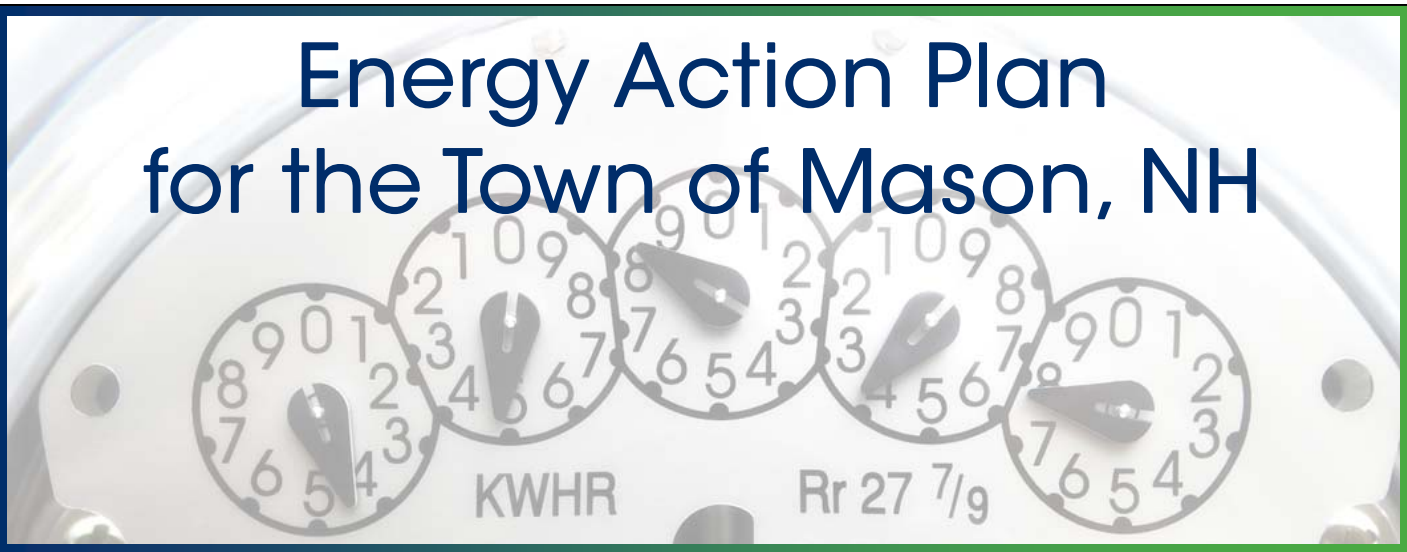
Energy Action Plan for the Town of Mason, NH



Prepared by the
Nashua Regional Planning Commission, Jan. 2010

Community Profile

Mason, New Hampshire is located in the western portion of the Nashua Region and is bordered by the NH communities of Brookline, Milford, Wilton, Greenville, and New Ipswich as well as Ashby, MA to the south. According to 2007 Census estimates, Mason is home to 1,352 residents, which places it 166th among NH's incorporated cities and towns. At the time of the 2000 Census, per capita income was $28,503 and median household income was $60,433. Mason's 2007 Municipal Budget Appropriations were $1,447,106.

Zoning ordinances were first established in 1967 and most recently updated in 2008. The Mason Master Plan was also updated in 2008. Mason voters elect representatives to the Board of Selectmen, while Planning Board, Conservation Commission, and Zoning Board members are appointed.

Mason Energy Inventory Background

In the fall of 2008 the Nashua Regional Planning Commission (NRPC) received grant funding from the NH Charitable Foundation and the US Environmental Protection Agency (EPA) to assist communities in the formation of Local Energy Committees, coordinate networking opportunities and workshops to help them learn from one another's experience, and conduct baseline energy and greenhouse gas emissions inventories. The goal of NRPC's Energy Program is to help communities establish a thorough understanding of their energy use and develop an accompanying action plan.

The first step taken in Mason was to conduct an inventory of the Town's municipal energy usage. Energy inventories help communities to assess their current energy use and track their energy reduction progress. The results are also beneficial in helping communities to prioritize potential energy reduction projects. NRPC conducted two inventories in Mason. Each inventory tool provides a unique look at municipal energy usage. The first inventory was completed using the Small Town Carbon Calculator (STOCC), which assesses energy use, cost, and greenhouse gas emissions from the town's municipal buildings, vehicles, and streetlights. The second inventory was completed using the EPA's Portfolio Manager, which provides a more detailed analysis of the town's municipal buildings. Portfolio Manager is an online, interactive energy management tool that allows users to track and assess energy consumption across a portfolio of buildings. By examining each building and comparing energy use across buildings, towns can see how well each building is performing and where improvements can be made.

The Nashua Regional Planning Commission was responsible for conducting the inventory. Town staff provided electricity use data for each municipal building for the period beginning January 1, 2008 through September 30, 2009. Propane, fuel oil #2, diesel, and gasoline data was provided for the

period of January 1, 2008 through March 31, 2009. NRPC staff entered the data into Portfolio Manager and STOCC.

The STOCC results precede the Portfolio Manager results in this report as the data provides an overall glimpse at Mason's energy usage and greenhouse gas emissions. Portfolio Manager results are more specific and detail-oriented for the buildings only and will be presented following the STOCC inventory information.

Small Town Carbon Calculator Inventory

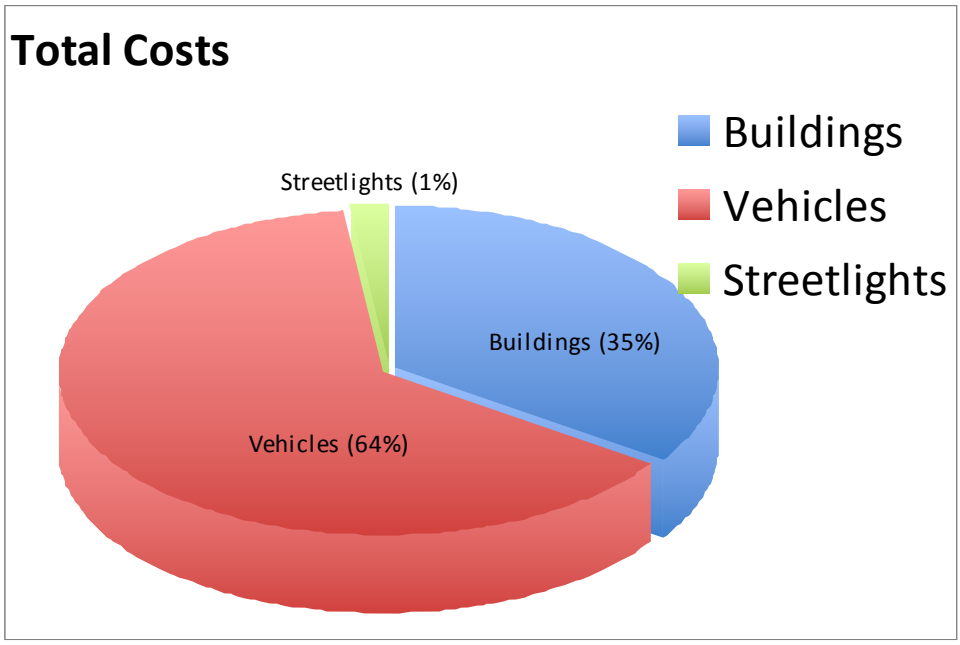
The Small Town Carbon Calculator (STOCC) provides more broad-based information on energy use resulting from buildings, vehicles, and streetlights. The purpose of using STOCC is to establish a total municipal baseline for energy costs, energy usage, and carbon dioxide emissions (a major greenhouse gas). In addition to municipal vehicles and streetlights, the following buildings were included in the STOCC inventory: Mann House, Highway Office/Garage, Fire Station, Police Station, and Town Hall. STOCC inventories are conducted on an annual basis and data from 2008 was used for this inventory.

Table 1

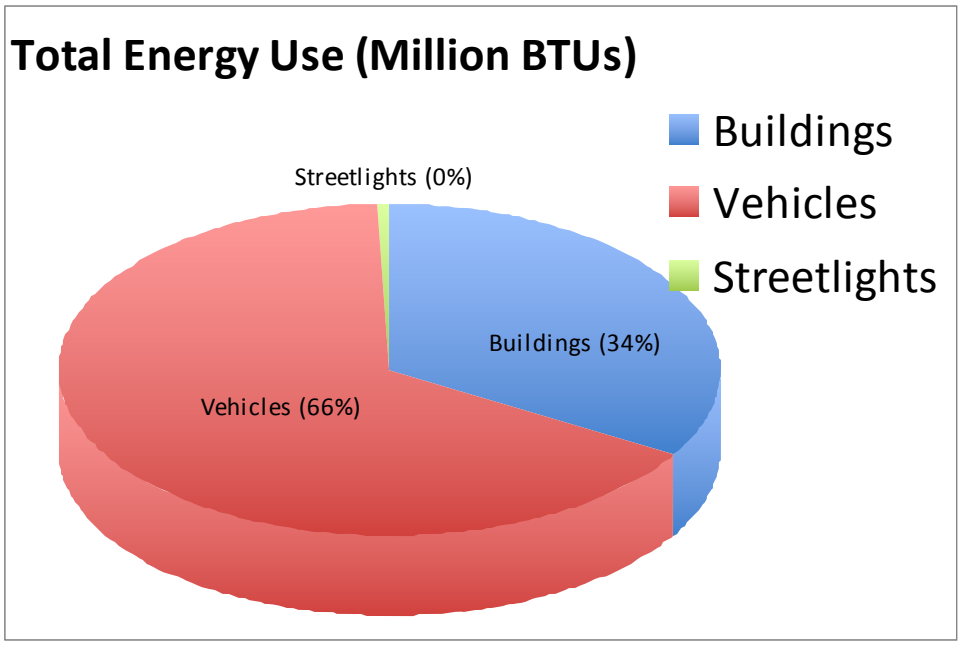
	Municipal Buildings		Vehicles		Streetlights		
	#	% of total	#	% of total	#	% of total	Grand Total
Cost	$27,972	35%	$51,528	64%	$1,533	1%	$81,032
Energy (million BTUs)	1,013	34%	1,984	66%	15	0%	3,012
CO_2 (lbs)	178,475	36%	317,105	63%	3,941	1%	499,521

In total, Mason spent $81,032 on energy in 2008, consumed 3,012 million BTUs of energy, and was responsible for 499,521 lbs of carbon dioxide emissions.

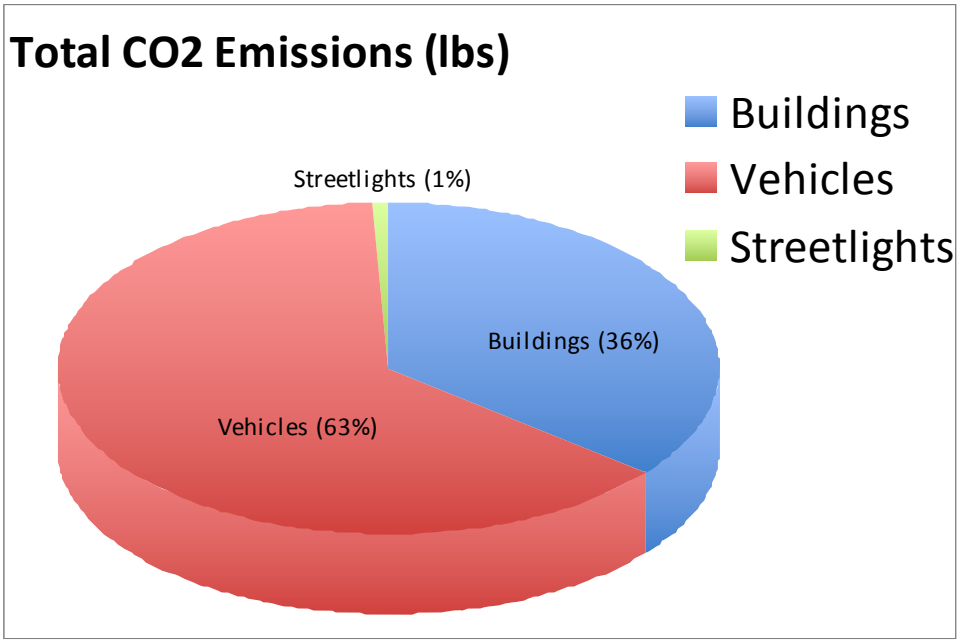
Graph 1



Graph 2



Graph 3



From these graphs, it is clear that the vehicle fleet represents a significant source of energy expenditures and costs for the Town. Moving forward, it will be equally as important for Mason to address energy use resulting from its vehicle fleet as it will be from its municipal buildings. Recommendations for reducing energy use from these sectors appear later in this report.

Portfolio Manager Inventory

The following municipal buildings were included in Mason's Portfolio Manager Energy Inventory:

Table 2

Building Name	**Size (ft^2)**	**Portfolio Manager Category**	**Fuel Types**
Fire Station	2,500	Other-Fire Station/Police Station	Electricity, Fuel Oil (No. 2), Propane
Highway Office/Garage	2684	Other-service	Electricity, Fuel Oil (No. 2), Propane
Mann House	2,060	Office	Electricity, Fuel Oil (No. 2)
Police Station	1,120	Other-Fire Station/Police Station	Electricity, Propane
Town Hall	2,470	Other-Social/Meeting	Electricity, Propane

The table below provides an overall summary of Mason's Portfolio Manager Energy Inventory results. A more detailed analysis by measurement type follows.

Table 3

Building Name	**Total Energy Use (kBtu)**	**Current Site Energy Intensity (kBtu/ft²)**	**Current Source Energy Intensity (kBtu/ft²)**	**Annual Energy Cost**	**Energy Cost/ft²**	**Total Greenhouse Gas Emissions ($MtCO_2e$)**
Fire Station	135,548.50	54.2	98.0	$3,912.59	$1.57	12.24
Highway Office/ Garage	341,002.9	127.1	191.8	$9,151.61	$3.41	27.96
Mann House	306,354.8	148.7	194.7	$6,277.96	$3.05	24.53
Police Station	133,272.04	119.0	196.8	$4,524.73	$4.04	10.7
Town Hall	127,457.45	51.6	63.5	$4,124.64	$1.67	8.82

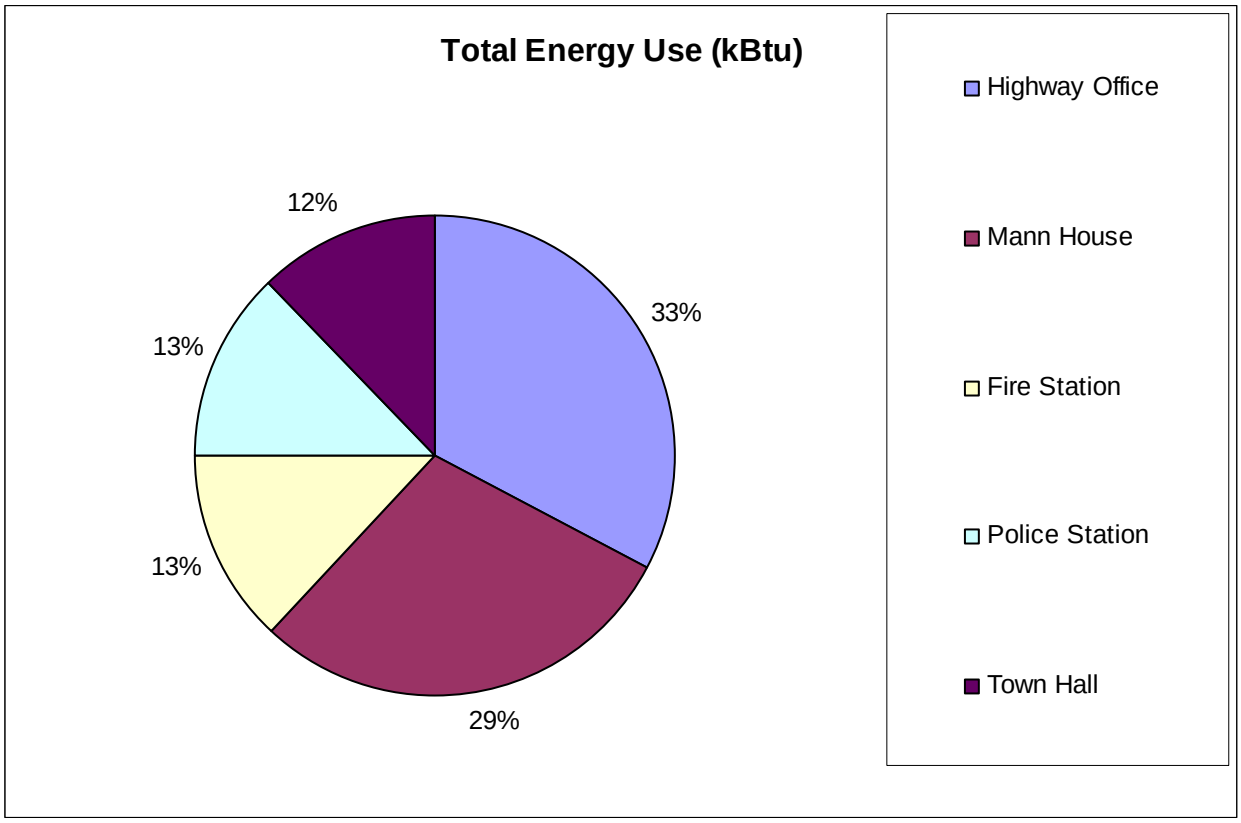
Energy Inventory Measurement Definitions:

- Site Energy Intensity—amount of energy expended per ft² on site to heat, cool, and electrify the area. This measurement fluctuates directly with actions such as how much lighting is being use and how the thermostats are set.
- Source Energy Intensity—amount of energy expended per ft² based on the type of fuel and the efficiency of that fuel type.
- $MtCO_2e$—metric ton carbon dioxide equivalent, allows emissions of greenhouse gases of different strengths to be added together.

Energy Use by Building

The Portfolio Manager Energy Inventory clearly demonstrates that energy use is not evenly distributed across Mason's municipal buildings. For example, two buildings—the Highway Office/Garage and Mann House—are consuming 62% of the total energy used across the entire portfolio of buildings. These results are illustrated in Graph 4 below.

Graph 4

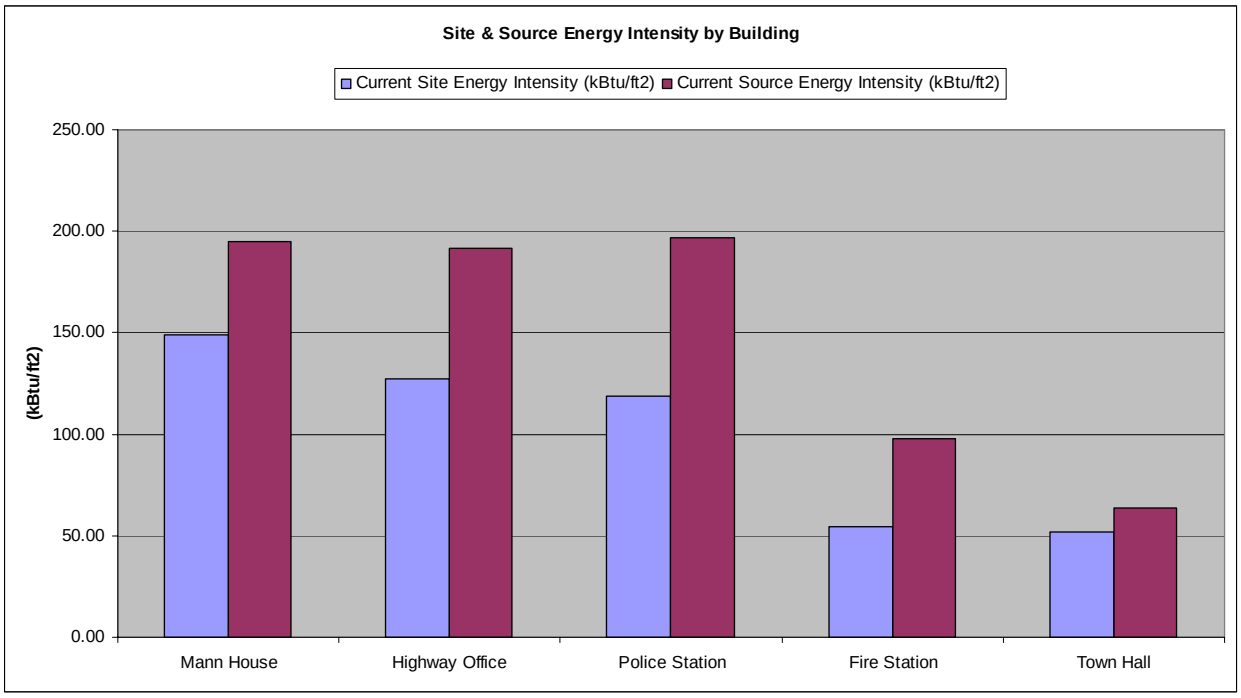


In addition to Total Energy Use, it is important to examine Energy Intensity, which provides a measure of the relative energy efficiency of a particular building. As mentioned above, site energy intensity is the amount of energy expended per square foot on site to heat, cool, and electrify the area. This measurement fluctuates directly with actions such as how much lighting is being use and how the thermostats are set. Thus, reductions in site energy intensity can be addressed through changes in behavior (ex. shutting computers off at night, turning down the thermostat) and through energy conserving technologies (ex. motion sensor lighting). Source Energy Intensity refers to the amount of energy expended per square foot based on the type of fuel used and the efficiency of that fuel type. Measures to reduce source energy intensity would involve changing the type of fuel being used to heat or cool the space.

In Mason, the Mann House (2,060 ft^2) has the highest site energy intensity at 148.7 kBtu/ft^2 and the Police Station (1,120ft^2) has the highest source energy intensity at 196.8 kBtu/ft^2. The Highway Office/Garage (2,684 ft^2) has the second highest site energy intensity and Mann House has the second highest source energy intensity at 127.1 and 194.7 kBtu/ft^2 respectively. Although site energy intensity is consistently lower than source energy intensity across Mason's portfolio of buildings, it is recommended that the Town focus on behavioral changes and simple energy conserving technologies first, as these are often the least

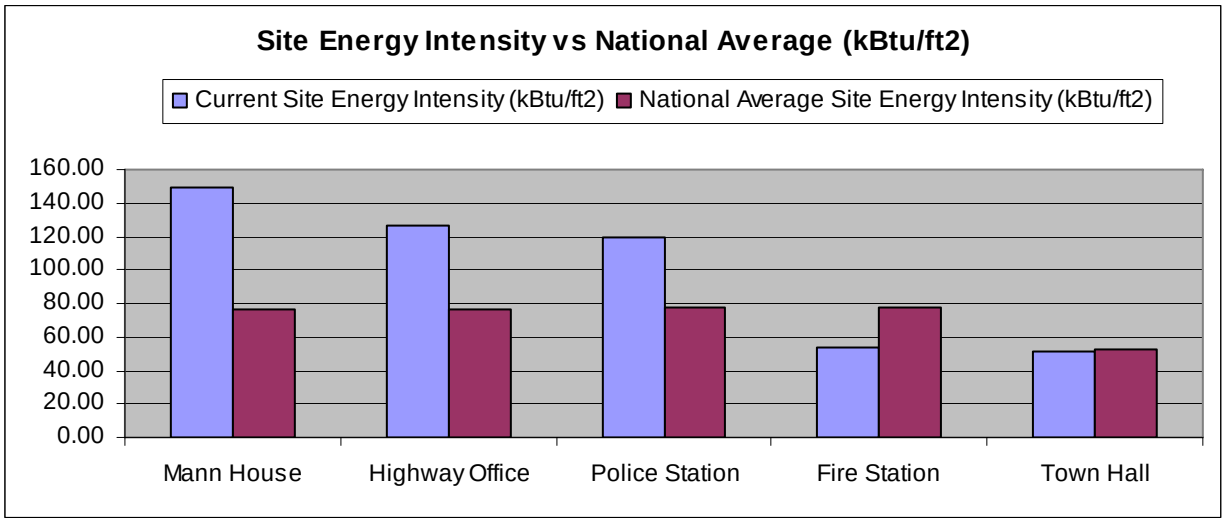
costly and most easily implemented actions. These measures can be enacted across all buildings, with a particular focus on Mann House and the Highway Office/Garage. A comparison of site and source energy intensities across buildings appears in Graph 5.

Graph 5

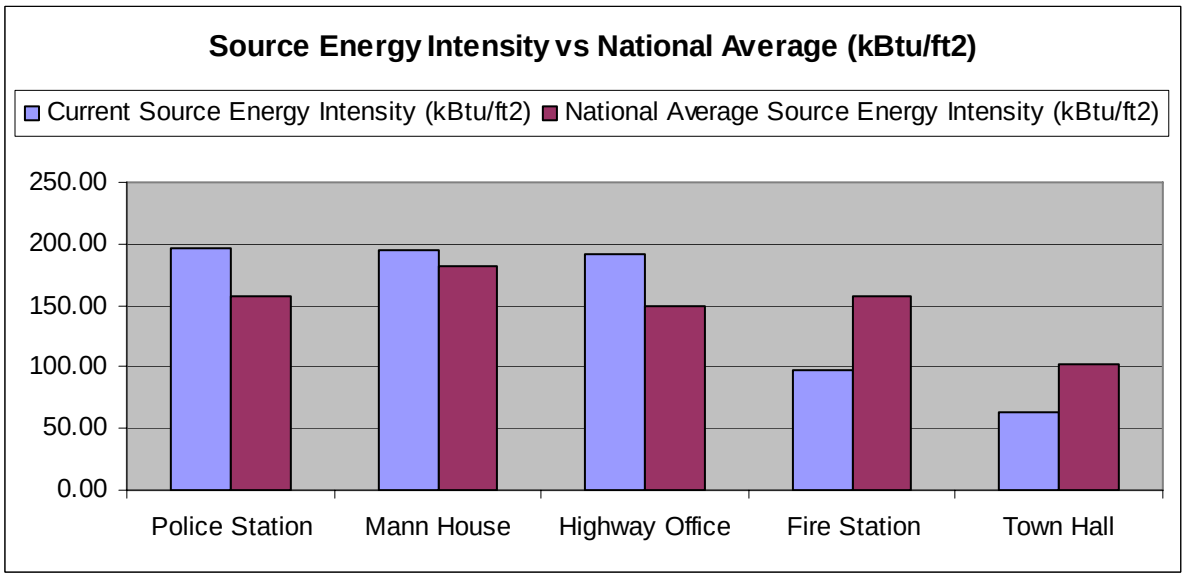


In addition to comparing site and source energy intensities across buildings in the municipality, Portfolio Manager also allows users to compare their buildings' site and source energy intensity to national averages for that building type. Graphs 6 and 7 illustrate these comparisons. Mann House, Police Station, and Highway Office/Garage all have higher site and source intensity than the national average, providing further justification for the need to examine these buildings carefully.

Graph 6



Graph 7

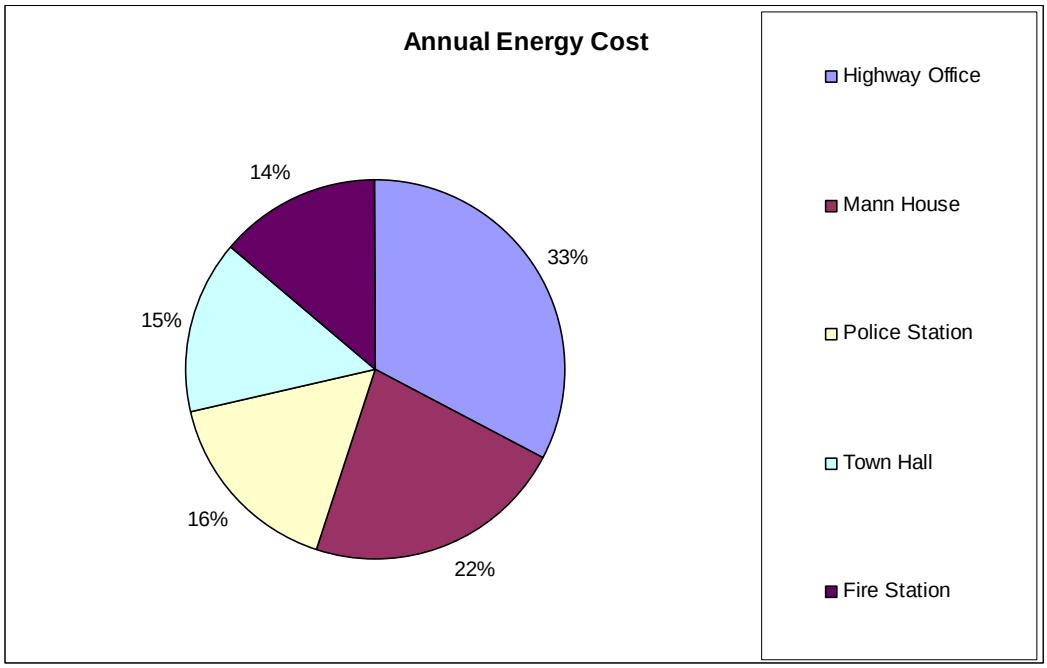


Costs by Building

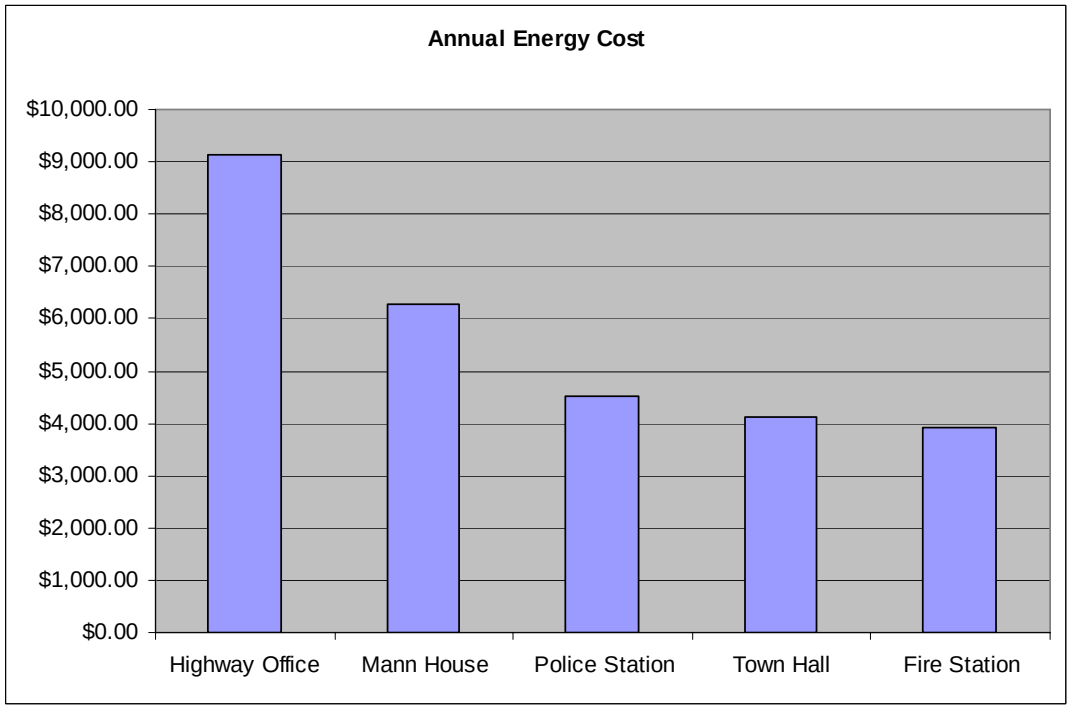
Another way to evaluate building performance is to examine overall energy costs and energy costs per ft^2. The cost of running municipal buildings is a major concern for most municipalities and therefore identifying ways to save on energy costs is often a priority when conducting energy inventories. The Highway Office/Garage has the highest annual energy cost at $9,151.61 and accounts for 33% of Mason's annual energy costs from buildings. Mann House has the second highest annual energy cost at $6,277.96. Even buildings that are not opened on a regular basis still cost the Town a significant amount

of money in energy costs. During this inventory period, annual energy costs for the Town Hall and Fire Station were $4,124.64 and $3,912.59 respectively. These results are illustrated in Graphs 8 and 9.

Graph 8

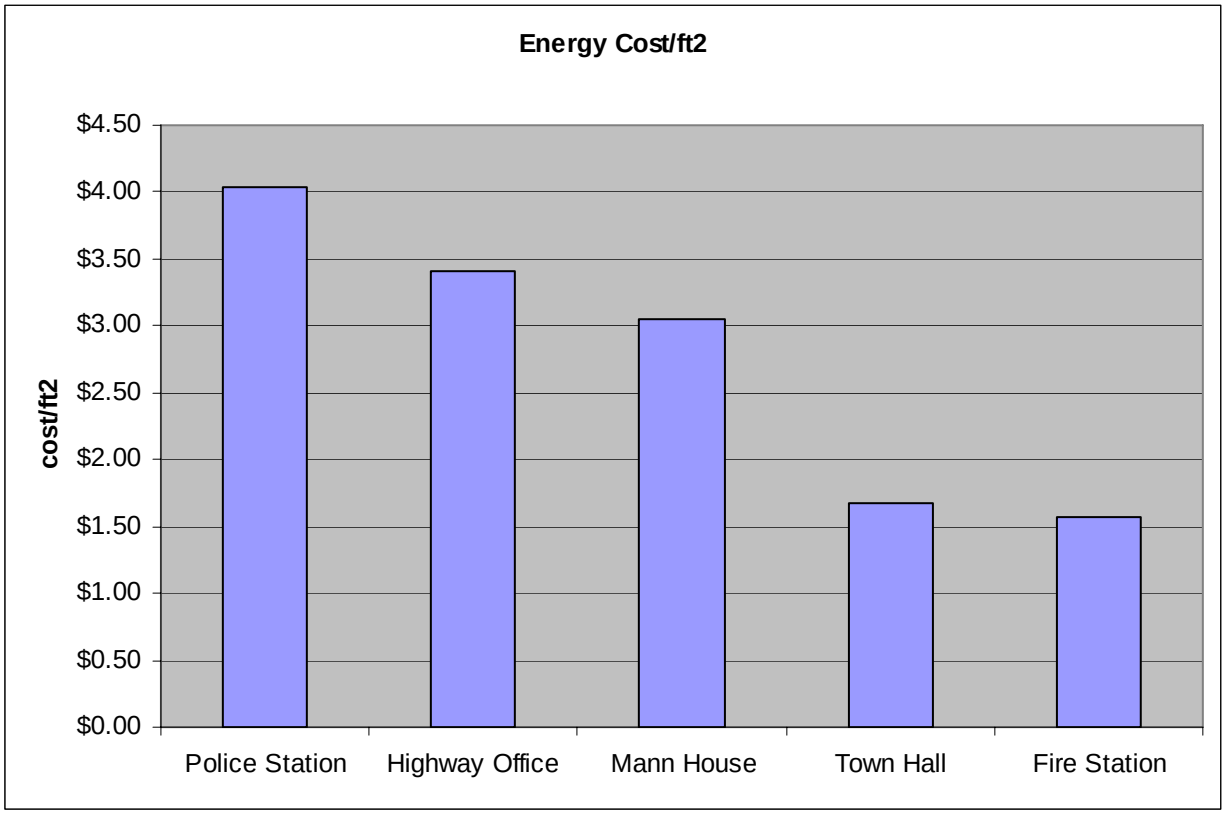


Graph 9



When comparing energy costs per square foot, the Police Station and Highway Office/Garage stand out at $4.04/ft^2 and $3.41/ft^2 respectively. Mann House also has a high energy cost per square foot at $3.05/ft^2.

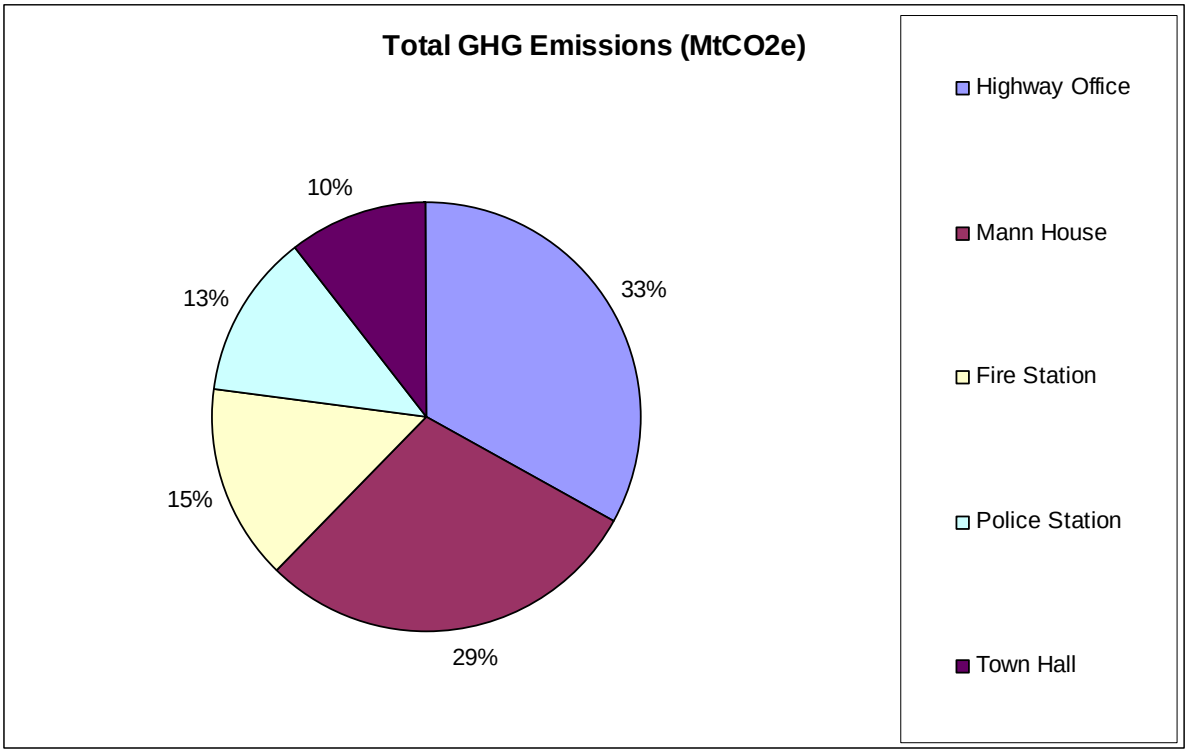
Graph 10



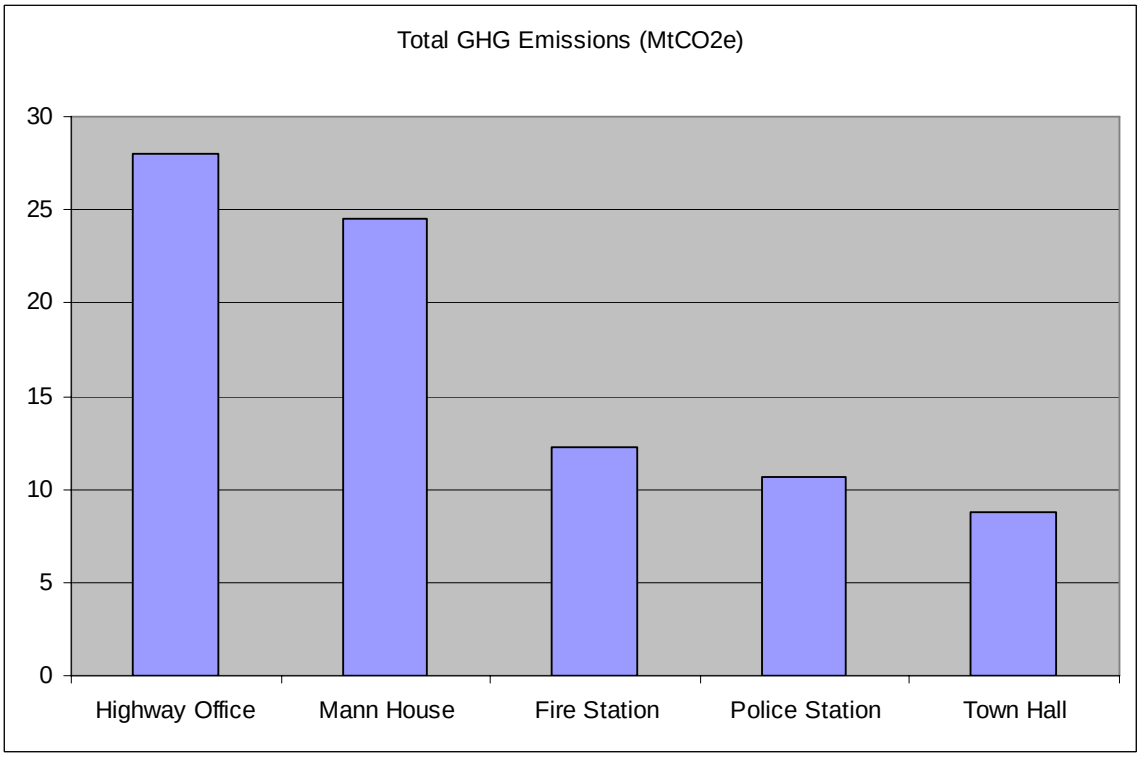
Greenhouse Gas Emissions

The final method for evaluating building performance is through greenhouse gas emissions. As mentioned above, Portfolio Manager measures greenhouse gas emissions in $MtCO_2e$, or metric ton carbon dioxide equivalent. This allows emissions of greenhouse gases of varying strengths to be added together. In Mason, the Highway Office/Garage and Mann House account for 62% of the total emissions coming from all 5 buildings in the portfolio. The Highway Office/Garage alone produces 33% of the emissions at 27.96 $MtCO_2e$.

Graph 11



Graph 12



Energy Inventory Analysis

When prioritizing which buildings to focus energy efficiency and conservation efforts on, it is important to look across the entire spectrum of performance measures, which include Total Energy Use (kBtu), Site Energy Intensity (kBtu/ft^2), Source Energy Intensity (kBtu/ft^2), Energy Cost/ft^2, Annual Energy Cost ($), and Greenhouse Gas Emissions ($MtCO_2e$).

The Highway Office/Garage was in the top three worst performing buildings in every category. It had the highest Total Energy Use, Annual Energy Cost, and Greenhouse Gas Emissions; the second highest Site Energy Intensity and Energy Cost/ft^2; and the third highest Source Energy Intensity. The consistency with which the Highway Office/Garage performed poorly in each of these categories indicates that further attention and priority should be given to this building.

Mann House was also in the top three worst performing buildings in every category. It had the highest Site Energy Intensity; the second highest Total Energy Use, Source Energy Intensity, Annual Energy Cost, and Greenhouse Gas Emissions; and the third highest Energy Cost/ft^2. As a result, Mann House should also be given further attention and priority.

The Police Station had the highest Source Energy Intensity and the highest Energy Cost/ft^2. It also had the third highest Site Energy Intensity and Annual Energy Cost.

The Fire Station had the third highest Total Energy Use and third highest Greenhouse Gas Emissions.

Finally, Town Hall did not rank in the top three in any category analyzed in this inventory.

Recommendations based on Energy Inventory Results

A recommended goal is to reduce municipal energy consumption by 15% below 2008 levels by 2015. This is in line with the NH Climate Action Plan's goal to reduce NH's annual greenhouse gas emissions by 80% below 1990 levels by 2050. In 2008, Mason consumed 3,012 MMBTUs of energy. A 15% reduction by 2015 would bring Mason's energy consumption level down to 2560.2 MMBTUs.

<u>Building Recommendations</u>

- Use Town staff, students, and volunteers to conduct walk-through building audits to look for easily correctable changes in behavior or easily implemented energy efficiency measures. Continue to track building performance in Portfolio Manager after subsequent actions have been implemented to measure associated energy efficiency improvements. The following buildings should be included in this process and are listed in order of priority:

1. Highway Office/Garage
2. Mann House
3. Police Station

- Use Mason's facility maintenance staff to recommission buildings that continue to perform poorly after walk-through audit recommendations have been implemented. Recommissioning examines the building's equipment systems operation and maintenance procedures and compares them to intended or design operations procedures. The primary focus of recommissioning is to identify operation and maintenance improvements that will result in energy cost savings and that are relatively fast and inexpensive to implement. Recommissioning does not necessarily involve the purchase or installation of new equipment or technology and in-house staff can typically implement many of the operation and maintenance improvements. Example recommissioning activities include calibrating building controls such as thermostats and occupancy sensors; adjusting operating schedules to ensure equipment is only on when necessary; checking for leaky or improperly functioning steam traps; and cleaning heat exchanger tubes in condensers, evaporators, and boilers to maintain optimal efficiency. Priority should be given to buildings that do not have an active preventative maintenance program.

- Conduct professional audits of buildings where no performance improvements are seen after implementing volunteer walk-through audit recommendations and recommissioning activities. Energy audits examine existing building systems for equipment replacement (retrofit) opportunities that will result in energy cost savings. Utility providers often offer free or low cost auditing services and should be utilized first.

- Focus initial actions on buildings that are very visible to the public, such as Mann House. This will raise awareness of Mason's commitment to reducing energy consumption and costs and helps to set a good example for citizens.

- Involve students to the greatest extent possible when conducting audits and making energy efficiency improvements. This will also help to raise awareness of the Town's efforts to improve energy efficiency and instill an environmental ethic in students and their parents.

- After energy efficiency measures have been successfully implemented, research the feasibility of installing green energy technologies (ex. small wind, solar, geothermal) in one or more municipal buildings. Priority should be given to buildings with high source energy intensity.

Vehicle Fleet Recommendations

- Maintain Town vehicles. A poorly tuned engine, for example, can increase fuel consumption by 10-20% depending on its condition. Keep tires properly inflated and aligned, conduct routine oil changes, and check and replace vehicle air filters. These measures not only reduce fuel consumption but also help vehicles to last longer.

- Instruct operators to drive more efficiently. Stay within posted speed limits and use cruise control. Avoid unnecessary idling, braking, and acceleration, which can improve fuel economy by 5-10%. Combine trips when possible; several short trips taken from a cold start can use twice as much fuel as one trip covering the same distance when the engine is warm. Finally, remove excess weight from the vehicle. Carrying an extra 100 pounds reduces fuel economy by 1-2%.

- Develop criteria within the Town's vehicle replacement policy to gradually phase in more fuel efficient or hybrid vehicles.

- Establish an anti-idling policy to encourage municipal fleet users as well as the general public to turn off their engines when the vehicle is not in use. NH state regulations under RSA 125-C:6, XII specify that when temperatures are above 32°F vehicles may not idle for more than 5 minutes. At temperatures between -10F and 32°F vehicles may not idle for more than 15 minutes. Contact the Nashua Green Team for information about the anti-idling policies they put in place for the City (www.nashuagreenteam.org).

- Conduct an analysis of the standard routes vehicles take and determine whether there are more efficient routes for them to travel. Contact Steve Russell with the City of Keene's Public Works Department to learn about route analysis studies conducted there.

- Continue to conduct energy inventories of the vehicle fleet. There are a number of reasons why some years may experience increased vehicle use. Cleanup from events such as ice storms and floods may result in abnormally high fuel usage for the year and may not provide an accurate picture of typical fuel usage. Complete a STOCC inventory for 2009 once complete data is available (early 2010). Visit the Clean Air-Cool Planet website for the excel files and more information about the inventory process. http://www.cleanair-coolplanet.org/for_communities/stocc.php