businesses so that individuals can advertise or search for rides. The savings of carbon dioxide, totaling 76.0 tons per year, would be the result of fewer vehicles on the road because of carpooling.

The benefits of ridesharing include: reducing commuting costs, reducing wear and tear on your vehicle, entering a more stress free commute, and helping your community by reducing traffic congestion and the amount of carbon dioxide emitted into the air.

CO₂ Emissions Reduction: 78.3 tons per year

4.6.10 Transportation Options Center

The downtown of Arlington should post a Transportation Options Center in a public, highly visible location that helps residents and visitors learn about the variety and ease of travel alternatives that are available in Arlington. Such information could include brochures highlighting alternative modes of transportation, maps and schedules of bus routes that travel through Arlington, information regarding the best and safest walking and bicycle paths through the downtown as well as information about car sharing options. This information should also be posted on SustainArlington.org. The carbon dioxide savings as a result of this information being provided to residents demonstrates how easy it is to use alternate forms of transportation and would encourage a change in methods of transportation.

CO₂ Emissions Reduction: 11.3 tons per year

4.6.11 Commuter Challenge



Arlington’s businesses and residents should partake in their own version of Canada’s Commuter Challenge⁵⁰ in its attempt to reduce emissions in transportation. On Earth Day, April 22, the town of Arlington should begin having a “Sustainable Commute” day where commuters in Arlington seek to use alternative, sustainable methods of transportation to go to work. Someday this could potentially turn into friendly competition with Cambridge, Somerville, Medford and other surrounding towns. Using a different method of commuting would hopefully inspire some individuals in Arlington to change the way they commute for the rest of the year and thus reduce their carbon dioxide emissions at the same time. “Sustainable Commute” day could be advertised throughout town with posters being displayed in public buildings, businesses and on SustainArlington.org.

CO₂ Emissions Reduction: 113 tons per year

⁴⁹ *Vermont Rideshare* [online]. [cited 17 April 2005]. Available from World Wide Web: <<http://www.vermontrideshare.org/>>.

⁵⁰ *National Commuter Challenge* [online]. [cited 29 March 2005]. Available from World Wide Web: <<http://www.commuterchallenge.ca/english/index.aro>>.

The Commuter Challenge is friendly competition between Canadian Communities to encourage the use of sustainable modes of transportation to and from work. During Environmental Week and on Clean Air Day several Canadian communities compete to determine which community has the largest number of individuals who use sustainable methods of transportation during their commute.

4.6.12 Use of Car Sharing

Arlington should promote car sharing for its residents. This can be done by providing information and links to various companies involved in car sharing on www.SustainArlington.org. One car sharing company that could be promoted on the website and throughout town is ZipCar. For more information about ZipCar, please refer to Appendix P. By increasing the amount of car sharing in Arlington, there can be a possible reduction of 78.3 tons of carbon dioxide per year.

CO₂ Emissions Reduction: 78.3 tons per year

Each Zipcar replaces seven to ten privately owned vehicles.

4.6.13 Campaign Challenge to Reduce Emissions

In Arlington, there should be an overall community campaign that will aim to reduce all greenhouse gas emissions on an individual basis. An example of such a campaign is Burlington, Vermont's 10% Challenge, which is a voluntary program to help residents and businesses reduce emissions by at least 10%.⁵¹ The 10% Challenge provides the tools and the information necessary to implement such a reduction. The online emissions calculator can be used to determine current annual emissions and to track the progress of emission-reduction techniques.

The Sustainability Program Manager should assist with the implementation of such a "challenge" campaign, providing literature and other tools to community members and businesses that wish to reduce emissions. In doing so, it is possible to educate residents on the large contribution of transportation towards their overall emissions.

CO₂ Emissions Reduction: 114.3 tons per year

4.6.14 Fuel-Efficient Car Choice Campaign

Although a change in the federal CAFE (Corporate Average Fuel Economy) standards would yield a huge gain in fuel efficiency, even without that, people can make choices within the existing vehicles on the market. In many cases, they can do this without sacrificing their perceived needs in a car – such as comfort, number of passengers carried, or cargo space. There is substantial variation in miles per gallon (MPG) between models even within the same vehicle classes, or between classes that provide the same functional utility.

For example, among compact cars, there is a 22 percent difference in MPG between a Toyota Corolla and a Saturn Ion. Among midsize cars, a Toyota Camry achieves 12 percent better mileage than a Chevrolet Malibu. Even larger savings can be found by switching from a small SUV to an equivalent-sized station wagon. A Toyota Matrix gets 15 percent better mileage than a Toyota RAV4. A Ford Echo mid-sized wagon gets 35 percent better mileage than a Ford Escape small SUV. For MPG comparisons please refer to the Appendix Q.

We estimate here that an effective social marketing campaign could influence 2 percent of drivers in Arlington to change their choice of vehicles; and estimate that over the five years 2006 through 2010 half of all drivers would purchase new cars. Further, based on the comparisons shown above, we estimate an average savings of 20 percent by choosing a more fuel-efficient vehicle.

CO₂ Emissions Reduction: 336 tons per year

⁵¹*Ten Percent Challenge* [online]. [cited 29 March 2005]. Available from World Wide Web: <<http://www.10percentchallenge.org/> found on the World Wide Web on March 29, 2005>.

4.6.15 Support and Lobby for State Government Policies to Improve Fuel Efficiency and Reduce Vehicle Miles Traveled

Several policies have been proposed at the state level that would significantly reduce transportation emissions in Arlington. The Town should lend its weight to efforts by the state administration, legislators, and environmental organizations to implement such policies. In combination, the three policies described below could reduce emissions by around 8 percent in 2010 and by higher amounts in later years.

Sliding scale auto sales taxes based on fuel efficiency: The state's 5 percent sales tax on motor vehicles could be modified to range from 0 percent to 10 percent based on the fuel efficiency of the vehicle model, with part of the variation within vehicle size classes. Governor Romney proposed such a system during his election campaign, and Arlington's State Representative James Marzilli has introduced it into the legislature. One estimate is that such a tax change could reduce CO₂ emissions by about 0.7 percent in 2010 and 3.3 percent by the year 2020.⁵²

Pay-As-You-Drive Automobile Insurance: One of the largest costs of owning a motor vehicle is insurance. But for almost all people this is a "fixed" cost, paid by the month or year, and not varying according to how much a person drives. Yet it is obvious that accident risks increase with miles driven, so charging for insurance at least in part based on amount of driving is logical. Doing so would increase the variable cost faced by drivers, and by one estimate could reduce vehicle miles traveled (VMT) by 5.6 percent to 11.2 percent.⁵³

Low rolling resistance tires: In order to help meet federal fuel-efficiency standards, virtually all new autos are sold with tires that reduce fuel use by having low rolling resistance (LRR). But such tires are generally not available when consumers replace their original tires, nor are tires even labeled with rolling resistance ratings. It has been estimated that requiring replacement tires to meet the same standards as new car tires would reduce CO₂ emissions by 1.6 percent in 2010 and 2.3 percent by 2020.⁵⁴

CO₂ Emissions Reduction: 13,300 tons per year

4.6.16 Lobbying for Federal Corporate Average Fuel Economy Standards⁵⁵

At the federal level, an important policy is the federal CAFE (Corporate Average Fuel Economy) standard. Presently, SUVs, vans and pickup trucks are held to a lower fuel economy standard than automobiles. Instead, there should be a universal fuel economy standard for all vehicles. Attempts to raise CAFE Standards 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. In order to obtain such a change in policy, Arlington residents should write, email or call their local state representatives and tell them how important it is to their constituency to reduce the amount of GHG emissions from motor vehicles.

CO₂ Emissions Reduction: 3,300 tons per year

⁵² MassPIRG Education Fund and Clean Water Fund. 2004. *A Blueprint for Action: Policy Options to Reduce Massachusetts' Contribution to Global Warming*. Boston: 24-25.

0.7% figure for 2010 extrapolated from 2020 figure by comparing 0.06 MMTCE (million tons carbon equivalent) expected savings in 2010 to 0.29 MMTCE expected savings in 2020.

⁵³ *A Blueprint for Action*, pages 25-26.

⁵⁴ *A Blueprint for Action*, pages 23-24.

⁵⁵ Town of Brookline. 2002. Local Action Plan on Climate Change [online]. [Cited March 2005]

Available from the World Wide Web: <<http://www.townofbrooklinemass.com/Conservation/PDFs/ClimateActionPlanTOB.pdf>>.

4.6.17 Lobby in support of the MBTA's Urban Ring Project

Arlington should urge the MBTA and the state government to provide funding for the MBTA's Urban Ring Project. The goal of the project is to help people get "around" easier by improving the circumferential connections among the spokes of the T's many radial lines, including the commuter train, green, blue, orange, red, silver and numerous MBTA bus lines. This improvement in transit will provide vital transportation and economic links between many Boston area communities. In addition, travel time and quality of service on the MBTA will be improved.

4.7 Conclusion

There are various strategies that can be used to reduce carbon dioxide emissions resulting from transportation activities in Arlington. Some of these methods will be more effective than others. To most effectively deal with the problem, it is necessary to implement a number of the policies that were described above. In most cases, Arlington will have to bear some cost and risk as a result of implementation. In the end, reducing carbon dioxide emissions from transportation will allow for the improved health, safety and welfare for both present and future generations in Arlington.

5 Outreach and Community Based Social Marketing (CBSM)

5.1 An Introduction to the Community Based Social Marketing (CBSM) Approach

The implementation of Arlington's Sustainability Action Plan (ASAP) will require residents, business owners, and municipal departments to change their behavior by adopting more sustainable practices. How do we encourage these three sectors of the Arlington community to participate in efforts to reduce carbon dioxide emissions?



To fully implement Arlington's climate action plan and reach the targeted emissions reduction goal, community members must be encouraged to reduce their CO₂ emissions and should be educated on the various options and benefits of adopting efficient behaviors. The Arlington community will benefit through implementation of the ASAP as CO₂ emission reductions improve air quality, reduce impacts on climate change, and provide savings in energy costs. Community education regarding the possible benefits of implementing this plan is the most important function of the ASAP because it is the people of Arlington who will be making sustainability happen. Therefore, the residential, commercial, and municipal sectors of Arlington make-up the target population of Arlington's Community Based Social Marketing (CBSM) plan.

CBSM is a pragmatic approach of encouraging sustainable behavior that has been shown to be highly effective at influencing behavior change.⁵⁶ The CBSM method involves identifying barriers and benefits to sustainable behavior, designing a strategy that utilizes behavior change tools, piloting the strategy with a small segment of the community, and evaluating the impact of the program once it has been implemented across a community.⁵⁷ CBSM is centered on the idea that generalized, information-intensive campaigns are not the most effective method to encourage sustainable behavior. Instead, CBSM focuses on developing a sustainability education campaign that is customized to address the perceived barriers and benefits for various sectors of a specific community.

The first step taken to develop a CBSM plan for Arlington is a survey of the perceived barriers and benefits of sustainability. Many Arlington residents completed a survey in April 2005 outlining their beliefs about a variety of issues including energy efficiency, renewable energy, transportation, and perceptions of sustainability. This survey (described in section 5.3.1) provided the data for the analysis of the current situation in Arlington and forecasts how the ASAP will be received in the community.

As Arlington's CBSM plan is developed, it is useful to understand how the target community members think and feel about the issues of climate change and sustainability. Many sustainable practices are already in effect in Arlington. For example, Utopia Cleaners on Massachusetts Avenue uses environmentally friendly dry cleaning products, Robbins Library had its lighting retrofitted so that it uses energy efficient bulbs, and many residents use energy efficient appliances. However, to achieve Arlington's targeted CO₂ reductions there must be greater participation within the community.

Arlington's CBSM plan will not only focus on encouraging continued sustainable behavior; the plan will also build awareness of environmentally conscious living to those who do not currently practice energy and fuel efficient behaviors. In order to encourage emission reduction amongst community members who are either not aware of the issues or feel there are too many barriers, a CBSM plan will be implemented to address the concerns identified through the April 2005 survey process.

⁵⁶ Doug McKenzie-Mohr and William Smith. *Fostering Sustainable Behavior: An Introduction to Community Based Social Marketing*. (Gabriola Island, B.C.: New Society Publishers, 1999.)

⁵⁷ Mohr et al. *Fostering Sustainable Behavior*, 15.

Step 1:

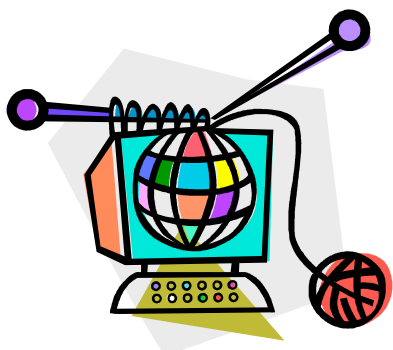
Doug McKenzie-Mohr, the founder of CBSM, identifies three main explanations for people not engaging in sustainable living practices in his book Fostering Sustainable Behavior. These explanations include the possibilities that people do not know about the activity or its benefits, people who know about the activity may perceive that there are significant difficulties or barriers associated with engaging in it, and although some people may feel that there are no significant barriers associated with an activity, they may perceive that they benefit most from continuing to engage in their present behavior because it is simply easier to do.⁵⁸

Step 2:

To address many of the perceived barriers to sustainability, the next step is to focus on methods useful to encourage behavior change. Mohr has also identified several human characteristics to consider when developing strategies to influence behavior change:

- People will naturally gravitate to actions that have high benefits and for which there are few barriers
- Perceived barriers and benefits vary dramatically among individuals, a benefit to one person may be a barrier to another
- Behavior competes with behavior [people make choices between behaviors - adopting one behavior (using compact fluorescent light bulbs) frequently means rejecting another (using incandescent bulbs)]

5.2 SustainArlington.org: Town-Wide Outreach



The SustainArlington.org website will be created to provide up-to-date information to Arlington residents, businesses, and Town Departments on Arlington's sustainability program. The website will be used to communicate all of the sustainability related opportunities and events available to the Arlington community. The website will also act as a forum for community members to ask questions and get answers about issues of sustainability.

5.2.1 Energy Efficiency Web Resources

- Current rebates and opportunities for the community to increase participation in energy efficiency
- Registration information to facilitate household energy audit sign-up
- Directory of carpenters, electricians, HVAC installers, insulators, and plumbers who work to improve household energy efficiency and use green building materials
- Schedule of information sessions for builders, carpenters, plumbers, electricians on energy efficiency
- Directory of retailers who sell energy efficient appliances and compact fluorescent light bulbs
- Information on Arlington's Residential Recognition Program for residents who are able to reduce their emissions by Kyoto Protocol levels
- PDF files of the various building codes
- Tips and suggestions for energy efficiency (e.g. sealing windows, programmable thermostat, powering off computer, etc.) also published in the *Arlington Advocate*
- Information about the Arlington home rehabilitation program
- Section for renters including useful tips for how they can participate in emissions reduction efforts given their limited control over some aspects of their housing
- Information about the Menotomy Weatherization Service

5.2.2 Energy Sourcing Web Resources

⁵⁸ Mohr et al. *Fostering Sustainable Behavior*, 2.

- Information on Renewable Energy Credits (REC), purchasing programs, available grants and rebates
- Information on installing renewable applications and available grants, rebates, and programs
- GHG Emission calculator. One example is:
<http://yosemite.epa.gov/oar/globalwarming.nsf/content/resourcecenter/toolsghgcalculator.html>
- Information on photovoltaic (PV) systems, solar water heating systems, and wind energy
- Directory of contractors who repair/install PV panels and solar hot water heating units
- Directory of retailers who sell PV systems and solar hot water heating units

5.2.3 Transportation Web Resources

- Link to MBTA travel planning website
- Arlington Rideshare Board
- Information about Town carpooling program
- Links to information about tax incentives for clean fuel and electric vehicles
- Information about alternative methods of transportation in Arlington
- Best and safest walking and bicycling paths through downtown
- Car sharing programs
- Advertisements for “Sustainable Commute” Day
- Links to literature about the reduction of emissions and using alternate forms of transportation

5.2.4 Miscellaneous Web-Based Outreach

- Arlington Forum containing testimonials of residents who have had good experiences with reducing their CO₂ emissions (e.g. use of compact fluorescents, energy saving appliances, purchase of REC’s)
- Q&A section where residents can ask questions and get a response from Arlington’s Sustainability Program Manager
- Arlington Sustainability Indicator’s detailing progress towards the emissions reduction goal

5.3 Targeted Outreach: Arlington’s Residential Sector

Increasing awareness amongst residents regarding the ASAP is an essential component of CBSM efforts because residential structures contribute the largest percentage of Arlington’s emissions, accounting for 45 percent of Arlington’s total CO₂ emissions. According to 1997 baseline data, Arlington households emitted approximately 214,000 tons of CO₂. The ASAP’s 10 percent reduction by 2010 calls for a decrease of household emissions by 21,400 tons.

According to the 2000 United States census, Arlington has a total of 19,000 households.⁵⁹ A marketing campaign targeted to Arlington households will be designed to increase awareness about the relationship between climate change and CO₂ emissions. Educational outreach will be utilized to communicate suggestions for household energy efficiency, purchase of REC’s, alternative transportation choices, and the potential cost savings and positive health impacts possible with town-wide emissions reductions. Sustainability indicators will be maintained by the Sustainability Program Manager and posted on the proposed SustainArlington.org website and displayed at Town Hall in the form of a regularly updated display that illustrates Arlington’s progress toward its CO₂ emissions reduction goal.

5.3.1 Research Methodology

⁵⁹ Data Set: Census 2000 Summary File 3 (SF 3) - Sample Data. [online]. [Cited 16 March 2005]. Available from World Wide Web: <www.census.gov>.

The data used to calculate current CO₂ emissions was derived from an inventory conducted in the year 2000 which measured 1997 emissions in Arlington. Additional data was analyzed from the 2000 US Census and from a web-based survey targeted to Arlington residents.

A Tufts University study of Arlington residents was conducted in April 2005; the two key goals of this survey were to inventory the current sustainable practices within Arlington households and also to identify the barriers of further implementation of sustainable practices. The resident survey contained questions pertaining to energy efficiency, energy sourcing, transportation, and perceptions of sustainability. The survey was designed and administered in April 2005 by graduate students from the department of Urban and Environmental Policy and Planning at Tufts University. Since the survey participants were self-selected, this does not qualify as a simple random sample of the community. However, as a pilot survey, it does provide useful information regarding barriers and perceptions of sustainability.

The web-based survey was advertised to various groups within Arlington along with an incentive providing the opportunity for one participant to win a \$50 gift certificate to Flora's Restaurant. The survey was advertised on the following websites and Listservs: Boston's Craigslist.org website, a general listserv for Arlington residents, Sustainable Arlington's Listserv, Arlington's Freecycle website, Live from Arlington's website, and by posting flyers in Arlington's Robbins Library, Town Hall, and the Senior Center. The resulting sample contained a total of 196 Arlington residents. Barriers identified in the survey are detailed in the following subsection.

5.3.2 Household related findings

The findings of the survey indicate that barriers to sustainability include a combination of internal and external barriers. Internal barriers include information specific to individuals, for example, concerns about the safety of bicycling to and from work. External barriers are best described as structural changes that are necessary in order for the behavior to be more convenient.⁶⁰ The external barriers present in the bicycling example include high traffic, narrow roads, lack of a dedicated bicycle lane, and the dangerous health impacts of breathing vehicle exhaust and getting hit by a car.

5.3.3 Residential Energy Efficiency and Energy Sourcing

Survey respondents described the current energy efficiency practices used in their household. Responses include:

- 56 percent use an energy efficient refrigerator
- 49 percent use an energy efficient washer/dryer
- 17 percent seal windows with plastic during colder months
- 59 percent use compact fluorescent energy saving light bulbs
- 52 percent use a programmable thermostat
- 54 percent have a furnace/boiler that is less than 15 years old

The CBSM plan encourages the continuation of these energy efficient behaviors and seeks to significantly increase the number of households engaging in these activities. During the survey, residents described household clean energy and energy efficiency practices they wanted to adopt but could not because they felt there were too many barriers. The majority of the barriers identified in this portion of the survey involve lack of information, expense, and uncertainty about the performance of energy efficient products and renewable energy sources. A sampling of the responses includes:

- Recovery of capital investments in adequate insulation for walls and attic is too long (10 – 15 years)
- Concern about the performance and the quality of light of compact fluorescent light bulbs

⁶⁰ Mohr et al. *Fostering Sustainable Behavior*, 15.

- Difficulty in locating a contractor who will work with “green building” materials
- In regards to photovoltaic on roof: too much shade over house, belief that system would not withstand winter in New England, concern over who would repair the photovoltaic system, uncertainty about the reliability, expense, aesthetics, belief that the power company would require the system to be disconnected in the event of a power failure
- Many renters expressed that they lack control over many aspects of their living space (e.g. appliances, insulation)
- There is no easily accessible information including reminders, tips, and suggestions for lifestyle changes
- There is little awareness of energy audits (e.g. who to call, what does it involve, time investment)
- Not enough information regarding the options to purchase renewable energy certificates is available

The resident survey revealed low levels of participation in a variety of energy efficiency and renewable energy programs, including: energy audits, low-interest loan programs, and REC purchasing. Survey responses include:

Household Energy Audit:

- 46 percent had received a energy audit
- 40 percent had NOT received a energy audit and would consider it if they had more information
- 15 percent had NOT received a energy audit and would NOT consider having one

Awareness of low interest loans and rebates available to Arlington residents for household renovation projects that use green building materials or improve energy efficiency:

- 3 percent were aware of this opportunity and had received a loan or rebate
- 33 percent were aware of this opportunity and had NOT received a loan or rebate
- 64 percent were NOT aware of this opportunity

Awareness of opportunities available through Mass Energy Alliance and other organizations to support renewable/non-polluting energy sources:

- 3 percent were aware and participate in this program or one similar
- 34 percent were aware and do NOT participate
- 63 percent were NOT aware of this opportunity

To participate in a renewable energy credit purchasing program, residents indicated the amount of money they would be willing to spend in addition to their current electricity costs

- 7 percent would spend \$15 or more per month
- 38 percent would spend \$5 - \$14 more per month
- 30 percent would spend less than \$5 more per month
- 25 percent would not spend any more per month

Since the Arlington resident survey revealed a lack of awareness of many of the energy efficient and renewable energy initiatives the ASAP supports, this identifies a need for promotion of the available programs. A set of CBSM recommendations were developed to increase awareness and participation in energy efficient and renewable energy programs. The survey questions and results are available in Appendix R.

CBSM Recommendation # 1: Campaign to increase awareness and participation in energy efficiency and renewable energy sourcing opportunities

1. Hold an “Arlington Energy Fair” to kick-off Arlington’s Sustainability Action Plan. The fair could be organized by the Sustainable Arlington group and Arlington’s proposed Sustainability Program Manager and modeled after the Cape Light Compact’s annual energy fair on Cape Cod. Event features include free compact fluorescent light bulb giveaways and incandescent bulb trade-in, dehumidifier and air-conditioner trade-in (residents drop off their old, outdated dehumidifiers and air-conditioners to receive a rebate coupon to buy a new energy efficient model), halogen lamp trade-in, solar PV system displays, solar hot water heating system display, energy efficient appliances on display, information kiosks with information about household energy audits, low-interest green remodeling loans, and REC purchases, and rebates.
2. Evening and weekend educational seminars created to teach Arlington residents about sustainable household practices (e.g. lifestyle changes, potential energy savings, REC purchases, etc.) in conjunction with workshops outlined in the energy efficiency section
3. Launch the SustainArlington.org website (as described in section 5.2)
4. Increase awareness of low interest loans for energy efficient household remodeling projects
 - a. Encourage local banks to advertise loans
 - b. Provide a brochure detailing loan options and green building materials to residents when they apply for a building permit at the Zoning Board of Appeals
5. Increase awareness of renewable energy technology options
 - a. Advertise options to purchase REC’s in town mailings including property tax mailings, water/sewer bill, and annual town census.
 - b. Education campaign highlighting benefits of using solar hot water heating units and PV systems
6. Establish a recognition program for households that make a commitment to reduce their CO₂ emissions through energy efficiency, renewable energy, and transportation changes.
7. Campaign to reduce “Computer Idling”
 - a. Arlington households should each be mailed a brochure that outlines the myths and facts associated with powering off computers and suggestions for how to reduce energy usage by enabling power management on the computer. The brochure should also include a projection of household energy savings as well as facts about climate change. Included with the brochure should be a ‘cool the climate’ sticker that residents can place on or near their computer to act as a prompt to remind them to power off their computer and save energy. (Sample brochure: see Appendix S)
 - b. Write article designed to increase awareness of the computer idling issue for publication in the Arlington Advocate. The article should provide similar information offered in the brochure.
 - c. ‘Cool the climate’ sticker campaigns should be part of the science curriculum in Arlington Public Schools. A brief lesson about the effects of computer idling along with the prompt sticker may encourage students to remember to power off their home computers each day.

Featured recommendation

One recommendation in Arlington's CBSM strategy focuses on the issue of computer "idling" or leaving the computer running when not in use. The resident survey indicates that of the residents surveyed, 12 percent leave their computer running at all times and 17 percent turn off their computer only if they are leaving the house for an extended period of time (e.g. weekend or vacation.) Figure 2 below displays the current trends relating to the computer habits of Arlington residents sampled.

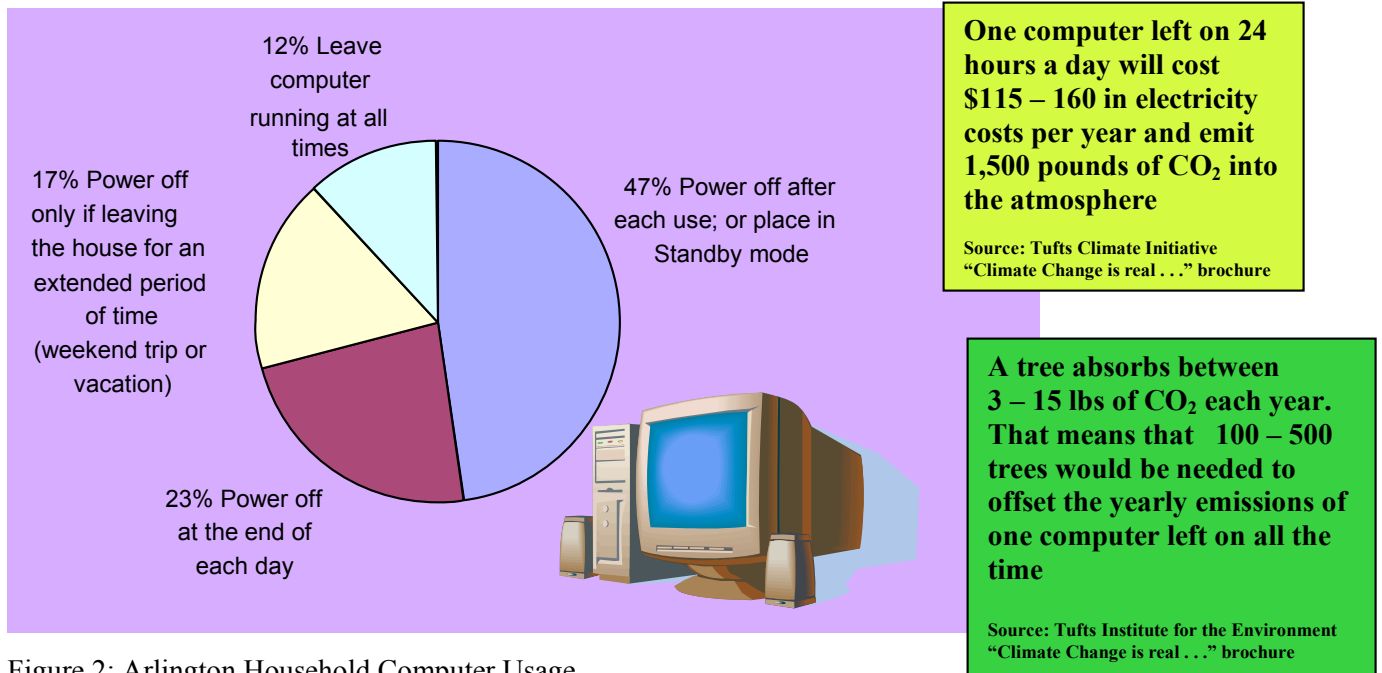


Figure 2: Arlington Household Computer Usage

To achieve the desired reduction in CO₂ emissions, it is necessary to educate residents on the amount of carbon dioxide emissions resulting from leaving computers on. Residents must be encouraged to power off their computers or place them in standby mode while not in use. If 50 percent of Arlington's households that currently leave their computers on all the time could be influenced to turn off their computer at the end of each day (resulting in approximately 12 hours of idling as opposed to 24 hours), this would result in a reduction of approximately 7,130 tons of household CO₂ emissions per year. This measure alone estimates a reduction of 33 percent of the required 21,400 tons of household CO₂ emissions that must be reduced by 2010. This example shows how incremental changes can help to achieve Arlington's emissions reduction goal.

5.4 Transportation related findings and recommendations

Decreasing vehicle emissions in Arlington is a complicated matter because of Americans' dependence on their automobiles and the failure of the US legislature to improve emissions standards for vehicles sold in the US. In this section, there is a focus on travel originating within Arlington and the analysis of transportation habits of Arlington residents investigates distance traveled, vehicle ownership, and methods of transportation.

According to 1997 figures, carbon dioxide emissions from transportation account for 168,000 tons, or 36 percent of Arlington's total CO₂ emissions. A 10 percent reduction by 2010 means that yearly carbon dioxide emissions must be reduced by 16,800 tons.

5.4.1 2000 US Census Findings

According to the 2000 US Census, there are a total of 23,716 workers aged 16 and over who live in Arlington.⁶¹ The first transportation related CBSM strategy targets Arlington residents who commute to and from work. Figure 3 illustrates the transportation habits of this population by detailing the primary method of transportation used in their commute to and from work.

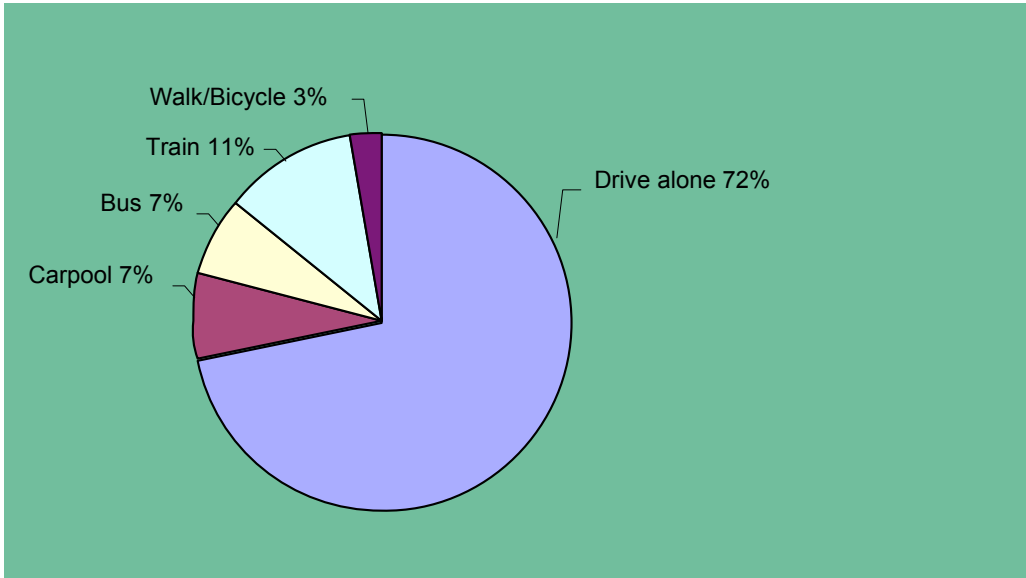


Figure 3. Method of Transportation to Work

A series of Geographic Information Systems (GIS) transportation data. The GIS analysis is a useful tool to identify the dominant transportation methods for each block group. The block group with the highest percentage of people who ride the train to work is the block group with the highest percentage of people who drive alone. Analyzing transportation by geographic area allows for the identification of patterns which considers bus routes, train station locations, and other factors.



is the
th
while
ion.

In addition, the April 2005 survey of Arlington residents inventoried the thoughts and feelings residents had about various modes of transportation. The survey questions were framed to collect important information from residents regarding the accessibility of public transportation, walk ability of Arlington, street safety, and congestion. Our key findings identify several barriers to adopting sustainable transportation practices, including:

- Lack of availability of hybrid vehicles, expense, uncertainty about performance, not enough capacity for family
- Concern about safety of riding bike to work – crowded and narrow roads, no bike path, vehicle exhaust

⁶¹ Data Set: Census 2000 Summary File 3 (SF 3) - Sample Data. [online]. [Cited 16 March 2005]. Available from World Wide Web: <www.census.gov>.



CBSM Recommendation # 2: Transportation Campaign

1. The first priority is to target the 72 percent of the population that drives to work alone. Residential areas with the highest rates of people driving to work alone can be identified in Appendix T. Community task force groups should be organized within each area so that individuals in these communities can brainstorm suggestions on how to reduce transportation related emissions in their specific neighborhoods. For example, the barrier in one community may be that public transportation is inconvenient or inaccessible. The neighborhood task force can develop lists of feasible transportation alternatives within their community.
2. Motivate and empower residents to voice their concerns over pedestrian safety issues. Mobilize a group of citizens to advocate for a bike lane on Massachusetts Avenue, safety issues for students walking to and from school, and enforced speed limits. Information should be disseminated in the following methods:
 - a. SustainArlington.org website
 - b. Sustainable Arlington's newsletter and listserv
 - c. Parent/Teacher Association in Arlington Schools
 - d. Arlington Bicycle Advisory Committee (ABAC)
 - e. Transportation Advisory Committee
 - f. Walk Arlington group newsletter
3. The Commonwealth of Massachusetts has mandated a 5-minute maximum idling time for vehicles. The emissions reduction initiative should include education of the health effect of idling. Information could be distributed through schools, community seminars, and SustainArlington.org. Small window stickers could be designed and distributed so that residents can place them on their car windshield. The stickers will serve as a prompt to remind Arlington residents to reduce their idling time.
4. Develop a program to communicate the importance of considering mileage per gallon (MPG) when selecting a vehicle. A list of fuel efficient cars should be posted on the SustainArlington.org website and an article highlighting the benefits of fuel efficient vehicles should be submitted for publication in the *Arlington Advocate*.

5.4.2 Survey Findings

Survey participants described the number of vehicles they owned, type of vehicle, and approximate MPG. Participants were also asked to select their preference of transportation options in a variety of scenarios (e.g. most convenient form of transportation to travel to and from work.) Lastly, participants indicated the approximate number of miles driven per week to work, to run errands, and for leisure activities. Complete survey results are available in Appendix R.

5.5 Targeted Outreach: Arlington's Commercial Sector

Increasing awareness among Arlington business owners of energy efficiency practices is another important component of carbon emissions reduction in Arlington. In 1997, commercial emissions accounted for an estimated 72,900 tons or 15 percent of the total carbon dioxide emissions in Arlington. Therefore to reach Arlington's 10 percent reduction goal, the commercial sector must reduce its emissions by 7,300 tons by the year 2010. How can we use CBSM to influence Arlington businesses to reduce carbon emissions?

A survey designed to inventory current sustainability practices of the Arlington community was tested on a group of Arlington business owners at a Rotary Club meeting on April 13, 2005 (see Appendix X.) In this survey, participants identified the type of business they worked in, described their current energy efficiency practices, and expressed their thoughts on Arlington’s initiative to reduce carbon emissions. Responses indicate that current practices include the use of programmable thermostats, energy saving office equipment, use of compact fluorescent light bulbs, automated light shut-off, and company-wide energy savings incentive programs. When asked about Arlington taking action on climate change, responses indicated that few individuals felt this was not an important issue and the majority believing that climate change is in fact an important issue for Arlington to address. CBSM efforts should be used to educate businesses on how they can benefit financially and improve environmental conditions in the Town by participating in Arlington’s sustainability initiative. The proposed “sustainability toolkit” containing information on implementation strategies and potential cost savings will act as a communication tool conveying sustainability ideas to businesses.

CBSM Recommendation # 3: Commercial Emissions Reductions	
Desired Behavior	CBSM Strategy
Use of energy efficient compact fluorescent light bulbs	Distribution at energy fair, "sustainability toolkit" direct mail campaign targeted to Arlington businesses that includes various styles of bulbs for the business to test out to determine which one will work best for their needs.
Purchase of renewable energy credits (RECs)	Advertisement in energy bills, information at Town Hall, provide information through the "Business Outreach" section of SustainArlington.com website, information in toolkit highlighting the benefits of participation
Utilization of low-interest loans for energy efficiency based remodeling	Distribute flyer at banks, description in "sustainability toolkit" direct mail campaign targeted to Arlington businesses highlighting information on various loan options.
Participation in Arlington's Alliance of Sustainable Businesses	Discuss possibility of this program with Town Manager, design window placard to be posted in window of participating businesses, develop protocol for participation in program
Development of an incentive program for employees who carpool, use public transport or bike/walk to work	Provide testimonials by businesses that have implemented an incentive program on how it works, suggested programs, etc. on SustainArlington.com and in "sustainability toolkit"

5.6 Targeted Outreach: Municipal Sector

Arlington’s municipal sector accounts for 19,000 tons of CO₂ emissions, or 4 percent of total emissions in Arlington. CO₂ emissions must be reduced by 1,900 tons by 2010. Several measures of reduced CO₂ emissions and energy cost savings have already taken effect including the Robbins library lighting retrofit, streetlight replacement program, and the health department’s purchase of a Toyota Prius.

Several town officials were interviewed between February and April 2005; these interviews included discussions of current and potential sustainability measures within Town departments. Departments interviewed include: Building Inspection, Department of Public Works, Purchasing, and Planning.

A survey designed to inventory the current sustainability practices of Arlington’s municipal operations was tested on a group of Arlington town employees in April 2005. See Appendix Y for detailed survey information. The goal of the

survey was to determine the existing environmentally conscious practices in town departments and to identify possibilities to reduce CO₂ emissions within each department. The description and web link to this survey was sent to 43 town employees and the survey received no response. This illustrates a potential challenge in the implementation of this plan; employees may not be interested or not have enough time to consider sustainable practices within their department. The municipal CBSM program will consider lack of time and department funding as barriers to increasing awareness and implementing sustainability. A proposed CBSM strategy involves a visioning workshop for town employees to brainstorm low-cost measures the town can take to reduce CO₂ emissions.

CBSM Recommendation # 4: Municipal Measures

1. Visioning Workshop to brainstorm low-cost CO₂ reduction measures and inform town employees of sustainable practices that could reduce CO₂ emissions. Discussion would include:
 - a. Purchase of Energy Star products
 - b. Efficient lighting retrofits
 - c. Purchase of green electricity
 - d. Installation of PV systems on municipal buildings
 - e. Municipal no-idling policy
2. Development of a sustainability resource “toolkit” to be distributed to town departments. The toolkit would be a folder with information highlighting potential energy cost savings and strategies for implementation of CO₂ emission reduction measures.
3. The Sustainability Program manager could act as a consultant to Town Departments and guide them through the process of implementing CO₂ reduction measures:
 - a. Enforcing and enhancing building codes within the building department
 - b. Converting DPW fleet to biodiesel
 - c. Integrate sustainable development principles in town planning department
4. Arlington could participate in a variety of partnerships to create a resource base for CO₂ emissions reduction measures.
 - a. Clean Cities Program
 - b. Become a “Solar Boston” Partner
 - c. Partner with other communities who have implemented climate action plans (Brookline, Cambridge, Somerville, Medford)
5. Participate in state and federal programs that support sustainability initiatives
 - a. State and federal funding
 - b. Federal tax incentive for clean fuel and electric vehicles

5.7 Conclusion



The 10 percent reduction by 2010 calls for a reduction of 47,400 tons of CO₂. The commercial, municipal, residential, and transportation CO₂ emission reduction targets set forth in this plan (in table 1) total an estimated 25,000 tons of CO₂ and they account for about 5 percent of the necessary reductions. However a decrease in the marginal emissions rate has already occurred due to a recent trend to switch from coal to natural gas. This accounts for 21,400 tons of CO₂ reduced annually, which represents the remaining 5 percent of reductions necessary to reach the 2010 goal. Therefore, it is possible for the Town of Arlington to meet its 10 percent reduction goal by implementing the measures proposed in this plan. It is also anticipated that additional reductions will come from new technologies such as hybrid vehicles, through nationally mandating Corporate Average Fuel Efficiency (CAFE) standards, and bringing more renewable energy sources online.