NH Municipal Energy Assistance Program

Made possible through the NH Public Utilities Commission and the Greenhouse Gas Emissions Reductions Fund

Municipal Greenhouse Gas and Energy Use Baseline

Report for Bedford

This report is a summary of greenhouse gas emissions and energy use for the town of Bedford, NH for the year 2008. The focus of this report is the municipal operations of the town, with special emphasis on town-owned buildings. It does not encompass residential, commercial, or industrial energy use. The following analysis of municipal energy use is based on data gathered from the municipality's utility bills for building electricity, building heating fuel, streetlight electricity, and municipal fleet vehicle fuel. Supporting data was also collected including building dimensions, hours of operation, number of streetlights, and vehicle types. The data was then analyzed using two software tools, Portfolio Manager Software provided online by the US Environmental Protection Agency (EPA) and the Small Town Carbon Calculator (STOCC) software developed by the University of New Hampshire and Clean Air-Cool Planet.[1] The STOCC software provides comparative information between the various sectors of municipal energy use (buildings, vehicles, and streetlights) while the Portfolio Manager software provides in-depth analysis of energy performance in individual buildings. The energy use per square foot is presented for each building, and Portfolio Manager allows for comparison of this metric to buildings of similar types across the US and in New Hampshire specifically.

This report was made possible by the Municipal Energy Assistance Program (MEAP), a collaborative project of Clean Air-Cool Planet, Jeffrey H. Taylor and Associates, the SDES Group, the Sustainable Energy Resource Group, Vital Communities, and Carbon Solutions New England and funded by the Regional Greenhouse Gas Initiative (RGGI). The community applied for support from the MEAP program and was selected to receive this baseline energy inventory. Community officials, employees, and volunteers then assisted the MEAP Energy Project Assistant, who collected and analyzed the data in this report.

Municipal Collaborator(s):	Chris Bandazian:	Bedford Energy Commission.
	Jim Stanford:	Bedford Public Works

This report was prepared by James Vayo.

[1] For more information on EPA Portfolio Manager Software, see www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager. Information on Small Town Carbon Calculator (STOCC) software is at www.cleanair-coolplanet.org.

Municipal Overview

Town population: 21,146[2].
Area of municipality: 33.1 sq. mi.
Population density: 635.9 persons/sq. mi.
Number of municipal buildings: 9
Total area of municipal building space: 115,002 sq. ft.
Average site energy intensity of all municipal buildings: 77.7 kBtu/sq. ft.
Number of street lights: 20 (+13 other facilities).
Number of vehicles in fleet: Data not collected (13 departments).
Number of municipal employees: Data not collected.
Municipal budget in baseline year: $24,596,051 (FY2009).
Total cost of municipal energy use in baseline year: **$551,956**.
Total municipal energy use in baseline year: **21,055 MMBtu**.
Total municipal CO2 emissions in baseline year: **1,847 tons**.

Community Profile

The town of Bedford located in Hillsborough County is bounded by Goffstown to the north, New Boston & Amherst to the west, Merrimack to the south, and Manchester to the east. Bedford, incorporated in 1750, is home to 21,122 residents, and ranked 12th by population among New Hampshire's incorporated cities and towns. Bedford's 2009 municipal budget appropriation was $24,596,051.

The Bedford's Master Plan is currently in the process of being updated in 2010. The master plan is expected to be completed this year and will refresh zoning and land use regulations. Bedford voters elect representatives to the Town Council which is chaired by Mike Izbicki. The town administrator, Russ Marcoux, the Bedford Local Energy Commission, and the Town Council all supported this energy inventory project.

Bedford Energy Commission

Much of the data in this report was collected by the Bedford Energy Commission, which has proven to be vital in the timely completion of this report. Special thanks to Bedford Energy Commission chair Chris Bandazian.

Bedford Municipal Buildings

Bedford Town Offices

Bedford Park Building

[2] Population numbers are taken from the 2007 estimates from the census bureau at http://factfinder.census.gov/servlet/SAFFPopulation?_submenuId=population_0&_sse=on.

Bedford Public Works Garage

Bedford Transfer Station

Bedford Library

Bedford Old Town Hall

Bedford Cable Television Building

Bedford Safety Complex

Note: Image not shown for the Bedford Pool Building which was included in this baseline energy inventory.
Other municipal buildings were excluded from this report due to their level of usage or third party energy responsibility.

Municipal Sector Analysis

For each participating municipality, data was gathered on the operations of several sectors under the jurisdiction of the municipal government: the buildings, vehicle fleet, and street lights. Different types of energy use were considered depending on the sectors, such as electricity use, heating fuel use, and fuel for vehicles. Where records were available, the costs of purchasing these energy sources were factored in to the analysis. The STOCC software was used for the analysis of the aggregate data on all municipal sectors.

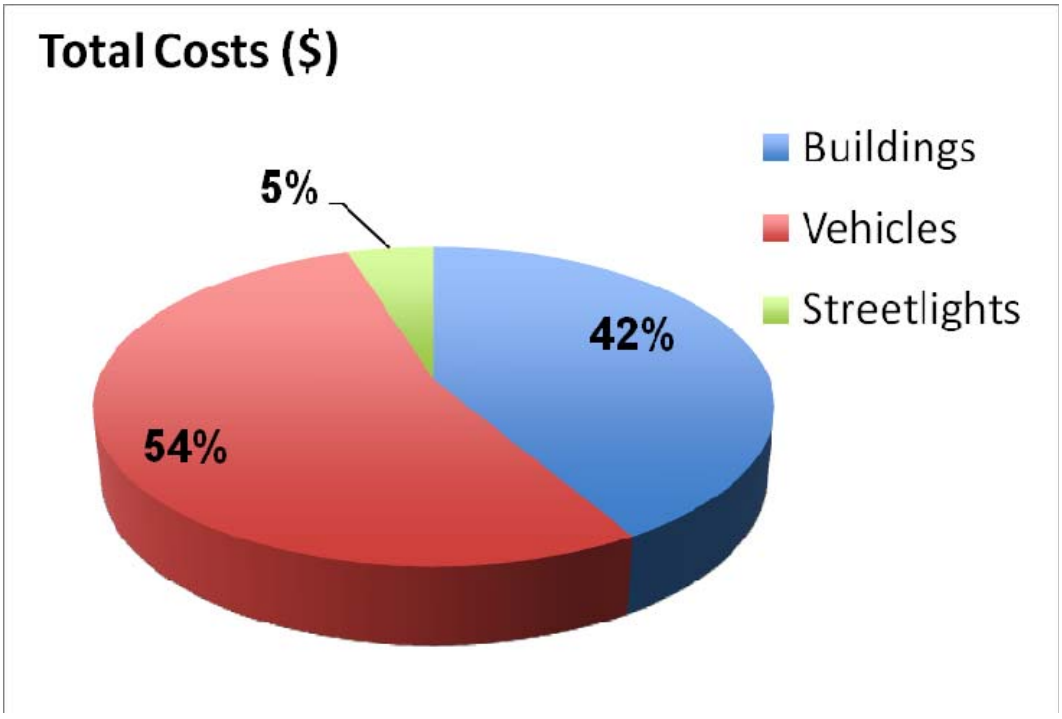
Table 1. Energy use, carbon emissions, and costs, by municipal sector

	Buildings		Vehicles		Streetlights		
	#	% of total	#	% of total	#	% of total	Grand Total
Cost	229,398	42	296,039	54	26,518	5	551,956
CO2 (lbs)	1,601,117	43	1,990,548	54	102,573	3	3,694,237
Energy (mmBTU's)	8,032	38	12,514	60	386	2	20,932

Generated by STOCC Software

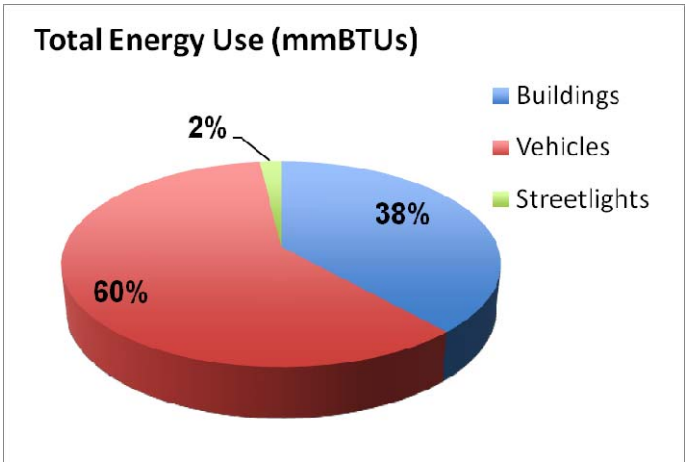
Snapshot of Municipal Energy Use, Emissions, and Costs by Sector

Graph 1c. Energy Costs by Municipal Sector ($)

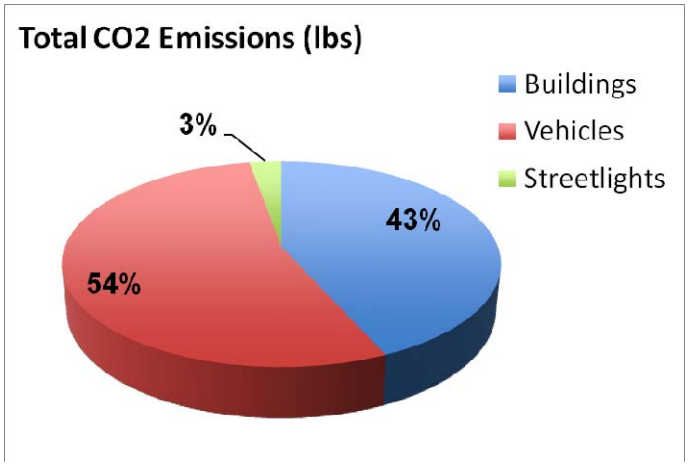


Snapshot of Municipal Energy Use, Emissions, and Costs by Sector (Continued)

Graph 1a. Municipal Energy Use (MMBtu)



Graph 1b. Municipal Carbon Equivalent Emissions (lbs)



The charts above show energy usage, emissions, and cost are weighted slightly towards the vehicle fleet. The vehicle fleet uses 22% more energy but only creates 11% more carbon emissions than the buildings. The vehicle fleet energy costs are also 12% higher than the energy costs of the selected municipal buildings (see chart below for list of municipal buildings included in the inventory). Vehicles take up a larger percentage to the total cost and use of energy. The price of energy per BTU is lower for vehicles than it is for buildings. One contributing factor to the increased cost per BTU, for buildings, is their electricity consumption. Electricity is typically more expensive per BTU than fuel energy.

Building Performance: Energy Use and Energy Intensity

Table 2. Energy Use and Intensity, by municipal building

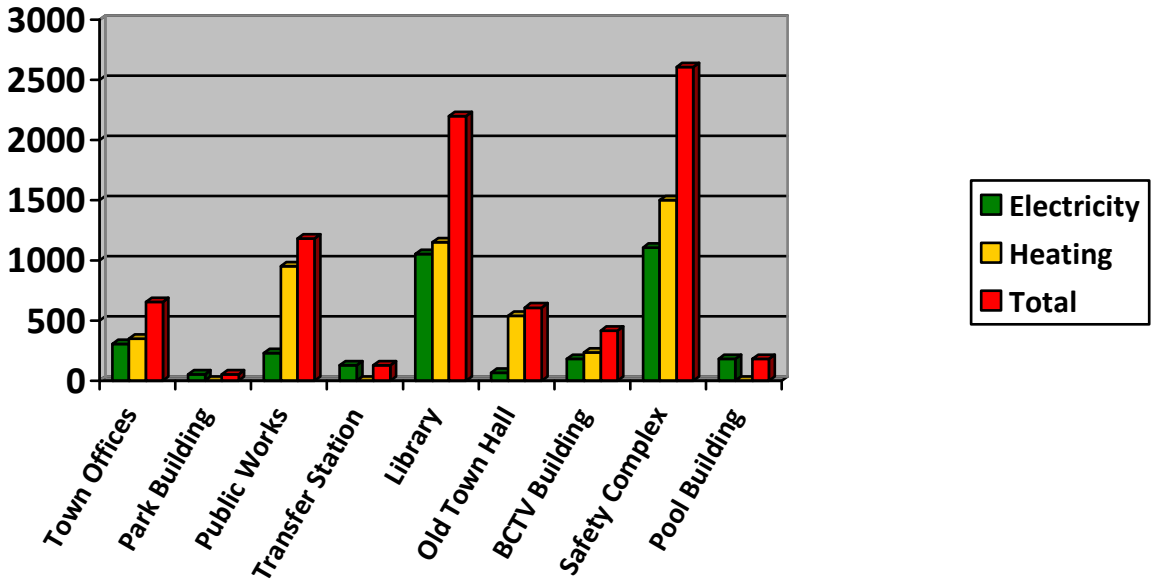
Name of Building	Heating Fuel Type(s)	Area (Sq. Ft.)	Energy Use: Electricity (million Btu)	Energy Use: Heating Fuel (million Btu)	Total Building Energy Use (million Btu)	Site energy intensity (kBtu/sq ft)[3]	EPA Average Site kBtu/sq ft for building type	NH Average Site kBtu/sq ft for building type
Town Offices	Oil	10,164	305.32	348.80	654.13	85.1	72.5	70.6
Park Building	Electric	3,736	53.88	0	53.88	14.4	25	28.5
Public Works	Oil	12,419	230.52	952.72	1,183.24	95.3	77	86.2
Transfer Station	Electric	5,192	128.83	0	128.83	24.8	25	53.7
Library	Oil	20,030	1,051.66	1,149.40	2201.06	109.8	104	80
Old Town Hall	Oil	8,320	67.56	539.93	607.49	73	66	42.6
BCTV Building	Propane	5,900	180.59	234.60	415.19	70.5	104	69.1
Safety Complex	Propane	34,674	1,106.03	1499.69	2605.73	75.3	78	91.3
Pool Building	Electric	3,000	182.15	0	182.15	60.7	65	42.6
Average	-	12,778	367.39	625.41	992.82	67.6	68.5	63.5

Energy use data generated by STOCC software; energy intensity data generated by Portfolio Manager Software.

[3] Site energy intensity = amount of energy expended per square foot *on site* to heat, cool, and electrify the area. This measure relates to how much is being used on site and fluctuates directly with how much lighting is being used, how thermostats are kept, etc.

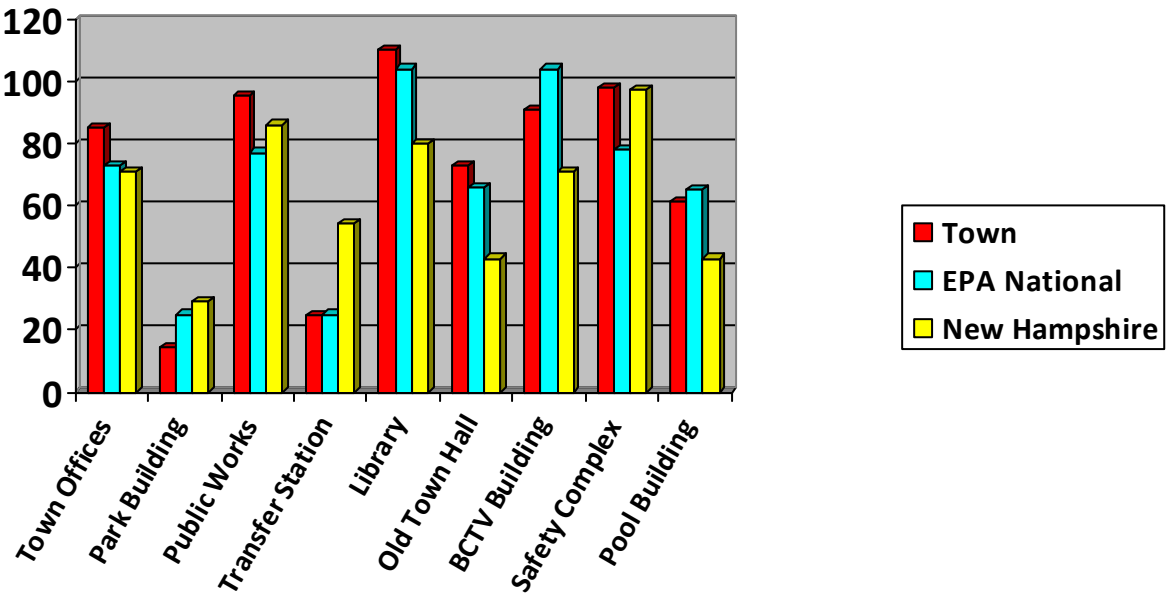
Snapshot of Energy Use by Building

Graph 2a. Energy Use for Electricity, Energy Use for Heating, and Total Energy Use in Municipal Buildings



The Transfer Station, Park, and Pool Buildings are a relatively small piece of the total cost in the buildings segment. The Safety Complex is the largest user of energy in the set of municipal buildings. The Safety Complex has a gross square footage of 34,674sq.ft and is largest building both in area and total energy cost in the data set. The energy usage chart above reflects the overall usage of energy for the buildings. A comparison of total energy use as a factor of area will also be needed to identify the most intensive users of energy. For example: The Bedford Library, which is roughly one third smaller than the Safety Complex in area, uses more energy for every square foot. While the chart above indicates the Safety Complex Building is clearly largest user of energy overall, it does not capture costs per square foot. Prioritizing municipal buildings for implementing efficiency measures will need to consider a variety of metrics and other considerations. The chart below offers an alternative insight into energy usage by measuring the amount of energy used per a square foot.

Graph 2b. Site Energy Intensity and Average Site Energy Intensity for Type of Building (kBtu/sq.ft.)



Snapshot of Energy Use by Building (Continued)

Energy intensity is the most powerful tool available for measuring the relative energy efficiency of particular buildings. Site energy intensity is calculated by taking the amount of energy used in the building (a total aggregate of heating fuel and electricity) and dividing it by the square feet of space. It can be reduced through behavioral and energy conservation measures. The best opportunities for saving energy on site would involve behavioral changes (such as keeping lights and computers turned off; turning down thermostats) and energy conserving technologies (such as motion sensor lighting).

Information about the source energy intensity of these buildings is available on your EPA Portfolio Manager account. Source energy is the energy used to produce the energy used in each building. Your municipality may consider reducing source energy intensity as a long-term goal. This can be accomplished through projects such as installing solar panels or a municipal combined heat and power plant.

Bedford's municipal building energy intensity is in line with the national average and slightly higher than New Hampshire's regional average. This is likely due to the age of the listed buildings. Many of the town buildings are relatively new in comparison to other observed New Hampshire towns. Bedford's municipal buildings also seem to have a higher level of service. This may be due to the town's moderately large population and proximity to Manchester, NH which is a larger regional city. Bedford's hours of operation, building occupations, and levels service are more comprehensive than other observed New Hampshire towns. The library is the most intense user of energy and the second highest overall energy cost. The Safety Complex is also a high user of energy in comparison the other town buildings likely due to its high gross square footage. Review of energy use in these two buildings should be highest priority. Furthermore, consideration of type and use of spaces within each municipal building may have a major impact on how these buildings are prioritized.

Building Performance: Cost and Emissions

Table 3. Energy Cost and Emissions, by municipal building

Name of Building	Area (Sq. Ft.)	Energy Cost ($)	Energy Cost per Square Foot	Energy Emissions (tons of CO2)	Energy Emissions per Square Foot (lbs/sf)
Town Offices	10,164 sf	$18,934	$1.86/sf	61.3	13.5 lbs/sf
Park Building	3,736 sf	$2,210	$0.59/sf	6.4	3.8 lbs/sf
Public Works	12,419 sf	$27,189	$2.19/sf	95.9	17.3 lbs/sf
Transfer Station	5,192 sf	$5,676	$1.09/sf	15.3	6.6 lbs/sf
Library	20,030 sf	$60,524	$3.02/sf	207.4	23.2 lbs/sf
Old Town Hall	8,320 sf	$13,027	$1.57/sf	46.9	12.6 lbs/sf
BCTV Building	5,900 sf	$14,000	$2.37/sf	47.1	17.9 lbs/sf
Safety Complex	34,674 sf	$80,536	$2.32/sf	295.3	19.1 lbs/sf
Pool Building	3,000 sf	$7,303	$2.43/sf	21.6	16.1 lbs/sf
Average	12,778 sf	$25,488	$1.99/sf	88.6	14.5 lbs/sf

Emissions data generated by STOCC software

Another method for identifying high energy users is to compare cost per square foot or emissions per square foot of each building. In this chart we again find that the Library and Safety Complex are both higher users of energy compared to the other buildings in the municipality. The Library emissions per square foot and cost per square foot are roughly a third higher than the town average for the buildings compared in this chart.

Analysis: Priorities and Custom Recommendations

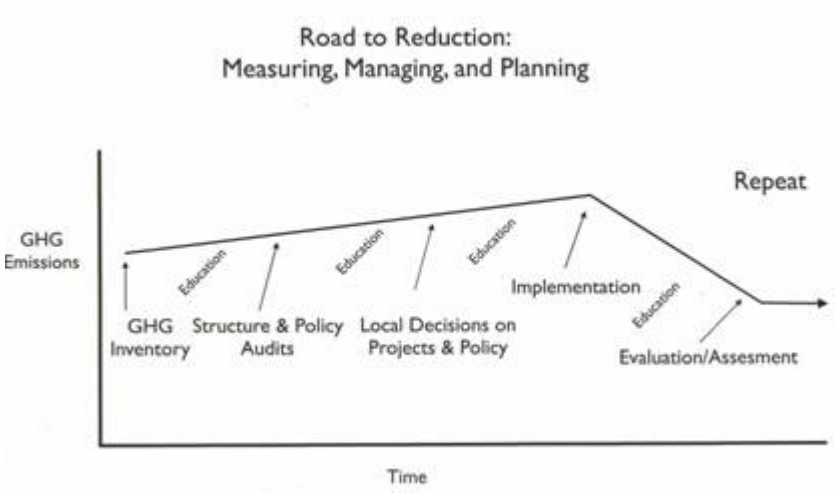
1. Bedford should target the Library and Safety Complex as their highest priority buildings. While the Safety Complex is the highest total energy user, the Library is the most intense user of energy out of all the municipal buildings. Further investigation of these two buildings relative to one another is needed and would be a good use of the time provided by SDES Group. A proper walk through of the Safety Complex may reveal that portions of the complex are fair performers relative to their use while other uses within the complex are poor energy performers. Furthermore, any number of building systems or may be isolated as a source problem in need of correction. As a parallel consideration the Library has a high exposure to the public and may be utilized as an example by the town, from which, residents can take precedent for their own energy reduction projects.
2. The town of Bedford should also consider conducting a comprehensive vehicle fleet audit since the fleet is the largest segment of energy use in the town. A proper audit will identify areas where savings are possible either from behavioral changes or through fleet modernization. Plan for investment in the vehicle fleet concurrently with the building sector. Vehicles account for 60% of Bedford's energy usage and municipal buildings account for 38%. Bedford should also enforce a no idling policy for all fleet vehicles to ensure emissions reductions. Police vehicles can be fitted with equipment which can eliminate the need to idle cars for either battery life issues or weather conditions.
3. The Old Town Hall may also be an efficient use of energy conservation funds. The Old Town Hall is particularly suspect as an energy waster due to its high heating costs in comparison to both its electricity consumption and the total hours of operation per week. My assumption is that the building has very little or no insulation and significant draft issues. Further investigation either by SDES group or another energy auditor is needed to isolate the sources of inefficiency and make recommendations.
4. The Public Works Garage should also receive further investigation since it is the third highest consumer of energy in this inventory. DPW's in the region typically suffer from poor heating system design but the costs to upgrade inefficient heating systems in garages, on average, require more capital investment up front. The garage, similar to the old town hall, also has uncharacteristically high heating costs in comparison to it electricity usage.
5. Bedford may be a good fit for the New England Carbon Challenge. This program can help residents realize their energy usage as well as help them get involved in finding ways to save energy. A town wide reduction in energy usage will help reduce demand on the existing energy infrastructure.
6. Streetlights are only 2% of Bedford's total municipal energy cost, but the town should consider approaching PSNH about conducting an audit on the town's street lights. PSNH already has a LED traffic light rebate program. In the future streetlights may also qualify for this type of rebate. Upgrading streetlights will allow the town to further cut costs by reducing energy consumption. LEDs also require less maintenance as the light emitting diodes last much longer than traditional commercial light bulbs.
7. MEAP will provide the EPA Portfolio Manager account to the Bedford Energy Commission for their continued use in tracking energy usage. Portfolio Manager is a helpful tool. Producing charts and graphs to illustrate energy usage on a month by month or year to year basis in a variety of combinations.

Analysis: General Recommendations for Municipal Energy Savings

1. Review existing Master Plan, Zoning Ordinances, and other town policies for inconsistencies with the goal to reduce energy usage.
2. Implement a behavioral change program in municipal buildings with municipal employees. Work with LEC Working Group for guidance to implement this initiative.
3. Implement buying strategy of Energy Star equipment and Products and environmentally sensitive office products, and implement awareness campaigns to encourage "thoughtful" consumption of equipment and products.
4. Evaluate ways to reduce fuel usage with vehicle fleet. This can be done by analyzing routes, usage, and a strict anti-idling policy.
5. Find alternative energy sources to reduce escalating fossil fuel prices and emissions. Investigate payback for possibly installing: a small CHP unit, biomass heating system or geothermal heat pump.
6. Encourage recycling and composting to the extent possible, in order to divert the amount of municipal solid waste (organic matter) going to landfill.

Next Steps

Once this draft inventory is finalized, the MEAP project team will work with your town to identify a low-performing building and to carry out an energy audit for that building. The selected building will receive a Decision Grade or Investment Grade energy audit. The audit will culminate in a set of recommendations for building retrofits and renovations that would allow the town to reduce its building's energy use.



Once the audit report is complete, the MEAP project team will provide on-going support to your town as your municipality begins the process of identifying priority renovations/retrofits, creating RFPs, hiring contractors and realizing potential reductions. All phases of this project will be accompanied by a program of public engagement and education.

Methods

Greenhouse gas inventory approach

Data collection for this inventory involved collaborative efforts between the Clean Air-Cool Planet staff, which organized the data collection process over all, and the local town representative volunteers. With personal connections to their home towns, volunteers were better able to ascertain where to access certain data and to spend time at local offices sorting through bills and records. To collect the data in each town, data sheets were developed based on the software/program that was used for data processing. We used 2008 as a baseline year to collect the fuel and energy consumption information. Data sheets were sent to the town representative, who then collected and/or accessed the data. Follow-ups were done on a regular basis to make sure that the inventory progressed, the data collection process was effective, and the data needed was more or less accurately collected.

Data processing and data analysis

To process the data collected, we used two types of fuel and energy assessment software. The first was the Small Town Carbon Calculator (STOCC) software used to quantify and estimate the amount of energy used and the greenhouse gases (GHG) generated from the energy usage. The STOCC software allowed us to make a municipal energy assessment by municipal sector. The second was the EPA Portfolio Manager Benchmarking Program, used to assess the energy consumption and GHG generated in specific buildings, based on square footage.

List of Acronyms

CA-CP	Clean Air-Cool Planet
EPA	Environmental Protection Agency
GHG	Greenhouse Gas
kBtu	Kilo British Thermal Units
MMBtu	Million British Thermal Units
STOCC	Small Town Carbon Calculator