



2009 Climate Action Plan

Submitted by

Falmouth Green Ribbon Commission

On

Energy and Climate Protection

Draft

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Executive Summary

The Falmouth Town Council unanimously signed the U.S. Mayors Climate Protection Agreement in May 2007. The agreement pledges the town to take actions to reduce global warming emissions by 7% below 1990 levels by 2012. Subsequently, the Council formed and charged the Ad Hoc Falmouth Green Ribbon Commission on Energy and Climate Protection (“FGRC” or “The Commission”) to formulate a Climate Action Plan to meet the objectives of the Agreement.

Falmouth’s Climate Action Plan estimates the town’s current carbon footprint, identifies carbon reduction goals for the community, and presents recommended strategies to reduce our community’s emissions and energy consumption and costs. The Commission recognizes that this work must be ongoing and that initiatives are taking place at various levels of government, which may present other opportunities for meeting the objectives.

The attached report provides background on our community, the Emissions Inventory done by the Emissions Subcommittee, assisted by many volunteers, town staff and others (please see Acknowledgements in Appendix: Emissions Inventory), and recommendations by the Commission.

We have organized the recommendations in the report by Sector. In the following table, we also categorize each recommendation as follows:

Category A: Council can and should act immediately.

Category B: Should be referred to one or more Ad Hoc Implementation Committee(s), responsible for further analysis and details. When complete Committee will bring back to Council for action.

Category C: In our Implementation Recommendation section, we recommend the creation of a Standing Committee. Recommendations in this Category would become the responsibility of the Standing Committee for further action.

The following table summarizes the action recommendations proposed by the Commission.

Topic	Recommendation	Category
Implementation	Create a Standing Committee	A
	Outreach and Education	C
	Web Site	A and C
	Full time Energy Coordinator	A

	Energy & Emissions Data	C
Energy Efficiency	Residential Energy Audit Program – REAP	B
	Rating System for Commercial Bldgs	C
	Smart Metering	A
	Reduce Energy Usage in Streetlights	A
	Cold Climate Heat Pump Demo Project	A
	Municipal Coordinated Financing for Energy Efficiency Upgrades and Renewable Energy	B
	Cool Roofs	A
	High Performance Energy Efficient Public Bldgs	A
	Change How We Heat Hot Water	C
	Renewable Energy & Fuel Switching	Wind Energy In Falmouth Coastal Waters
Wind Energy - Land		B
Municipal Renewable Energy Supply		C
Tap Existing Gas Pipeline to serve Falmouth, Cumberland, Yarmouth and Conversion of Cousins Island Plant		B
Change How We Heat Water		C
Transportation & Land Use	Complete Streets Policy	A
	Accelerate Bike/Pedestrian Development	A
	Lobby to raise the State Gas Tax	A
	Retitle DPW to Director of Transportation	A
	Municipal No Idling Ordinance	A
	Establish Policies for Town Vehicle Purchase and Use	A
	Reduce Vehicle Miles Travelled	A and C
	Yards and Yard Maintenance	A and C
	Charge to the Comprehensive Plan Committee	A
Waste and Recycling	Strengthen Town Recycling Efforts	A
	Wastewater	C

Part I: General Information

A. Background

Prompted by the efforts of a citizen's action group, Cool Falmouth, the Falmouth town council joined hundreds of other local governments in signing the U.S. Mayors Climate Protection Agreement in May 2007 (Appendix I) and formed the Green Ribbon Commission. The Commission was tasked to create a report with recommendations to lower energy bills, improve air quality, support economic development, reduce emissions, and promote a sustainable quality of life throughout the community for generations to come. The Commission will support the town to be a leader in the area of energy conservation and sustainability, as well as assist in promoting and enhancing the extensive list of efficiencies already under way.

Commission members represent a diverse set of interests and backgrounds (Appendix II) and were officially appointed by the Council in June 2008. The Commission met regularly throughout the past year to discuss emission inventories, reduction targets, review other community's approaches and to develop specific recommendations. The group strove to make decisions based on consensus and to ensure that all voices had a place at the table. The recommendations in this plan are similar to those in plans developed by other towns and states. The Commission's work has followed The Cities for Climate Protection Campaign 'Five Milestone' Process which recommends the following steps:

1. Complete a Greenhouse Gas Emissions Inventory and Report
2. Set an Emissions Reduction Target
3. Complete a Local Climate Action Plan to Reduce Greenhouse Gas Emissions
4. Implement the Local Climate Action Plan; and
5. Monitor the Impact of Emissions Reductions Measures.

B. Framework: Climate Change, Energy Security and Adaptation

In 2005, the Town of Falmouth is estimated to have produced over 290,000 metric tons of carbon dioxide, and spent about \$30 million on the fuels producing these emissions, with another \$6.3 million spent by Falmouth businesses. Because of Falmouth's relative affluence compared to the rest of Maine, these estimates, based on state-wide data from the U.S. Energy Information Administration, are most likely on the low side. The Maine State Planning Office estimates Falmouth's 2005 population at 10,600 implying a minimum of 11 tons and \$2,800 per person. The great majority of these dollars leaves not only Falmouth, but also the state and country, and thus represents a significant drain on our local and national economy.

The emitted carbon dioxide is Falmouth's contribution to global climate change and disruption. As stated in the U.S. Mayors Climate Protection Agreement:

"Climate disruption of the magnitude now predicted by the scientific community will cause extremely costly disruption of human and natural systems throughout the world including: increased risk of floods or droughts; sea-level rises that interact with coastal storms to erode beaches, inundate land, and damage structures; more frequent and extreme heat waves; more frequent and greater concentrations of smog."

The good news is that we can provide our desired energy services—warm well-lit homes, hot water, transportation, fresh food, and entertainment—while reducing short and long-term energy costs. As a result, we have the opportunity to reduce our emissions, increase our energy security, and capture some of the \$30 million that the town residents are currently losing each year.

C. Community Context

As a coastal town, Falmouth has much to protect and treasure. It is remarkable for its natural beauty, resources and quality of life while being close to one of Maine's largest cities. Its coastline is marked by islands, coves, streams, and rivers while its harbor embraces one of the largest anchorages in Maine. Its elevation rises to 504' at Blackstrap Mountain, and the interior is divided into seven distinct watersheds with abundant forests, wetlands and arable land. Falmouth citizens have a tradition of supporting conservation and the protection of open space.

The town's population is approximately 10,500 with over two thousand being of school-age. Falmouth's schools are among the best in the state. The income level is described as upper middle class with the majority of households living in single family dwellings. Falmouth experienced rapid growth in recent years, and much of the housing stock was built before modern energy efficiency standards and codes were in place (more than half built before 1960). Many, if not most, of these houses lack adequate insulation and suffer from inefficient heating systems.

Falmouth's development is suburban with generally low population density and no historic town center. The town abuts Maine's largest city, Portland, and residents are highly dependent on automobiles to access jobs, schools and commercial centers. Falmouth's commercial sector is concentrated along Rte. 1 and at Exit 53 of the Maine Turnpike and consists of retail, service, and office developments.

Transportation issues are made more complex with a number of important transportation corridors that pass through the town including (I-295, I-95, Route 1, Route 88, Falmouth Road

and Blackstrap Road). Most residents commute out of town for work. A 1990 study showed 20 % worked in Falmouth. Falmouth has 87 miles of roadways, 69 of which are non-highway. Traffic studies completed in 1997 showed substantial increases in traffic in both rural and urban areas of town.

Falmouth is accessible via public bus transportation provided by the METRO – Greater Portland Transit District. The bus goes between Portland and Falmouth six days a week with stops in several areas of Falmouth. The People’s Regional Opportunity Program’s (PROP), Regional Transportation Program (RTP), provides transportation for citizens on an as needed basis. There are two railroad lines which pass through town, one of which will carry passengers from Brunswick south to Boston starting in 2010. No stop is currently planned in Falmouth. Bike routes are in place on Rte. 1 and Rte. 88.

There is a natural gas line which runs through Falmouth, but there are no laterals off this gas line servicing the town.

Two-thirds of the town is supplied with water from Sebago Lake through the Portland Water District with the remainder of the town using private wells. A Town-owned and run sewer system deals with wastewater for many homes including the town of Cumberland. Household waste is hauled for incineration to Ecomaine in Westbrook using a curbside pay-per-bag system. The town provides bins for single-sort recyclables pick-up, and has one of the highest recycling rates in the state, recording rates at over 50% in 2007. The Town maintains a Transfer Station which takes pay-per-bag, recyclables and yard waste brought to the site. Some yard waste is composted by the town and a significant amount of brush is collected and hauled for incineration used to produce electricity outside of Falmouth.

D. CO2 Emissions Inventory

The Falmouth Emissions Inventory was completed using the Clean Air and Climate Protection (CACP) software obtained through the town’s membership in ICLEI, Local Governments of Sustainability^[1]. CACP software calculates emissions resulting from energy consumption and waste generation. The software determines emissions using specific factors according to the type of fuel used, and aggregates and reports the three main greenhouse gases (CO₂, CH₄, and N₂O) in terms of equivalent carbon dioxide units, or CO₂e. Converting all emissions to equivalent carbon dioxide units allows for the consideration of different of different greenhouse gases in comparable terms.

The Falmouth Greenhouse Gas Emissions Inventory encompasses data for the year 2007. In consultation with ICLEI, 2007 was chosen as the baseline year, as it is the year for which the most complete and reliable data is available. The data collection, input, examination and extrapolation was completed out by the FGRC Emissions Inventory Task Group.

The data is broken into two categories/sectors identified as Community and Government. The Community Sector covers emissions within the geopolitical boundary of Falmouth, Maine. The Government sector covers emissions of the Falmouth municipal operations and the Falmouth School Department. Note that the two sectors do not “fit” together as the data for the Government Sector is measured data and the data for the Community sector is both measured and estimated. Additionally, the Community data covers all emissions in the jurisdiction, including government and school department emissions. For the full emissions inventory and detailed discussion by sector, including local government emissions, see Appendix.

Falmouth Community Green House Gas Emissions by Sector

	Equiv CO ₂ (tons)*	Equiv CO ₂ (%)	Energy (MMBtu)*
Residential	67,200	23	776,500
Commercial	24,200	8	252,200
Transportation	198,000	68	2,311,000
Waste	600	0.2	
Total	290,000	100	3,339,700

* Tons CO₂e and MMBtu rounded to nearest hundred.

While other towns also typically report highest emissions from transportation, Falmouth’s transportation sector is disproportionately high, likely due to the two highways (I-95 and 295) that pass through town. Consequently, there is a significant segment of transportation emissions that we have little direct control over.

In the residential sector, light fuel oil is the biggest contributor to emissions, supplying 50,000 tons CO₂e, or 74% of the total. The 74% contribution from fuel oil is generally consistent with media reports that Maine is one of the most oil dependent states in the country. Electricity accounts for 15,400 tons CO₂e, or 23% of the total.

Emissions Goal and Target

The goal and timeline of the U.S. Mayors Climate Protection Agreement (USMCPA) is to reduce global warming emissions (CO₂) community-wide by 7% below 1990 levels by 2012. The Falmouth Green Ribbon Commission is recommending that the Town try to achieve this target by adopting a target of 2% average annual reductions. The 2% average goal is easy to understand, measure and plan for, and provides a realistic long-term planning tool. It also recognizes that in some years the emissions reduction will be greater than other years,

depending on the timing of implementation of solutions. In addition, many other communities have adopted the "2% solution" goal, most notably the more than 40 counties that signed the Cool Counties Climate Stabilization Initiative.

The 2% average goal puts the Town on target to meet not only the USMCPA target but also a long-term goal of approximately 80% reductions from current levels by 2050, the goal that the scientific community believes is the minimum to prevent the worst effects of climate change. This also supports the state of Maine's long term target of 75% to 80% below 2003 levels (LD 845) and the long-term goal (80% reduction by 2050) adopted by the American Clean Energy and Security Act, passed in the U.S. House of Representatives and likely to be approved by the Senate and signed into law by President Obama in 2009.

E. Guiding Principles

The Falmouth Green Ribbon Commission developed its strategies and recommendations based on a number of core principles and observations including:

- Focus on areas of agreement. Reducing energy waste through energy efficiency, replacing fossil fuels with cleaner energy sources, and smarter transportation and land use planning have numerous overlapping benefits of addressing climate change and air pollution, lowering costs to consumers and taxpayers, stimulating economic growth, providing greater energy security, and improving quality of life.
- Bold actions are called for, and ambitious, innovative, and pioneering approaches are required. In general, the obstacles to reaching our goals are not technological, scientific or economic, but rather changing how we think and do business.
- Utilize a variety of types of recommendations: some by government, some by individuals, some by business; some small, some big, some easy, some not, some which we expect will be greeted with consensus, others which require further work and dialogue.
- A mixture of incentives, regulation and education is necessary.
- A well-informed community is critical and a substantial role for education and outreach is called for in the plan.
- Fossil fuel costs do not reflect the actual costs to the environment or society.
- Recommendations should be evaluated based on their reduction potential, cost effectiveness, feasibility, additional benefits provided, and the opportunity for rapid deployment.

- Utilize “low hanging fruit”, actions which can take place immediately and are relatively simple, and “big ideas”, more complex, may take longer to execute but are “game changing.”

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Part II: Action Recommendations

A. Introduction

The Falmouth Climate Action Plan recognizes that addressing climate change and energy security issues requires action and coordination by individuals, government, and business. There is no single solution to reducing emissions and energy use. Our recommendations include a mixture of small, achievable steps that provide immediate results and longer-term solutions that will require initial investments that will be recovered over time.

The Commission's action recommendations are based on two core strategies: 1) Reducing the use and waste of fossil fuels by increasing energy efficiency, including transportation/land use efficiencies, and 2) Transitioning to cleaner energy sources. It should be noted that energy efficiency includes reductions in energy use due to conservation and behavioral modifications (e.g. turning off lights) and also through the adoption of technological modifications (e.g. home insulation, solar hot water, etc.).

We envision that additional action recommendations beyond those contained in this report will be appropriate in the coming months and years, particularly as the public's understanding of the urgency and options continue to increase, and as the federal and state governments also take actions.

B. Categorizing the Action Recommendations

Some recommendations we feel are ready for adoption immediately by the Council; these are actions already in place by other communities or which we feel are relatively straightforward. Others we feel should be implemented as quickly as possible but might be more complicated and thus the Council might need more support to ready them for implementation. Still others we feel are worthy of further consideration, but might need more community input or education, weighing of cost and benefits, etc.

We have divided our recommendations into categories based on the criteria noted above:

A: Actions that the Council should move forward immediately.

B: Actions which should be carried out by one or more task specific ad hoc committees.

C: Actions to be carried out by a newly created Standing Committee on Climate Change and Energy Efficiency (see "Implementation" below).

The Commission is confident that its recommendations are feasible and cost effective, will result in cost savings for individuals, businesses, and local government, and meaningful reductions of emissions and energy use. Where possible, we have included credible, documented estimates. However, each recommendation ideally should include associated specific emissions reductions, fiscal cost/benefit, and rate of return/payback period. The Commission did not have the resources and expertise to conduct such detailed analysis.

C. Recommendations: Implementation

1. Standing Committee

The Commission will sunset once its report is finalized and submitted. We believe that it is time to create a Standing Committee to continue this work, to educate the populace and decision makers and to keep action moving forward on action items. To avoid “committee sprawl” we recommend that the Council discuss with the existing Recycling Committee to see if that Committee would like to expand its mission to include energy efficiency and climate protection, as Waste and Recycling are a part of this topic. If that recommendation is not supported, either by the Council or by the Recycling Committee, then we recommend that a separate standing committee be set up.

Recommendation: *The Council consider whether the mission of the Recycling Committee should be expanded to include topics of climate change and energy efficiency. If that is deemed inadvisable, we recommend the creation of a separate Standing Committee for this topic.*

2. Outreach and Education

The importance of Outreach and Education in dealing with Climate Change-related issues cannot be overstated. Measures to reduce energy use and adopt new behaviors and/or technologies may be mandated or incented, but will have limited success if not accompanied by education and outreach. The Sustainability Coordinator of a Maine-based trucking company stated that incentives to drive 60 miles per hour alone did not bring about the desired behavior. When education was added to incentive, the greatest reduction in fuel consumption resulted.

Outreach and Education provides many opportunities to encourage the adoption of energy efficiency and renewable energy measures within the community. It is important to collaborate with individuals and groups who have some expertise and build upon established networks.

Examples of such initiatives might include some of the following:

CFL lightbulb exchanges

- Commute Another Way Day
- Walk/Bike to School Days
- Weatherization Workshops
- Courses/Programs through Community Programs, at Falmouth Memorial Library and at Falmouth Schools
- Competitions and/or Challenges in the Schools and/or Neighborhoods
- Tours of “Green Homes and Buildings”

Recommendation: *The Standing Committee should have responsibility for an ongoing Outreach and Education effort.*

3. Town Web Page on Climate Change and Energy Efficiency

A Town web page devoted to climate change and energy efficiency is an ideal medium for keeping residents community informed on Town efforts and opportunities, and allows the public to give input and suggest ideas.

We have found that the current town web site format, using the software template [Town Meeting] limits the ability to educate and inspire; graphics are limited as are layout options. The town web site page link could take the user to a new web site which allows pictures, links, etc. The site could be maintained by the committee volunteers or by town staff assigned to support the committee. The site could also have a forum for exchange of ideas, and could be used to reach out to other communities, community groups, etc.

Recommendation: *The Town Council instruct the Manger to allow the Standing Committee to establish a web site which is more flexible and graphically friendly than the current web page provided for town committees.*

4. Create Full Time Energy Coordinator Position

Both private companies and local governments have found that in order to carry out their climate protection initiatives, they need to create a position of Energy Coordinator or Director of Sustainability. Portland has recently created such a position. We recommend that Council create a paid staff position to support and help organize the implementation phase. The Coordinator would be responsible for administering infrastructure capitalizing initiatives; monitoring and summarizing the feedback on the input website; producing and publishing

emissions, energy, and expenditures information regularly and creatively; and overseeing and coordinating all Town energy and emission efforts. There is much work that needs to be done, and quickly. We reluctantly concluded, despite our most conservative fiscal instincts, that the town needs such a position, more than the current 10 hours per week provided by the current Energy Sustainability Coordinator position.

Since many of aspects of our communities are simliar, and thus the strategies will be similar, we recommend approaching Cumberland, Yarmouth and/or Freeport to share this position.

Recommendation: *The Council should create a position of “Energy Coordinator”, possibly a shared position with other towns for cost reasons.*

5. Energy Use & Emissions Data

It is difficult to control what is not measured. We found it very difficult to get accurate information particularly on heating oil consumption. As pressure builds, we believe a a system or systems will become available to monitor energy consumption and emissions at many levels, by buildings, by homes, by communities.

Recommendation: *The Standing Committee should look for ways to measure and publicize energy consumption and carbon emissions.*

D. Recommendations: Energy Efficiency

1. Residential Energy Audit Program ("REAP")

The goal of the REAP program is to decrease energy use and increase building quality and performance, thereby lowering energy bills and decreasing the demand for fossil fuels for residents of Falmouth. This should be accomplished without apparent penalties to homeowners and without placing undue hardships on builders and developers who may be deterred by additional regulations. Instead, this will be an incentive program, one that will be perpetuated by individuals who want to improve how they live, in terms of both comfort, durability of their investment and monthly savings. In time, a demand for knowledge of minimum home energy standards will be created.

1. Building energy audits will be required by all homeowners prior to receiving their Certificate of Occupancy (CO) for any home construction project. The critical outcome of this report for the Town's purposes is the result of the HERS (Home Energy Rating System) Index, an objective gauge developed by the Residential Energy Services Network that establishes a numeric grade for the performance of a house in terms of relative energy use. A HERS Index of 100 represents the energy use of the "American Standard Building" (The HERS Reference Home) and an Index of 0 (zero) indicates that the proposed building uses no net purchased energy (a Zero Energy Building). ENERGY STAR standards require a HERS Index of 85 in our climate zone. Each 1-point decrease in the HERS Index corresponds to a 1% reduction in energy consumption compared to the HERS Reference Home.

2. The town will increase building permit fees by approximately \$300 to pay for these audits. To the applicants of the building permit, it's a nominal cost compared to the price of their projects. The Town of Falmouth will negotiate a contract with several qualified Residential Energy Auditors at a reduced rate, in exchange for consistent work with the town. If applicants' audits do end up meeting a prescribed HERS Index (for instance, ENERGY STAR) then a portion of their building permit fee (say, \$100) will be refunded at the time the certificate of occupancy is issued. If Zero Energy is achieved, a full \$300 refund is given.

3. The town will not require any specific Index to be achieved in order for the CO to be given. Instead, a public database of HERS Indices will begin to accumulate and the community, and particularly realtors, will begin to understand that this measurable and objective information on individual homes is available. Citizens can then begin to look for the HERS index before purchasing new homes, in much the same way people look for the MPG measure when buying a car. A proven parallel to this method is the now ubiquitous radon test: law does not require it, but it's perceived by homeowners to be of great importance. Realtors have proliferated this awareness by demanding these tests. We have much the same hope for the HERS Index.

4. Additionally, top-performing buildings will be rewarded by being published in the Forecaster and on the Town's website. Although all results will be publicly available, only the best results will be published. The intent of this program is not to shame people into improving their homes, but rather to engage citizens in improving their own lot and be recognized for doing so. Names of clients, builders and designers will be displayed (unless privacy is preferred). Builders and designers who are able to produce homes

with improved HERS Indexes will be rewarded with this free advertising, thus increasing the incentives for creating more energy efficient homes in Falmouth.

The results of this program are expected to be an energy-efficient home construction policy with minimal impact on the current workings of the town system, town employees, residents, builders or designers.

2. Institute a Public Rating System for All Commercial Buildings

We recommend that the Town study the adoption of a rating system for all commercial buildings. Similar to a Health Department inspection, all commercial buildings will be inspected for energy efficiency (or for cost saving purposes, they could self-report) on various energy efficiency standards, and then this would earn them a rating which would be required to be posted on the building and business front door[\[3\]](#).

3. Smart Metering

There is an old saying, “Knowledge is power.” It applies to the world of electrical energy use (no pun intended). Innovations in technology have enabled the average electrical homeowner to monitor their individual electrical usage and adjust that usage to a time period when the demand for power is most advantageous to the user. A “Smart Grid” allows both the user and producer the capability to monitor and react to the demand in electrical load. A “Smart Grid” for the homeowner would allow greater awareness of electrical use with the possibility of savings based on decisions made by the user.

Smart metering would allow CMP to monitor usage for individual residences while providing real time information to the homeowner. Currently homeowners have the capability to have their usage monitored by CMP in relation to peak and off peak demand, but it is not real time and there is no advantage to the homeowner to monitor their usage. There currently is a Time of Use rate available to residential customers; however, there are few to no accounts that use it. The cost per kWh On Peak is higher than any of the commercial rates and since the homeowner is not receiving the information in real time, they have no feel for what amount of power is being used and when.

- Advantages to a smart grid:
 - Awareness for both CMP and the homeowner.
 - Troubleshooting outages for CMP becomes easier and more efficient (finding where in the grid there are no readings).

- Allows the homeowner to determine their electrical use based on cost. It enhances individual choice.
- Removes a significant number of meter readers from driving around all day everyday.
- Disadvantages:
 - Based on the current rate structure there is no advantage for the individual consumer to shift to a Residential-Time of Use account.
 - The capital cost of installation is prohibitive for any power company. Even though efficiency would improve and operating costs would drop, the rate of return on an upgrade that would reduce revenue does not warrant an investment from the private sector.

Recommendation: *Instruct the Town Manager to volunteer the Town (and/or invite other communities the Greater Portland area to participate in this as well) to be a test platform for “Smart Grid” installations. Discuss with the PUC a new, or modification to, the Residential-Time of Use rate to provide an incentive for the homeowner to monitor their use while allowing Central Maine Power the ability to recover the capital cost of installation from the rate payer.*

4. Reduce Overall Energy Usage in Town Streetlights

Falmouth has 614 active streetlights and 37 Streetlight Special Facilities. As most streetlights are on an average of 10 to 11 hours per day, 365 days per year, the KWH’s are significant. Jaffrey and Rindge, NH have recently decided to turn off up to 30% of streetlights, saving approximately \$30,000/year. Ann Arbor, MI, is in the process of installing LED bulbs in their street lights.

Recommendation: *Develop a comprehensive lamp-by-lamp streetlight inventory and criteria for evaluating removal or replacement options; remove or replace streetlights that are wasteful or inefficient and not needed for public safety within the town, and work with CMP (which owns most of the poles and lights) to install LEDs or other high energy efficiency bulbs.*

5. Cold Climate Heat Pump Demonstration Project

Currently, the majority of buildings in Maine are heated by fuel oil. A promising alternative to fuel oil may be Cold Climate (sometimes called low temperature) Heat Pumps, which are fairly common throughout the United States. They are usually used in conjunction with natural gas as the source of their energy. Until recently, in cold northern areas there was no effective heat pump that could be used in extreme conditions.

When thinking about heat pumps visualize a refrigerator. The concept is similar, but when heating the process is reversed. By using compressors and economizers the temperature of a refrigerant can be controlled to draw off heat from the air. That heated refrigerant is then pressurized making the temperature rise. At the higher temperature the heat is transferred to the air in the air handling system and distributed as heat. The refrigerant is then passed through an economizer where excess heat is drawn off and passed to the compressor as waste heat. The only differences between this and geothermal heat is air is used as the heat source rather than the warm ground.

The problem with regular heat pumps is they do not work well below 30 degrees F. The physics of the heat transfer requires supplementary heat sources rather than just compressed refrigerant (something needs to burn). In the case of the cold climate heat pump, an additional compressor is used to reheat the refrigerant with an additional stage of compression. This allows for use at temperatures below -40 degrees F.

Comparison to other heating sources:

Type	Annual Consumption	Efficiency	Unit cost	\$/Million BTU
Fuel Oil	1,000 gals	78%	\$2.88	\$26.62
Electric	31,705 kwh	100%	\$1.556	\$45.62
Kerosene	1,002 gals	80%	\$5.099	\$47.21
Propane	1,519 gals	78%	\$2.25	\$31.58
Cold Climate Heat Pump	10,411 kwh	300%	\$1.556	\$15.20

- Advantages:
 - Provides air filtration using forced hot air.
 - Provides heating and air conditioning
 - High temperature air delivery
 - Humidity control
 - No fossil fuel required
 - Reduces carbon emissions over fuel oil by 5000-7000 tons/year
 - Depending on electrical source, no carbon emissions
 - Can be retrofitted into older systems.

- Disadvantages:
 - Will not work with forced hot water heat.

Recommendation: Install a Cold Climate Heat Pump System in a municipal facility and document the savings in energy costs and the reduction of CO2 emissions as a point of

education at the entrance to the facility and on the town's web site. Maintain brochures inside the facility for any Falmouth resident to obtain more information. The best facility in Falmouth to start such a project would be the Public Library. With any savings in the project, take what is saved and apply it to another municipal building, if the test site is successful.

6. Municipal Coordinated Financing for Energy Efficiency Upgrades and Renewable Energy

There are a number of barriers to individual's investing in energy efficiency measures or renewable energy including lack of information, uncertainty about the energy savings and high upfront costs (which is both a psychological and financial barrier for many people). Municipal financing measures have been introduced in communities ranging from Palm Desert, CA to Babylon, NY for investments to reduce energy consumption and to increase the use of renewable energy. These mechanisms are being used to encourage widespread adoption of measures to reduce emissions by lowering interest rates and transaction costs.

In most cases, the municipality creates a special tax or assessment district, develops an approval process, and provides upfront capital through bonds or other financing. The homeowner identifies work and chooses contractor, applies for financing and repays through their tax bill for periods of up to 20 years. Increased tax bills are offset by reduced energy bills. There is little or no upfront cost to property owner and as the upgrades stay with the property, so does the tax obligation—if the property is transferred or sold, the new owners will pay the remaining tax obligation .

Examples of existing programs include:

Babylon, NY (211,792, pop.)

The Town of Babylon's [Long Island Green Homes \(LIGH\)](#) is a self-financing residential retrofit program for upgrading the energy efficiency of existing homes at little or no out-of-pocket cost to the homeowner. The Town will pay the licensed contractor once the work has been completed. The homeowner, who is not obliged to take on debt, will then repay the Town on a monthly basis for an amount and term agreed upon in advance. Once the obligation is satisfied, typically in six to ten years, all of the savings go directly to the homeowner. Should the homeowner move before the obligation is satisfied, it is assigned to the home.

The Town (Babylon) will subsidize up to \$12,000 of efficiencies per home, obliging the homeowner to pay a monthly benefit assessment fee. In year one, the amount of the monthly fee is structured to be less than the monthly savings on a resident's energy bills. The Town will levy a 3% administrative fee incorporated into the monthly payments. For homes that are already energy-efficient, the Town may help fund the

installation of renewable energy systems like solar, and potentially, vertical wind turbines.

Contact: ligreenhomes@townofbabylon.com. LIGH's website is at <http://ligreenhomes.com/page.php?Page=home>

Cambridge, MA (101,300, pop.)

A city-sponsored non-profit organization, the Cambridge Energy Alliance (CEA) is investing over \$100 million over the next five to six years to enable energy-efficiency retrofits of half of all city buildings, and reduce electricity demand by 15% and annual GHG emissions by 150,000 tons (10% of city's total). CEA estimates that the value of the energy savings is expected to be roughly \$160 million over the next 10 years.

Under the program, CEA participants (residents and businesses) will pay for efficiency and clean energy projects directly or through CEA-arranged financing for a term of up to ten years such that loan repayments are matched or exceeded by annual energy bill savings. No upfront costs will be required for such installations, and there will be no cost to Cambridge or state taxpayers.

A homeowner investing in a cost-effective package of measures addressing heating, cooling, insulation, water use, and lighting can typically save 20-30% of his or her current utility bills. For a homeowner spending \$3,000 annually for electricity, gas, oil and water, the annual savings would be \$600-1,000.

For more information, see www.cambridgeenergyalliance.org.

Recommendation: Town Council appoints an ad hoc committee to research and develop a town municipal financing program for energy efficiency upgrades and renewable energy within the town.

7. Cool Roofs

A cool roof reflects and emits the sun's heat back to the sky instead of transferring it to the building below. "Coolness" is measured by two properties, solar reflectance and thermal emittance. Both properties are measured from 0 to 1 and the higher the value, the "cooler" the roof." Studies have shown that the benefits of cool roofs are true in cold climates not just the sunny south.

Cool roofs directly reduce green house gas emissions by conserving electricity for air

conditioning therefore emitting less CO₂ from power plants. Cool roofs also cool the world independently of avoided carbon emissions, simply by reflecting the sun's energy as light back to the atmosphere, thereby mitigating global warming. A Lawrence Berkeley National Laboratory study found that world-wide reflective roofing will produce a global cooling effect equivalent to offsetting 24 gigatons of CO₂ over the lifetime of the roofs. This equates to \$600 billion in savings from CO₂ emissions reduction (www.coolroofs.org)

Additional Cool Roof Resources:

<http://www.consumerenergycenter.org/coolroof/>

<http://www.facilitiesnet.com/roofing/article/Beyond-Myths-To-Solutions--7052>

<http://www.ornl.gov/sci/roofs+walls/facts/CoolCalcEnergy.htm>

<http://www.epa.gov/heatisland/mitigation/coolroofs.htm>

Recommendation: *The Town Council should adopt a "Cool and Green Roof" policy which*

- *Encourages all new commercial roofs be either vegetated, or a cool roofs.*
- *Encourages all existing commercial roofs greater than 40,000 square feet should be retrofitted as a "cool roof" within 10 years. This can be accomplished through a coating applied to the existing grey roof.*

8. High Performance, Energy Efficient Public Buildings

Well-designed, high-performance "green" buildings provide substantial economic and social benefits at minimal or no additional first cost. Operating expenses can be dramatically reduced. Commercial buildings command higher rents and result in higher productivity and reduced sick time. In schools, attendance and test scores are higher. The primary obstacle to accessing these benefits today is limited expertise and experience in the design and construction of such buildings. This recommendation seeks to leverage the Town's building efforts as a means to accelerate this learning curve at the same time that the Town benefits from these advanced buildings.

The town now has experience with the LEED rating system through the new public safety building. In addition to LEED, which is a standardized system of the United States Green Building Council, the American Institute of Architects has articulated the "2030 Challenge". The 2030 Challenge is to make all new buildings, developments and major renovations meet a fossil fuel, GHG-emitting, energy consumption performance standard of 50% of the regional (or country) average for that building type, towards a goal of carbon-neutrality by the year 2030

www.architecture2030.org/2030_challenge).

Recommendation: *The Town Council should require that all new municipal buildings, including schools, are built to meet the highest feasible LEED standard and, meet the “2030 Challenge” energy performance standards. The Council should also encourage all new municipal construction be built with the most advanced energy performance designs available, aggressively seek out the frontiers of what is possible, and make Falmouth a national green building leader.*

9. Change How We Heat Water

Because traditional home water heaters keep water hot all the time, it is a poor use of energy to keep 40+ gallons of water hot all the time. Two sensible alternatives are:

- Solar Hot Water (highest initial install cost but best environmental outcome)
- On-Demand Water Heaters (fueled by either propane or electric)

New construction should be encouraged to use either solar hot water heating, or on-demand water heaters; plumbing a hot water heater so that it is always “on” should be discouraged. In addition, there should be an educational campaign to inform owners of existing homes about the benefits of switching to solar or on-demand heaters, and to realtors about educating their buyers on considering the type of water heater in their home search.

Hot water is a year-round need for homes and many businesses. The annual energy required to provide hot water in residences is typically exceeded only by that required for home heating and cooling. Energy requirements for producing domestic hot water in residences account for roughly 15 percent of all household energy use.

A variety of systems are available for producing domestic hot water, including systems devoted solely to hot water and combined systems capable of providing space heating/cooling as well as domestic hot water. The range of options include those systems providing increased efficiency in the use of traditional energy sources (e.g., fuel oil, natural gas, propane, electricity) as well as the use of renewable energy sources such as solar. The energy performance for these alternatives and the total lifetime capital plus operating cost vary widely, providing opportunities for substantial reductions in energy usage and emissions while providing lower lifetime costs for the property owner.

The town of Falmouth can encourage the transition to higher performance water heating systems by educating residents and business owners.

First, there are existing state and federal programs that provide various financial incentives to home and business owners. I.e., see the following references applicable to home owners:

http://www.energystar.gov/index.cfm?c=products.pr_tax_credits#7 and

http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=US37F&State=federal¤tpageid=1&ee=1&re=1

For information on federal renewable energy tax credits.

http://www.energystar.gov/index.cfm?c=products.pr_tax_credits#7 and

For information related to Maine's **Home Energy Loan Program (HELP)**, initiated in September 2006, provides low-interest loans to residents for energy improvements. Under HELP, the Maine State Housing Authority provides loans ranging from \$2,800 to \$30,000 at a fixed interest rate of 3.95% to homeowners. (Note that rates and terms are subject to change.)

http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=ME10F&state=ME&CurrentPageID=1&RE=1&EE=1

The HELP loans may be used to finance home energy audits, insulation, air sealing and weather stripping, and heating system repair or replacement. Eligible heating system improvements generally include furnace cleaning and tune-ups, replacement burners and/or fuel storage tanks, replacement systems and supplemental heating systems that meet certain efficiency standards, efficient wood stoves and wood pellet systems, geothermal heat pumps, and solar water-heating systems.

The existing state incentive programs have limited capital, and the money is often already spoken for well in advance of when these funds can be actually spent. The federal programs are in the form of tax credits and may not provide substantial benefits to those Falmouth residents that might benefit the most from these energy upgrades.

As discussed at the beginning of this section, domestic water heating has sufficient impact on energy and emissions as to warrant inclusion in any Municipal financing measures.

Recommendation: *The Standing Committee should educate the population and the building community on more modern and cost efficient ways to provide hot water and to provide information on programs and incentives available.*

E. Recommendations: Renewable Energy & Fuel Switching

1. Wind Generation In Falmouth Coastal Waters

At the recent Economic Development Council of Maine’s annual meeting, Dr. H.J. Dagher PE gave an excellent presentation about energy use in Maine and the possibility of filling future needs through wind generation.

By placing wind turbines in coastal waters, where the wind is more consistent, those communities that have coastline and place turbines within 8 nautical miles of the coast can benefit from a clean and renewable source of energy and the revenues generated by the turbines.

After the presentation Dr. Dagher asked the audience if there were any communities interested in locating wind turbines in their coastal waters.

Falmouth is well located in terms of a dense population and a large area of coastal water, and could very well serve as a pilot area for close in wind turbines.

Recommendation: *The Town Council should hold public hearings to gauge the public’s support for indicating to the State that the community is interested in siting coastal water wind turbines off the Falmouth shore.*

2. Wind Generation In Falmouth – On Land

Recommendation: *The Town Council should charge the Town Manager with identifying an appropriate, existing ordinance that would translate well for Falmouth and that would permit the erection and operation of appropriate scale wind generation facilities on private and public land. (Don’t reinvent the wheel, go find one and “borrow” it).*

3. Municipal Renewable Energy Supply

Some towns have installed municipally owned renewal energy operations. Hull MA, for example, has successfully erected several wind turbines. Other towns have installed solar arrays on municipal buildings.

Three technologies—wind, solar, and biomass--have significant promise for Falmouth. Owned and maintained either by the Town or by a cooperative arrangement, these could supply a

reliable, local source of clean power at stable prices. Rapidly emerging municipal solar technology (GridSolar, NanoSolar, and MorganSolar; etc.) is making solar photovoltaics a strong economic investment for establishing such a facility, or facilities. Falmouth may be able to produce a significant portion of its total energy demand, especially after performance upgrades, from solar.

Biomass Pyrolysis offers a clean, efficient, scalable co-generation technology that can utilize a wide range of biomass fuels. Biomass pyrolysis produces a “synthetic” gas (“syngas”) that is largely methane and can be used in combined cycle power production. It also produces charcoal, “biochar”. Biochar is a valuable agricultural soil amendment, retaining nutrients and water, and enhancing soil ecosystems. As a stable form of carbon, it also represents a net removal of carbon from the atmosphere and as such is “carbon negative”.

Advanced medium scale wind turbines (FloDesign Wind Turbine, <http://www.technologyreview.com/energy/21737/?a=f>; BroadStar Wind Energy; etc.) may also provide an opportunity for modest amounts of renewable power if sites with suitable wind can be identified.

Recommendation: *The Town Council should authorize the Town Manager to identify and bring forward recommendations on the feasibility and suitable locations of the development of Municipal renewable facilities.*

4. Tap Existing Gas Pipeline to serve Falmouth, Cumberland, Yarmouth and Conversion of Cousins Island Plant

Most of the rest of the Country has access to natural gas supply. Because of this, over the last forty years or so, a significant infrastructure allowing cost-effective distribution of natural gas has been built within major cities. Boston is served by three separate systems, and Portland initially was served as an extension of Boston’s system through Northern Utilities. The northern edge of that system is located in Portland with the very end of its “capillary “ distribution web extending to the southern border of Falmouth. Economics, at the time of its construction, did not allow for extensions beyond Portland.

- As a result, Falmouth and other communities north of Portland grew with a fuel-oil based energy supply . Fuel oil, while easy to store and move, is rich in carbon and can be expensive. Oil-based energy developments also included major industry supply, including the Cousins Island Power Complex (the Wyman Plant or “Wyman”), owned and operated by an affiliate of FPL (Florida Power & Light). Wyman is operated as a peak-day generation plant which is fed by fuel-oil supply received and stored at the

Plant from inbound fuel oil tankers. It is relatively rare, these days, to generate power with oil. Nonetheless, Maine, because of its infrastructure history, still has one of these Plants on Casco Bay. Wyman generates significant carbon emissions - and begs for a “solution” in terms of its significant carbon emissions and lack of efficiency.

- In 2004, Trans Canada and ConocoPhillips sought to convert the Plant to Liquefied Natural Gas (LNG) supply service thereby improving the Plant’s emissions profile and, perhaps, integrating it more into the power grid. That LNG project had environmental problems of its own and was vetoed by local voters in Harpswell.
- Wyman continues with its role as an oil-fired peaking plant, but can still be converted to natural gas service, not from LNG plants, but rather through natural gas pipelines to the west.
- In the late nineties, two new mainline natural gas systems were constructed through Portland moving gas from north to south. The first, Maritimes & Northeast Gas (M&NE) is a high-pressure, 36-in diameter line from the Sable Island gas field, offshore Nova Scotia to Dracut, Massachusetts – servicing Boston. The second, known as Portland Gas Transmission (PGT), is a similar high-pressure system extending from near Montreal (the Canadian Border) to Westbrook, Maine. PGT and M&NE actually combined their systems, at the behest of the Federal Energy Regulatory System, from Westbrook southward to Dracut.
- The M&NE line passes through Western Falmouth (east of Highland Lake). PGT intersects with M&NE from the northwest at a point just below Falmouth. Flows from both lines move, at the moment, from south to north and are operating at high pressures in the 1100 psig range.
- Also, the Wyman Plant maintains a right-of-way for its electrical output that passes just south of Yarmouth, through Cumberland to the Falmouth Country Club. The right-of-way then bisects Falmouth Country Club proceeding to the southwest where it intersects the main power grid just adjacent to the M&NE gas line.
- These power right-of-ways have been excellent corridors in reverse for natural gas supply.
- With the expansion of the gas line will come opportunities for natural gas fueling stations.

Recommendation: Town Council should contact Cumberland and Yarmouth and establish a tri-town ad hoc committee to study and work with the PUC and the owner of the Wyman Plant to determine if the conversion is feasible.

F. Recommendations: Transportation & Land Use

Jonathan Rubin reports in Maine’s Climate Future (U Maine, 2009) that, while transportation accounts for 20% of US GHG Emissions, it accounts for 40% of Maine’s GHG emissions.

Falmouth's local transportation emissions are in line with this report. To reduce emissions in this sector there are three general courses of action which may be taken: change the fuel type/vehicle in use, make engines more efficient, and/or work to reduce the VMT (Vehicle Miles Travelled). Although these actions are not within a town's capacity to effect directly, they may be influenced by Town policy and residents' decisions and behavior.

1. Adopt a Complete Streets Policy

To quote from the National Complete Streets Coalition: "Complete streets are designed and operated to enable safe access for all users. Pedestrians, bicyclists, motorists and transit riders of all ages and abilities must be able to safely move along and across a complete street." Instituting a complete streets policy ensures that transportation agencies routinely design and operate the entire right of way to enable safe access for all users. Places with complete streets policies are making sure that their streets and roads work for drivers, transit users, pedestrians, and bicyclists, as well as for older people, children, and people with disabilities.

The citizens and institutions of Falmouth spend significant money on vehicle fuels and expenses related to vehicles. Transportation is the second largest expense for American households, costing more than food, clothing, and health care. Even before the recent run-up in gasoline prices, Americans spent an average of 18 cents of every dollar on transportation, with the poorest fifth of families spending more than double that figure. Reducing dependence on vehicles will save families money.

According to the National Complete Streets Coalition: "The potential to reduce carbon emissions by shifting trips to lower-carbon modes is undeniable. The 2001 National Household Transportation Survey found 50% of all trips in metropolitan areas are three miles or less and 28% of all metropolitan trips are one mile or less – distances easy to walk, bike, or hop a bus or train. Yet 65% of the shortest trips are now made by automobile, in part because of incomplete streets that make it dangerous or unpleasant for other modes of travel. Complete streets would help convert many of these short automobile trips to multi-modal travel. Simply increasing bicycling from 1% to 1.5% of all trips in the U.S. would save 462 million gallons of gasoline each year. "

Although Falmouth's population distribution is more suburban and rural than a typical metropolitan area, the Complete Streets perspective has much to offer. Falmouth continues to move forward with parts of its Bike/Ped Master Plan (Please see Bike/Ped Recommendation.). A Complete Streets policy will ensure that there are generally agreed-upon priorities when renovating and/or constructing new transit paths which will complement this Plan and will contribute in the development of a Master Transportation Plan. (See Consolidate

Transportation Planning Recommendation.)

2. Implement planning measures to reduce roads and parking lots

It has been pointed out that, even with cleaner cars and fuels, transportation-related emissions will continue to exceed the target goal for global climate stabilization if VMT continues to rise.^[5] Improved planning measures can dramatically reduce Vehicle Miles Travelled (VMT).

- Consider creating less parking space, particularly free space. Planning for the maximum number of cars by laying down asphalt lots encourages more cars, creates heat islands and a large, impervious area for polluted storm-water run-off to rapidly move into the larger environment.
- Provide adequate Park 'n Ride spaces near highway entrances and near some bus stops.
- At schools, provide priority spaces for carpool vehicles, HOV spaces, encourage alternatives modes of transportation to/from school.
- In public and commercial space, provide priority spaces for HEV (high efficiency vehicles).
- Plan roads and location of developments to be served by present and future access to alternative modes of transportation.
- Slow traffic through traffic-calming measures when appropriate. Drivers take their cues from signs and road design.
- **Use Roundabouts at Intersections.** Roundabouts cut emissions and are safer than a conventional intersection with traffic lights.
 - Roundabouts cut hydrocarbon emissions at intersections by as much as 42%. Ten roundabouts in Virginia save 200,000 gal. of gas a year.
 - No traffic lights to light and maintain or power.
 - Roundabouts are safer. One study looked at 24 intersections that had been converted from traffic lights to roundabouts and found that total crashes dropped nearly 40% while injury crashes dropped 76% and fatal crashes by about 90%.

3. Accelerate Bike/Pedestrian Development in Falmouth

We recommend expediting the development of Falmouth's infrastructure for biking and walking. Falmouth is well-suited for biking and walking as its terrain is gentle, commuting distances are limited, its population is not large and vehicular traffic is not heavy. In spite of significant winters, walking and biking remain viable mobility options for 8 months a year. With the continued development of infrastructure and outreach to educate people about the benefits and responsibilities of biking and walking, some car trips and associated emissions will be avoided.

The Commission recommends the following three actions be implemented:

1. Establish a Bike/Ped Task Force as was recommended in the Bike/Ped Master Plan of 2003. Such a Task Force will work with the municipality to provide instruction in lawful, responsible behavior among bicyclist, pedestrians, and motorists. Use media to deliver safety messages.
2. Work to improve existing traffic laws which affect pedestrians and bicyclists, and to support their enforcement.
3. Work to reduce or eliminate disincentives for bicycling and walking and incentives for driving single-occupant motor vehicles.

The cost of these recommendations is variable whether one is developing outreach and education strategies or putting in sidewalks. Reductions in emissions add up. Looking at shifting just 20 trips per day (avg. within Falmouth trip 4 miles, roundtrip) from single occupant automobiles to bicycles could reduce up to 16,320 pounds of CO₂ a year and save \$1,512^[6]. Co-benefits from more biking and walking include less vehicle traffic, healthier citizens, a greater feeling of community with increased social interaction and the projection of a town which is friendly and livable.

4. Build Political Support for and Lobby the State to raise the State Gas Tax

Gas is relatively inexpensive compared to the society costs associated with driving. There is a belief in the citizenry that the gas tax fully pays for the roads. Not so. Many costs of roads are born by the property tax, and by the general fund / income tax. One glaring example is that when residents of the state are asked to vote for bonds for roads, there is no corresponding increase in the gas tax to pay for that bond.

Because the tax on gas is relatively low, Americans are more susceptible to swings in the gas price than for example Europeans. Gasoline needs to maintain a higher price point, consistently, to reward those who invest in more efficient automobiles, to get people in the habit of using mass transit, to live closer to work, etc.

The Town Council can influence this discussion by charging its representative to the Legislative Policy Committee of the Maine Municipal Association to take this issue to that body and request that it be debated. The Council can foster discussions locally on raising the state gasoline tax. Residents of the town can weigh in on the state debate by supporting a higher tax on gasoline; most legislators are afraid to do so without feeling that there is public support for this.

Some of the money can be used to reduce the cost to the general fund on road costs. A higher gasoline tax need not result in higher state spending. Additionally, the state should require that bonds for transportation (roads, bridges) be funded through an increase in the gasoline tax, and

that the impact on the gas tax should be put on the ballot to the voters. In this way the voters recognize that by voting for infrastructure bonds, that we will all share in those costs at the pump.

5. Consolidate Transportation Planning/Name a Director of Transportation

To reduce the overall VMT by Falmouth vehicles, a holistic view of transportation is required, one which:

- Puts a high value on connectivity of various kinds of routes (paths, sidewalks, roads, Public transportation routes)
- Recognizes and encourages the most efficient modes of transportation with the lowest emissions (whether by public bus, car, or bike, for instance)
- Considers ease of access to public transportation
- Considers the reduction of VMT by fossil-fueled vehicles to be a high priority

In recent years, other study groups have considered transportation issues and have made recommendations such as a Falmouth Transportation Committee or a Bicycle/Pedestrian Task Group noting the need for more attention to health and safety of Falmouth citizens. All note the need for more attention to matters of Transportation.

Historically, Falmouth's Director of Public Works has been engaged in the bigger transportation picture by being a liaison to PACTs, METRO and working with the Trails efforts. In more recent years, this larger view appears to have become distributed over several departments and committees. If the Director of Public Works were to become the Director of Transportation, for instance, transportation and pedestrian issues and development would have a central, coordinated home.

We are aware that the Department of Public Works has recently received \$50,000 to use in the creation of a town-wide Transportation Master Plan. In light of the challenges presented by Climate Change, we hope our recommendation will be seriously considered.

Recommendation: Change the title of Director of Public Works to Director of Transportation.

6. Municipal No-Idling Ordinance

Idling vehicle engines contribute to GHG emissions. Idling a vehicle for 5 minutes a day wastes about 13 gallons of gas a year and produces 247 lbs. CO₂. It is known that vehicle emissions also contribute to air pollution generally and aggravate lung ailments such as asthma. In Maine,

9.3% of children currently suffer from asthma, the highest rate in New England according to a 2004 study report.

People commonly let their cars idle to warm them up, while they run to do an errand, wait at traffic lights and while waiting curbside for a passenger. Trucks may idle while drivers deliver freight and at a job site. Few realize that warming a car engine up for more than 30 seconds is unnecessary or that shutting off an engine and restarting uses less fuel than 10 seconds of idling.

In 2007, Falmouth registered almost 3000 vehicles. Hypothetically, if a each registered vehicle idles for an of average of 5 minutes/day, emissions from idling would account for 1,610 tons CO₂e. Of government emissions, transportation accounted for almost 38% of its total emissions. What part of these emissions was attributable to idling is unknown; however, a “No Idling” Policy will produce some reductions and raise awareness of the impact of vehicular emissions generally.

Several towns and municipalities have such policies and ordinances. For the policy to be effective, education and outreach efforts will be necessary. The Sierra Club, EPA, American Lung and Natural Resources Canada have well-developed strategies for implementation.

No-idling in Falmouth, with necessary exceptions recognized, is a low/no cost idea with positive effects.

Recommendation: *The Council should charge the Town Manager to charge the planning staff to borrow from or copy (an) existing no-idling ordinance(s) and bring forth a recommended no-idling ordinance for public hearing and council vote.*

7. Establish Policies for Town Vehicle Purchase and Use

The Town Manager has been working to purchase gasoline efficient vehicles, and he has done away with reimbursement for employees’ use of personal vehicles in favor of their using a Town-owned hybrid gas-electric Prius, one of the most fuel-efficient vehicles available today. To institutionalize these policy changes, the Commission recommends that the Sustainability Coordinator and the Town Manager’s Office develop written policies for purchase and use of Town-owned vehicles.

Recommendation: *Institutionalize existing policies | develop written policies for purchase and use of Town-owned vehicles.*

8. Reduce Vehicle Miles Travelled (VMT)

We recommend that Town of Falmouth and Commercial employees and residents be encouraged to reduce their VMT by the means best suited to their situation. Transportation is a major contributor to Falmouth's carbon footprint. In the jurisdiction of Falmouth, 198,051 tons CO₂ was emitted in 2007 according to the Inventory, 68% of the total emissions. Although it is difficult to determine exactly how much of the total emissions are attributable to the people of Falmouth, by removing the State Highways contribution we have a better idea: 69,522 tons CO₂ or 43% of the total footprint measured.

Every gallon of gasoline used produces 19-20 lbs. CO₂. One less person commuting independently by car makes a substantial difference. If half of Falmouth's 2000 registered vehicles stayed at home just three days a week while their owner carpooled, for example, 100,000 gallons of gas would not be burned, 950 tons CO₂e would be avoided and \$185,000 would have been saved^[7]!

By checking resources from the break-room bulletin board to carpooling websites (such as GoMaine or GoLoco), employees, students and others may find ways to share the ride and reduce their VMT and commute costs. The Transportation Equity Act for the 21st Century (TEA-21) has amended the federal tax code to create financial incentives for commuter benefits for employers and employees. See <http://www.smartcommute.org/ForEmployersSS.htm>.

The non-profit organization, Portland Green Streets offers challenges and incentives for choosing alternative modes of travel. Schools, town Government and local businesses may think up specialized incentives for their commuters to reduce their VMT.

Falmouth High School has been working to reduce School Department transportation expenses (VMT is reduced concurrently). Some are talking about ways to reduce the number of single-occupancy student cars in the parking lot. This is a positive development.

Riding the School Bus: It is said that 20%-30% of AM traffic in America's communities is from private vehicles on their way to school. Falmouth could encourage more students to ride the bus by communicating to students and parents the positive environmental benefits of riding the school bus.

Bicycling: See Bike/Pedestrian Recommendations in this section. Maine now offers an incentive for bicyclists who commute.

Telecommuting: Telecommuting is an effective way to reduce VMT and emissions. 23.5 million employed Americans teleworked at least one day per month in 2003. This number rose to 24.1 in 2004. This number is expected to rise to 40 million by 2010.

Public Transportation: Public Transportation via Metro is another effective way to reduce VMT. The recently expanded route with its accompanying incentives (See Green Streets,

qualified free passes, and discounted student summer passes) has the potential to develop ridership while reducing VMT.

Recommendation: *Town government should encourage alternatives to single person occupant cars for commuting, and the Standing Committee educate and outreach to the community on the important of reducing vehicles miles travelled.*

9. Yards and Yard Maintenance

Per hour of operation, a power lawn mower emits 10-12 times as much hydrocarbon as a typical auto; a weed eater emits 21 times more and a leaf blower 34 times more. According to the U.S. Environmental Protection Agency (EPA), a traditional gas powered lawn mower produces as much air pollution as 43 new cars each being driven 12,000 miles. One gas mower emits 87 lbs. of the greenhouse gas CO₂, and 54 lbs. of other pollutants into the air every year.

Recommendations:

- *Standing Committee: Provide education to the community on what they can be done to lessen yard maintenance impact such as natural landscaping, smaller lawns, and naturalized areas in building lots.*
- *Municipal and School: Reduce minimum town mowed areas; get help from Master Growers, town garden clubs, extension service.*

10. Charge to the LPAC | Comprehensive Plan Committee

The town is in the process of updating its comprehensive plan. The Council has the opportunity to “charge” the Comprehensive Plan Committee.

The Comp Plan update should consider how the town should build out in the future, where and how roads should be built/expanded, the best location for future housing stock. New to the comp plan update should be an awareness of the connection between land use and emissions, and energy efficiency. Large lot housing makes public transportation uneconomic. Conservation subdivisions which don’t provide for agriculture uses on the “common” land could restrict future generations’ food source. A number of towns around the country are looking at the ordinances and land use plans in new ways. One is Vancouver, which has adopted an “Eco Density Charter” in its town charter (<http://www.vancouver.ca/ecodensity>). The Thomas Jefferson Planning Commission has written a “livable community” design manual. <http://www.tjpc.org/community/designManual.asp>. The Smart Code is an alternative to traditional zoning and regulates land uses and density based on a concept known as a transect. Some members of the Council have been introduced to the Smart Code in the past few years, but no real effort has been made to make this change in thinking and law in our community.

We strongly urge that this be taken seriously and that rather than looking at the obstacles to how a town converts from traditional zoning, we look at how it can be done.

Smart Growth refers to development practices that result in more compact, accessible, multi-modal communities where travel distances are shorter, people have more travel options, and it is possible to walk and bicycle to more destinations. Smart growth policies typically reduce per capita vehicle travel 10-30%. Although these land use changes take many years to be achieved, they provide diverse and durable benefits.

Finally, published federal government reports are now showing where changes in traditional climate patterns are likely to affect specific geographic areas including coastal areas of Maine. Land use planning should look forward to what these changes are likely to be and consider these changes when looking at public and private investments (wastewater treatment plants, bridges, parks, etc). This is now being referred to as “adaptation”.

Recommendation: *The Council should include in its charge to the Comprehensive Plan Committee the following:*

- *Adopt the Smart Code in place of the traditional zoning, and use the transect methodology of the Smart Code in planning for future land development, densities, and uses in town.*
- *Consider future needs for food production to be located close to the population.*
- *Investigate an “eco density” charter or variation thereof and introduce it to the community.*
- *Embed “smart growth” policies and recommendations in the Comprehensive Plan.*
- *Look at forecasted impacts on geographic parts of town for changing climate patterns and take these forecasts into account in updating the Comp Plan.*

G. Recommendations: Waste and Recycling

1. Strengthen Town Recycling Efforts

Falmouth has a dynamic and active recycling program led by the Recycling Committee of the Town. We applaud and support all their efforts.

Curbside collection of trash is on a weekly basis and curbside recycling collections, introduced in June 2007, are every second week. Further recycling options are available at 3 Recycling Stations (located at the Transfer station, Bucknam Rd and at Exit 10).

EcoMaine processes both the trash and recycled materials. Non-recyclable trash is processed in the ecomaine waste-to-energy plant which produces enough steam to generate 100,000 - 110,000 megawatts of electricity annually -enough to serve all the homes in both South Portland and Gorham. Burning the trash also reduces its volume by 90 per cent, leaving only ash to be buried at the landfill site.

Single sort recycling was introduced in May 2006. The many ripple-effect benefits are both economic and environmental and include: increased participation in recycling, less time for curbside collection, less idling time for trucks (resulting in less pollution), and fewer trips to the ecomaine recycling facility. All recycled materials are processed and sold at market rate. By December 2007 54% of residential waste was recycled.

Commercial waste and recycling data is difficult to measure as there are no incentives or requirements for businesses to provide information. Of note, Maine state law (statute Title 38, section 2138) requires businesses employing 15 or more people to recycle office paper and corrugated cardboard. EcoMaine produces a guide for small business recycling.

Recommendations:

- ***Maintain current curbside collections and consider weekly curbside recycling pick-up.***
- *Encourage EcoMaine communities to collectively bear cost of recycling stations i.e. “silver bullets”.*
- *Promote commercial recycling by education, incentives and annual recognition e.g. in Forecaster.*
- ***Enforce Statute Title 38, section 2138 (see above) and consider fines for non-compliant businesses as source of town revenue.***
- *Study idea of community composting site, possibly with public/private ownership and servicing neighboring communities.*
- ***Create ordinance that requires all public places have not only trash bins but also single-sort recycling and returnable bins.***

2. Wastewater

Many practical design and operating decisions made by wastewater treatment plants (WWTPs) can significantly affect overall environmental performance, particularly greenhouse gas (GHG) emissions. Electricity constitutes between 25 and 40 percent of the budget of a typical WWTPs.

The town recently upgraded its wastewater plant and in the process greatly reduced its emissions. However, there is still additional work to be done in terms of piping and valve upgrades.

The majority of Falmouth homes and businesses are on a public sewer system. The wastewater plant is located at Clearwater Drive with numerous pump stations through out town. Sewer charges are based on water usage and billed through Portland Water District. Wastewater is processed, water removed and solid waste hauled to commercial composting site in Unity, ME. The average annual cost of haulage of solid waste is \$100,000.

Recommendations:

- *Evaluate administrative and technical options for reducing GHG emissions through solid waste reduction, energy efficiency improvements, and/or operational modifications.*
- *Prioritize and plan GHG emission reduction projects.*
- *Implement highest priority projects.*

Draft July 13

III. Conclusion

We would like to thank the Town Council for making a commitment to reduce CO2 emissions and do our part to address the challenge of global climate change. We all learned quite a bit along the way and clearly there is more to be done. This report represents a point in time and the recommendations for which there was strong support among the members.

The problem of global warming can be overwhelming, but the Commission has come to understand that there are many actions, some small, some big, that all of us can take to not only reduce energy waste but also to reap the many benefits of a cleaner energy economy. We feel optimistic that, working together, our community can make a real difference for our town and our world.

Draft July 13

Appendixes

Appendix I: US Mayors Climate Change Agreement

US Mayors Climate Change Agreement

[Unanimously approved by Falmouth Town Council, May 2007]

ENDORISING THE U.S. MAYORS CLIMATE PROTECTION AGREEMENT

WHEREAS, the U.S. Conference of Mayors has previously adopted strong policy resolutions calling for cities, communities and the federal government to take actions to reduce global warming pollution; and

WHEREAS, the Inter-Governmental Panel on Climate Change (IPCC), the international community's most respected assemblage of scientists, has found that climate disruption is a reality and that human activities are largely responsible for increasing concentrations of global warming pollution; and

WHEREAS, recent, well-documented impacts of climate disruption include average global sea level increases of four to eight inches during the 20th century; a 40 percent decline in Arctic sea-ice thickness; and nine of the ten hottest years on record occurring in the past decade; and

WHEREAS, climate disruption of the magnitude now predicted by the scientific community will cause extremely costly disruption of human and natural systems throughout the world including: increased risk of floods or droughts; sea-level rises that interact with coastal storms to erode beaches, inundate land, and damage structures; more frequent and extreme heat waves; more frequent and greater concentrations of smog; and

WHEREAS, on February 16, 2005, the Kyoto Protocol, an international agreement to address climate disruption, went into effect in the 141 countries that have ratified it to date; 38 of those

countries are now legally required to reduce greenhouse gas emissions on average 5.2 percent below 1990 levels by 2012; and

WHEREAS, the United States of America, with less than five percent of the world's population, is responsible for producing approximately 25 percent of the world's global warming pollutants; and

WHEREAS, the Kyoto Protocol emissions reduction target for the U.S. would have been 7 percent below 1990 levels by 2012; and

WHEREAS, many leading US companies that have adopted greenhouse gas reduction programs to demonstrate corporate social responsibility have also publicly expressed preference for the US to adopt precise and mandatory emissions targets and timetables as a means by which to remain competitive in the international marketplace, to mitigate financial risk and to promote sound investment decisions; and

WHEREAS, state and local governments throughout the United States are adopting emission reduction targets and programs and that this leadership is bipartisan, coming from Republican and Democratic governors and mayors alike; and

WHEREAS, many cities throughout the nation, both large and small, are reducing global warming pollutants through programs that provide economic and quality of life benefits such as reduced energy bills, green space preservation, air quality improvements, reduced traffic congestion, improved transportation choices, and economic development and job creation through energy conservation and new energy technologies; and

WHEREAS, mayors from around the nation have signed the U.S. Mayors Climate Protection Agreement which, as amended at the 73rd Annual U.S. Conference of Mayors meeting, reads:

The U.S. Mayors Climate Protection Agreement

A. We urge the federal government and state governments to enact policies and programs to meet or beat the target of reducing global warming pollution levels to 7 percent below 1990 levels by 2012, including efforts to: reduce the United States' dependence on fossil fuels and accelerate the development of clean, economical energy resources and fuel-efficient technologies such as conservation, methane recovery for energy generation, waste to energy, wind and solar energy, fuel cells, efficient motor vehicles, and biofuels;

B. We urge the U.S. Congress to pass bipartisan greenhouse gas reduction legislation that includes 1) clear timetables and emissions limits and 2) a flexible, market-based system of tradable allowances among emitting industries; and

C. We will strive to meet or exceed Kyoto Protocol targets for reducing global warming pollution by taking actions in our own operations and communities such as:

1. Inventory global warming emissions in City operations and in the community, set reduction targets and create an action plan.
2. Adopt and enforce land-use policies that reduce sprawl, preserve open space, and create compact, walkable urban communities;
3. Promote transportation options such as bicycle trails, commute trip reduction programs, incentives for car pooling and public transit;
4. Increase the use of clean, alternative energy by, for example, investing in "green tags", advocating for the development of renewable energy resources, recovering landfill methane for energy production, and supporting the use of waste to energy technology;
5. Make energy efficiency a priority through building code improvements, retrofitting city facilities with energy efficient lighting and urging employees to conserve energy and save money;
6. Purchase only Energy Star equipment and appliances for City use;
7. Practice and promote sustainable building practices using the U.S. Green Building Council's LEED program or a similar system;
8. Increase the average fuel efficiency of municipal fleet vehicles; reduce the number of vehicles; launch an employee education program including anti-idling messages; convert diesel vehicles to bio-diesel;
9. Evaluate opportunities to increase pump efficiency in water and wastewater systems; recover wastewater treatment methane for energy production;
10. Increase recycling rates in City operations and in the community;
11. Maintain healthy urban forests; promote tree planting to increase shading and to absorb CO₂; and
12. Help educate the public, schools, other jurisdictions, professional associations, business and industry about reducing global warming pollution.

NOW, THEREFORE, BE IT RESOLVED that The U.S. Conference of Mayors endorses the U.S. Mayors Climate Protection Agreement as amended by the 73rd annual U.S. Conference of Mayors meeting and urges mayors from around the nation to join this effort.

BE IT FURTHER RESOLVED, The U.S. Conference of Mayors will work in conjunction with ICLEI Local Governments for Sustainability and other appropriate organizations to track progress and implementation of the U.S. Mayors Climate Protection Agreement as amended by the 73rd annual U.S. Conference of Mayors meeting.

Draft July 13

Appendix II: Existing Climate Protection Activities in Falmouth

The professional leaders at both the municipal and school departments consistently take measures to spend wisely our limited energy dollars and consciously move in a direction which lessens the town's impact on the environment. Guided by the residents of Falmouth, the town is taking a leadership role in addressing the reality of global climate change.

Through the recent passage of the Open Space Bond it is evident that citizens in Falmouth place a high priority on the preservation of clean air, water and arable land. It was made clear that the town takes seriously its responsibility for addressing the effects of pollution through the 2008 town council signing on to the U.S. Mayors Climate Protection Agreement.

The following is a select list of what has been done by the town to-date:

Police & Public Safety Department:

- Police Station achieved LEED Silver status in 2009
- Green Cleaning Products used town wide due to requirement at new station
- Chief's primary vehicle is a Hybrid 4 Cylinder Toyota Camry
- Downsized two patrol car engines to six-cylinders, from eight
- Maintained police motorcycle patrol
- EPA Energy Star Benchmarking being completed in summer 2009
- Converted most traffic signals to LED
- LED light bars on Police vehicles

Information Technology Department:

- Data Center moved to Police Station to share uninterruptible power supply (UPS) device
- Converted town council meeting materials to paperless with online availability for all
- Installed VOIP phone system
- Converted to thin client servers
- Instituted Online Process for: Community Programs Brochure & Registration and for Vehicle Registration

Town Hall:

Administration

- Upgraded vehicle fleet to Toyota Prius' (Codes, Central Fire, General Use)
- Instituted an employee commute policy to prioritize hybrid use, \$10,500 annual savings
- 2008, developed part-time position of Energy and Sustainability Coordinator
- Joined EPA's Energy Star Challenge
- LED Christmas Lights – utilizing more each year
- Increased recycling rates within town via single sort curbside pick up
- Spring of 2009 town hall moved to 4-day week and enhanced town's online services
- Developing a comprehensive Energy Management Plan for the town with the goal of reducing municipal energy costs by 40% of 2007 figures by 2017

Building

- Improved light quality at Town hall, switched from incandescent to fluorescent bulbs, installed T-8s lamps with electronic ballasts and occupancy sensors
- Exterior lights are high pressure sodium efficient fixtures using photocell timers
- Personal CRTs changed to LCD
- All kitchen appliances Energy Star registered
- Implemented new Energy Management System
- Installed software driven town wide security system
- Upgraded boiler to high efficiency Viessmann Vitodens condensing unit and hot water to small staged gas fired heater. This propane unit has cascade controls and outside temperature setback.
- Stimulus funds grant is being pursued to remove asbestos siding and increase insulation.
- All buildings going through Energy Star benchmarking process during the summer of 2009

Fire and EMS Services:

Central Fire

- Red Toyota Prius chosen as personnel commuter vehicle
- Upgraded bay area heating system to two high efficiency propane Viessmann Vitodens condensing boilers with cascade controls and outside temperature setback. HVAC system is a high efficiency Trane propane rooftop unit.
- High efficiency 60 gallon propane fired hot water heater installed to handle long lasting emergency situations such as recent ice storms. A climate adaptation measure.
- Replaced overhead doors with 2" high R value panels, brush style weather stripping for longevity and fully insulated glass.
- All office and bay lighting replaced with T-8 lamps and electronic ballasts
- Exterior lighting replaced with HID full cutoff fixtures on photocell control
- All windows replaced with low E insulated glass or storefront style glazing with insulated glass.

- 1" polystyrene insulation added to existing walls and new walls in addition were SIP's panels per police station design.
- Assistant Chief Patey assisting with facility design and operation skills to make town's buildings energy efficient.
- Stimulus Grant being pursued to install solar thermal hot water system on flat roof.

Winn Rd.

- Four student fire fighters moving to station summer 2009, efficient lighting, appliance and insulation being done in preparation.
- FEMA Stimulus Grant being applied for to upgrade and expand fire station. Several sustainability criteria are to be met during construction. Solar thermal hot water system is being recommended.

Wastewater Department:

- Major upgrade to plant completed in 2008. Upgrade of motors, fans and variable speed drive pumps and use of biologic agents in treatment process are projected to save over \$50,000/year in electrical costs.
- Installation of deeper aeration tanks and fine bubble aeration will result in major reduction in use of chemicals and energy.
- Administration building renovation included use of energy efficient materials, such as energy star windows, radiant heat, 2'X6' construction, 16" of insulation and fluorescent lighting. Project took advantage of Efficiency Maine rebate program for businesses.

Department of Public Works:

- All diesel vehicles using B-10 or B-20 mix
- Heating system upgraded to high efficiency propane Viessmann Vitodens condensing boiler with cascade controls and outside temperature setback. Waste oil is fuel source for heating hot water and bay area.
- All lighting upgraded to high efficiency T-8 and T-5 lamps with electronic ballast.
- Increased recycling rates within administrative areas.
- DEP voluntarily called in to do audit of building runoff and air quality.

School Department: [to be added]

Appendix III: Emissions Inventory

Green House Gas Emission Inventory

Falmouth, Maine

2008

Prepared by

**Falmouth Green Ribbon Commission
on Climate Change and Energy Efficiency**

Emissions Subcommittee

Credits and Acknowledgements

The following individuals, organizations and departments are gratefully acknowledged for their contributions toward the preparation and production of this community wide emissions inventory for the Town of Falmouth:

Volunteers

Claudia King - Co-chair Cool Falmouth; Emissions Subcommittee	Dee Conroy Vella, Emissions Subcommittee
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Cathy Van der Kloot, Cool Falmouth	Ben Tweed, Student, Falmouth High School
Denise Dyck, Cool Falmouth	Simone Egidi, Student, Falmouth High School
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Ellen Klain, Volunteer	

Town of Falmouth

Nathan Poore, Town Manager	Chief Edward Tolan, Police Dept
Anne Gregory, Assessor	Doug Patey, Fire and EMS Dept
John McNaughton, Finance Dept	Pete Clark, Wasterwater
Randy Davis, Finance Dept	Diane Moore, Wastewater
Ellen Planer, Finance Dept	Dan O'Shea, School Dept
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Ryann Stevens, Public Works	Al Ferris, Code Enforcement Dept
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Stephanie Cutts, Policy Analyst, Cool Cities	

Program

ICLEI - Local Governments for Sustainability

Missy Stultz, Senior Program Manager
Courtney Forrester, Program Associate

Jonathan Knauer, Program Associate

And

Maine Dept of Transportation
Greater Portland Council of Governments
ECO Maine

METRO - Greater Portland Transit District
Natural Resources Council of Maine
Pine Tree Waste

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Introduction

The Falmouth Green Ribbon Commission (FGRC) Emissions Subcommittee prepared this greenhouse gas (GHG) emissions inventory in 2008 using data through the year 2007. The need for conducting a detailed inventory of greenhouse gas emissions comes from the idiom “what you can measure, you can manage.” For several years scientific communities around the globe have been publishing reports that document the rise in levels of certain pollutants, which have exacerbated the greenhouse gas effect in the atmosphere surrounding the earth.

There is compelling evidence that the rise in the pollutants, labeled greenhouse gases, has been caused in part by the actions of human kind. The six most common gases which are relevant to radiative forcing (greenhouse effect), as listed by the Intergovernmental Panel on Climate Change (IPCC) are: Carbon Dioxide, Carbon Monoxide, Methane, Nitrous Oxide, Tetrafluoromethane, and Hexafluoroethane. (The CACP software addresses the most commonly found gases and converts them equivalents of Carbon Dioxide for ease of comparison.) The movement to measure and then work to reduce these gases is the inspiration for the creation of the FGRC and Emissions Subcommittee. For the purpose of this initial emissions inventory we have limited our scope to those directly attributable, and straightforwardly accounted for, within the boundaries of the town of Falmouth. Future inventories may want to investigate the full life cycle of pollutants attributable to energy use in Falmouth.

Falmouth recognizes that climate change is a reality that must be addressed immediately to avoid dire environmental and economic consequences. Spurred by the efforts of a citizen’s action group, Cool Falmouth, the Falmouth Town Council adopted a resolution authorizing the chair, Richard Olson, to sign the U.S. Mayors Climate Protection Agreement in May 2007. To work towards that goal, the FGRC is following a practice, known as ICLEI’s Five Milestone Process for Climate Mitigation, which has been used successfully by other towns, cities and states to address the challenges posed by climate change.

There are five milestones along this path:

- Conduct a baseline inventory of GHG emissions
- Establish an emissions reduction target
- Develop a Climate Action Plan (CAP) to meet reduction targets
- Implement the CAP
- Monitor, verify and report improvements in GHG emissions

This report represents the first of these five steps. Before detailing the findings of the inventory, this report first provides background information on both the town and the process (Section 2). Section 3 describes the methods used to complete the GHG emissions inventory. Inventory results are presented in Section 4. Section 5 offers conclusions of this report, and describes the next steps in the Five Milestone process.

Inventory Methods

The main objectives of the GHG emissions inventory are: 1) to establish a baseline, against which to measure future progress; 2) to define the largest sources of emissions and the greatest opportunities for emissions reductions; and 3) to serve as an education tool that will help motivate change.

The GHG inventory employs data collected for the calendar year 2007. After consultation with ICLEI Northeast, the Commission selected 2007 as the baseline year, because this was the year with the most complete and reliable data. It is expected that a standing committee will be responsible for updates to the inventory, which will be necessary to track reductions in emissions.

The inventory calculations were carried out using the Clean Air and Climate Protection (CACP) software obtained through the town's membership in ICLEI, Local Governments of Sustainability. The software was developed by Torrie Smith Associates, and was originally released in 2003. It is the intellectual property of the State and Territorial Air Pollution Program Administrators and Association of Local Air Pollution Control Officials (STAPPA/ALAPCO) and ICLEI.

The CACP software calculates emissions resulting from energy consumption and waste generation. The CACP software determines emissions using specific factors (or coefficients) according to the type of fuel used. CACP aggregates and reports the three main GHG emissions (CO₂, CH₄, and N₂O) in terms of equivalent carbon dioxide units (CO₂e). Converting all emissions to equivalent carbon dioxide units allows for consideration of different greenhouse gases in comparable terms. For example, on a per-weight basis, methane (CH₄) is 21 times more potent than carbon dioxide in its capacity to trap heat. Therefore, the CACP software converts one metric ton of methane emissions to 21 metric tons of carbon dioxide equivalents. The potency of a given gas in heating the atmosphere is defined as its Global Warming Potential (GWP)[\[8\]](#).

The CACP software reports input and output data in several formats, including detailed, aggregate, source-based and time-series reports. Once a target reduction year has been agreed upon by the FGRC, the CACP software will be used to forecast future GHG emissions, based on growth rate indicator data inputs. This feature can be used in conjunction with the CACP measures selector and ICLEI's CAPP tool to craft a pragmatic and achievable GHG reduction plan.

Emissions coefficient factors used in the software are based on USEPA's (2007) Inventory of Greenhouse Gas Emissions and Sinks: 1990-2005[9]. The emissions coefficients and quantification method employed by the CACP software are consistent with national and international inventory standards established by the Intergovernmental Panel on Climate Change[10] and the U.S. Voluntary Greenhouse Gas Reporting Guidelines (EIA form1605). Coefficients are updated by ICLEI as new scientific research results become available.

Emissions Results

The inventory results presented in this section are segregated into two main sectors: Community and Government. Each sector is distinct in scope and in the way that the data is gathered. In both cases, results are limited by the quantity and quality of available data. It is the nature of the work that community data is based on best available estimations and government data upon actual figures.

A. Community Sector Emissions

The community sector refers to emissions associated with all sectors of the town, including the municipality and schools, within the geopolitical boundary of Falmouth.

Emission calculations for the community sector analysis are based on complete data when available, or modeling calculations, assumptions, and estimations when data are lacking.

Table 1 summarizes community emissions by sector: residential, commercial, transportation, and waste. Transportation is the largest emitter at 68% of total emissions or 198,000 tons CO₂e. Residential follows at 23% of total emissions or 67,000 tons CO₂e. Sources of GHG by each sector are detailed in the following subsections.

Table 1. Community Green House Gas Emissions by Sector

	Equiv CO₂ (tons)*	Equiv CO₂ (%)	Energy (MMBtu)*
Residential	67,200	23	776,500
Commercial	24,200	8	252,200
Transportation	198,000	68	2,311,000
Waste	600	0.2	
Total	290,000	100	3,339,700
* Tons CO ₂ e and MMBtu rounded to nearest hundred.			

It is important to note that emission calculations for sections of the Community Sector analysis are based on complete data when available, and modeling calculations, assumptions and estimations when the data did not exist. By comparison, the Government sector analysis is based upon review of actual utility invoices and data collected by the various departments responsible for emissions creation. This will allow the Government to track its individual facilities and vehicles and to evaluate the effectiveness of its emissions reduction efforts at a more detailed level. The results of both sectors are limited by the quantity and quality of available data.

Climate Action Plans do not typically capture all CO₂ emissions. A document summarizing key findings from CAPs, developed by the Town of Chevy Chase, MD outlines some of the missing activities:

"They do not, for instance, include air travel (into or out of a city). When Aspen, Colorado calculated its air travel, it constituted almost half of total transport which itself constitutes two-thirds of Aspen's CO₂ emissions. Aspen is a relatively small city with a large amount of private and commercial air traffic for tourism and so is a special case. Nonetheless, air travel should be included in assessments where relevant. In addition, no city included the energy costs of consumer goods in their calculations except to the extent that they are reflected in solid waste. Carbon dioxide is emitted in the extraction of resources, production, and transport of all goods and those who consume more goods will be causing emissions of more CO₂[\[2\]](#). "

B. Transportation

While other towns also typically report highest emissions from transportation and residential, Falmouth's transportation sector is disproportionately high. This finding is likely due to the two highways (I-95 and 295) that pass through town. Consequently, there is a significant segment of transportation emissions that we cannot directly influence through local action.

C. Residential

GHG emissions associated with the residential sector include direct emissions (i.e., created onsite) and indirect emissions (i.e., created far away but directly attributable to the particular consumer). Table 2 summarizes residential energy use by fuel source, covering both heating and lighting of homes.

Light fuel oil is the biggest contributor to residential emissions, supplying 50,000 tons CO₂e, or 74% of the total. The 74% contribution from light fuel oil is generally consistent with media reports that Maine is one of the most oil dependent states in the country. Electricity accounts for 15,400 tons CO₂e, or 23% of the total. Electricity use includes both heat and light. Wood fuel contributes 60 tons CO₂e and represents just 0.1% of total residential emissions. Propane produces 2,000 tons CO₂e and represents 3% of the total residential emissions.

Table 2. Residential Energy Usage by Source

	Equiv CO₂(tons)	Equiv CO₂ (%)
Electricity	15,400	23
Fuel wood (Air Dry)	60	0.1
Light Fuel Oil	50,000	74
Propane	2,000	3
Total	67,460	100

Data on electrical use is expected to be highly accurate, in that Central Maine Power (CMP) reports the exact metric required in the model. In contrast, inputs on the other three fuel sources were estimated through statistical analysis and projection. Input variables on home heating energy were calculated based on the residential square footage and primary heat sources documented by the Falmouth's Assessor's Office.

D. Commercial

In Falmouth, the commercial sector primarily includes retail businesses and Government. As mentioned previously, the Government emissions are presented as part of the whole town and also in a sub-section in a more detailed analysis, however have not been double counted. Little if any industry is located within Falmouth. Within the commercial sector, electricity represents the biggest source of GHG emissions, 63% of total emissions and 15,200 tons CO₂e. As discussed above for the residential data, electricity use includes both heating and lighting. It has been reported by Maine Power Options that electrical rates are expected to continue to increase, due in part to the growing demands on the ISO New England grid especially during

peak times, and the capacity charge rate structure. Thus, focusing on improving commercial electricity efficiency will likely yield substantial GHG reductions as well as cost-savings for the commercial building owners. After electricity, light fuel follows in magnitude, representing 24% of total commercial emissions, or 5,800 tons CO₂e. Propane produces 13% of total commercial emissions, equivalent to 3,200 tons CO₂e.

The consumption calculations are based on the Assessor’s records of primary heat sources, square footage and CMP electrical records. Commercial buildings typically rely on more than one source of heat.

Table 3. Commercial Sector Energy Consumption by Type

	Equiv CO₂(tons)	Equiv CO₂ (%)
Electricity	15,200	63
Light Fuel Oil	5,800	24
Propane	3,200	13
Total	23,200	100

E. Waste

The waste sector represents waste that was incinerated after curb-side collection or drop off at the transfer station. Total waste-related emissions are almost 600 tons CO₂e, which represents less than 1% of the total community emissions. Waste data excludes recycled materials, as well as chipped brush and wood.

Waste emissions also exclude commercial waste, because the local haulers do not keep consistent data for this variable. By some estimates, commercial waste may account for as much as 1,500 tons of waste annually. In the absence of accurate breakdowns of waste type, it is not possible to accurately calculate the CO₂e. If data on waste become available in the future, waste-related emissions estimates should be refined.

Table 4 was calculated using a methodology called “waste characterization,” based on the composition of the waste that Falmouth incinerates. ICLEI and other agencies have used this sampling technique to determine the average composition of the waste stream for specific targets such as geographic area, household composition, business type, etc.

Table 4. Residential Waste by Category

	Equiv CO2(tons)	Equiv CO2 (%)
Collected brush	27	4.5
Paper Products	79	13.2
Food Waste	27	4.5
Plant Debris	21	3.5
Wood/Textiles	8	1.3
All Other Waste	437	73
Total	599	100

Given the magnitude of the “all other waste” category (72% of total), refined characterization of waste composition may yield more accurate estimates. Programs targeting waste reduction are some of the most effective and low cost options for reducing GHG emissions, as shown in Table 5 in relation to CO2e avoided through recycling. A goal of waste reduction is to encourage consumers to consider the complete life cycle of a product, before a purchase is made. Reuse involves reusing an item for new purposes when the original use has ended. If a product cannot be used effectively throughout its life cycle, an alternate choice should be considered.

Table 5. Comparison of Residential Waste and Recycling

	Weight (tons)	Equiv CO2(tons)
Incinerated Waste	2,908	599
Recycled Waste	1,781	395(avoided)
Total	4,689	599

395 tons CO₂e Avoided By Recycling!

The ICLEI software does not have a provision in the current year analysis to account for recycling efforts. The town’s recycling rate has increased steadily over the past few years and is approaching Cumberland’s rate of 60%.

F. Government Emissions

In an additional calculation, the Government (municipal and schools) emissions were measured, as opposed to modeled. This section is a subset of the numbers contained in the Community Emissions, and is not “in addition to”.

The government sector analysis is based on actual utility invoices and data collected by various municipal departments. Compilation of such data allows the municipality to track its individual facilities and vehicles and to evaluate the effectiveness of its emissions reduction efforts at a more detailed level.

The government data analysis is based on invoice review and reporting by the town’s Accounts Payable (A/P) department, such that figures approach 100% accuracy in almost every category. There may be de minimis (less than 5% of total) emissions that have not been accounted for in the government analysis. An example of a de minimis emission is the Department of Public Work’s practice of burning waste oil from vehicles, to heat the maintenance bay. Although the quantity of waste oil burned is not tracked, GHG emissions from this source are expected to be less than 5% of the government sector’s total GHG emissions.

The town’s buildings account for the greatest portion of the total emissions, 49%, equivalent to 3,000 tons CO2e emitted. The vehicle fleet accounts 21% of the total, equal to 1,300 tons CO2e. Employees’ commutes account for 17%, or 1,000 tons CO2e, while water/sewage (treatment, pump stations and wastewater treatment) accounts for 11%, or 700 tons CO2e.

The town is currently looking at all structures to try and determine the highest and best use for each, in anticipation of the construction of a new elementary school. If uses are modified in the future, buildings emissions will likely change.

Table 6. Government Emissions Summary by Sector

	Equiv Co2 (tons)	Equiv Co2 (%)	Energy (MMBtu)
Buildings (including schools)	3,000	49	33,000
Vehicle Fleet	1,300	21	17,000
Employee Commute	1,000	17	12,000
Streetlights	100	2	1,200
Water/Sewage	700	11	6,600
Total	6,100	100	69,800

Table 7. Government Emissions by Fuel Type

	Equiv CO2 (tons)	Equiv CO2 (%)
Electricity	1,889	31
Light Fuel Oil	1,937	31.5
Propane	11	0.2
Biodiesel (B-20)	840	13.6
Diesel	4	0.1
Gasoline	1,462	23.8
Total	6,143	100

G. Comparison of Community and Government Emissions

Although comparing the Community CO2e Emissions and the Government CO2e is not an “apples to apples” comparison (Please read how the data is gathered for each Sector.), looking at them together allows us to make a couple of statements. First, we can see that it is non-governmental entities making the vast majority of measured emissions. It can be deduced that, although businesses and through-traffic contribute substantially to the overall emissions, Falmouth residents and their residences contribute the largest percentage.

Table 8. Comparison of Total Emissions from Community and Government

	Equiv CO2(tons)	Equiv CO2 (%)
Community	290,104	98
Government	6,143	2
Total	296,247	100

Second, although the government’s emissions may be relatively small (2%), the government has a special role in town. The government can take a leadership role in implementing reductions and in demonstrating their efficacy. Developing programs at the government level may help define which reduction measures make the most environmental, economic and social sense for application in the commercial and residential sectors. And finally, the Government Sector may yield CO2e reductions more readily than the rest of the town. Such success may encourage others to make the necessary changes.

[1] Software developed by Torrie Smith Associates, 2003. Intellectual property of the State and Territorial Air Pollution Program Administrators and Association of Local Air Pollution Control Officials (STAPPA/ALAPCO) and ICLEI.

[2] <http://www.townofchevy Chase.org/assets/documents/pdfs/committees/climate/What%20do%20Climate%20Action%20Plans%20say.pdf>

[3] Idea modified from Los Angeles County Public Health initiative to bring restaurants into compliance with health standards.

[4] (<http://www.completestreets.org/>)

[5] Growing Cooler: Evidence on Urban Development and Climate Change, Urban Land Institute, <http://www.uli.org/>

[6] Calculations involve biking 7 days/week for 8 months. 20 lbs. CO₂ per gallon of gas. Avg. car gets 24 mpg and gas costs \$1.85

[7] Assumes 8 mile commute, 16 perday, 50 weeks, 24 mpg, 19 lbs. CO₂e per gallon gas)

[8] For more information, see Appendix E Global Warming Potentials (IPCC Second Assessment Report 1995).

[9] See Appendix for detail: Table G.7 eGRID for electricity, Table G.9 for transport fuels, Table G.1 for fossil fuel combustion, Table G.3 for factors by fuel type and sector, "Appendix E" for Global Warming Potentials conversions. Source: ICLEI Local Government Operations Protocol, 8/08.

[10] 1996 Revised IPCC Guidelines for the Preparation of National Inventories