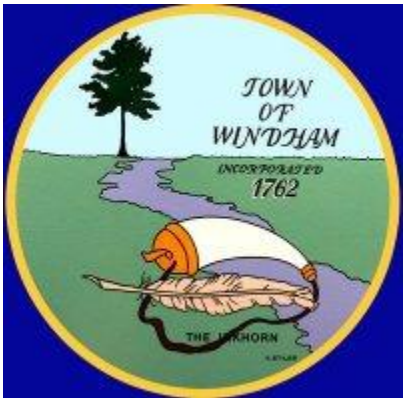
2009 Municipal Energy Use and Greenhouse Gas Baseline Report for Windham, Maine



GPCOG

Prepared for the Town of Windham, Maine
by the Greater Portland Council of Governments

May 2011

Contents

Summary

This report is a summary of greenhouse gas emissions and energy use for the Town of Windham, ME for the year 2009. 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 Greater Portland Council of Governments (GPCOG)[1] prepared this report using data collected from various sources within the town by the Windham Energy Committee (WEC). Ben Lake, GPCOG Program Analyst, compiled and analyzed the data using Clean Air and Climate Protection (CACP) Software 2009 provided by ICLEI – Local Governments for Sustainability; and Energy Star Portfolio Manager Software from the US Environmental Protection Agency (EPA) and Department of Energy (DOE).[2] Clean Air-Cool Planet[3] provided resources for this inventory process. This report is a partial completion of the deliverables for the US DOE Energy Efficiency and Conservation Block Grant (EECBG) that Windham received for its energy planning work.

[1] www.gpcog.org.
[2] For more information on CACP software, see www.cacpsoftware.org. Information on Portfolio Manager Software is available at www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager.
[3] www.cleanair-coolplanet.org/

Quick Facts

Town population (2008 estimate): 15,727[4]
Area of municipality: 50.3 square miles[5]
Population density: 313 people per square mile
GPCOG region total population (2007 estimate): 250,000
Municipal population as a percent of GPCOG: 6.3%
Total area of municipal building space: 72,910 square feet
Average site energy intensity of all municipal buildings: 75.0 kBTU/sq. ft.
Number of street lights: 323
Number of vehicles in fleet: 75
Total cost of municipal energy use in 2009: $325,661
Total municipal energy use in 2009: 15,549 MMBTU
Total municipal greenhouse gas emissions in 2009: 1,280 metric tons[6]

Introduction & Methodology

Windham applied for and received a Template Energy Efficiency and Conservation Block Grant (EECBG), administered through Efficiency Maine. The EECB Grants are a program of the US Department of Energy, and were created and financed through the American Recovery and Reinvestment Act of 2009. The purpose of the EECBG program is to assist local, state, and tribal governments in developing and implementing strategies to reduce their energy use and fossil fuel emissions while improving the energy efficiency of their operations.

This EECB Grant provided the Town with funding for: 1) establishing a Local Energy Committee; 2) conducting a municipal energy use and emissions inventory; 3) writing an energy plan; 4) conducting community outreach on energy use and efficiency; and 5) initiating implementation of the energy plan's recommendations.

The Windham Energy Committee (WEC) was formed in order to implement this grant, and met for the first time in October of 2010. The group is staffed by Windham Assistant Town Planner Ben Smith, and made up of Windham residents with interest and/or experience in the field of energy efficiency, building engineering, heating, cooling and ventilation, and fleet management.

Windham contracted with the Greater Portland Council of Governments (GPCOG) to provide technical support and expertise with conducting their municipal energy use and emissions inventory, and crafting their energy plan. GPCOG has previously assisted three other communities in the region with completing energy and emissions inventories. Providing this assistance to towns in the region is one

[4] Population numbers are taken from the 2008 estimates of GPCOG, available at http://www.gpcog.org/data_center/Municipal_Profiles.php.
[5] 2000 Census Data – American Fact Finder, US Census Bureau (www.census.gov)
[6] Greenhouse gas inventories conventionally use metric to measure greenhouse gas emissions. Metric tons are used in this report to enable comparison between this and other greenhouse gas inventories.

way that GPCOG is implementing its recently adopted Sustainability Principles - the first of which states, "A sustainable Greater Portland Region is one that uses non-renewable resources sparingly, renewable resources at a sustainable rate, and in a continuous cycle."

Knowledge and understanding of how energy is being used for municipal activities is valuable because it allows towns to examine their facilities, vehicles and activities for potential improvements in efficiency, as well as opportunities to use alternative energy. With this baseline, Windham will also be able to calculate energy and emissions savings from future energy efficiency improvements and alternative energy projects. This report is a partial completion of the deliverables for the US DOE Energy Efficiency and Conservation Block Grant (EECBG) that Windham received for its energy planning work.

Data Collection & Analysis

Data for this report was collected by WEC members from numerous sources within the Town of Windham. To process the data collected, GPCOG used two types of fuel and energy assessment software. ICLEI's Clean Air and Climate Protection (CACP) Software 2009 quantifies the amount of energy used and the greenhouse gases (GHG) generated from the energy usage. Energy Star's Portfolio Manager Benchmarking Program supplemented CACP software by providing additional information on building energy use.

Clean Air and Climate Protection (CACP) Software 2009

The CACP software estimates emissions of the following greenhouse gases from energy consumption data:

CO_2: Carbon Dioxide
N_2O: Nitrous Oxide
CH_4: Methane

To simplify the data output, the program converts these gases into one CO_2 equivalent (CO_2e) value according to the relative greenhouse effect of each gas. For example, N_2O is about 310 times more potent than CO_2 as a greenhouse gas, so the program multiplies the mass of N_2O by 310 to obtain the CO_2 equivalent value. CH_4 is approximately 21 times more powerful than CO_2. CO_2e provides a useful measure of greenhouse gas emissions because it incorporates all greenhouse gases into a single, uniform unit. In this report, greenhouse gas emissions are expressed in terms of either metric tons or kilograms of CO_2e.

Energy consumption is presented in units of British Thermal Units (BTUs), either thousand (kBTU) or million (MMBTU). This allows the direct comparison of electricity and different fuels together based on their individual energy content.

The CACP 2009 Software is divided into two primary categories: municipal government and community. Government analysis includes all municipal-owned facilities, properties, equipment, buildings, and operations. Community analysis includes everything within the town limits (including the government). This report focuses on municipal government operations.

Energy Star Portfolio Manager Software

Portfolio Manager Software is provided by the federal Energy Star program, resulting from a partnership of the US Department of Energy and the Environmental Protection Agency. Benchmarking with Energy Star provides buildings with energy use and efficiency ratings that can be used to compare them to other buildings of the same type nationwide. If high enough, these ratings can also enable buildings to be officially certified by Energy Star, which can be useful for recognizing energy saving efforts and actions within the community. These ratings and certification can also be a goal to work towards for local energy committees, public works and facilities managers, and town councils, and achieving them can be one way for these groups (or the larger community) to demonstrate their commitment to energy savings (and emissions/cost reductions as a result).

Municipal Overview

The CACP 2009 Software municipal analysis generates greenhouse gas emissions data for government operations. The municipal analysis only includes facilities under municipal control.

This municipal analysis is divided into four categories:

- *Buildings*: Emissions resulting from energy use in municipal buildings
- *Vehicle Fleet*: Emissions resulting from fuel use in town-owned vehicles
- *Street Lights:* Emissions resulting from electricity use for street and traffic lights
- *Water Usage:* Emissions resulting from energy used to supply drinking water for municipal activities

Table 1
2009 Windham municipal energy use, greenhouse gas emissions, and costs, by activity

Municipal Sector	Energy Use		GHG emissions		Energy Cost	
	MMBTU	Portion of Town MMBTU	Metric tons CO2e	Portion of Town emissions	$	Portion of Town Costs
Buildings	5,291	34.0%	495	38.7%	$133,981	41.1%
Vehicles	9,538	61.3%	695	54.3%	$128,682	39.5%
Street Lights/ Signals	717	4.6%	89	7.0%	$59,044	18.1%
Water Use	3	<0.1%	<1	<0.1%	$3,954	1.2%
Total	**15,549**	**100.0%**	**1280**	**100.0%**	**$325,661**	**100.0%**

Table 1, on page 5, shows a summary of each category's energy consumption, CO_2 equivalent emissions, and cost. The following graphs show the relative energy use, greenhouse gas emissions and cost by sector.

Windham's 2009 municipal activities consumed 15,549 MMBTUs of energy, and produced 1,280 metric tons of carbon dioxide-equivalent emissions (CO_2e) (Table 1). The majority of Windham's energy use was due to its vehicle fleet, which consumed over 60 percent of the total energy used, with municipal buildings only using about one-third (Figure 1A). Emissions were clearly correlated to energy use, but the two values do not mirror each other exactly. Vehicles consumed 61 percent of the Town's energy use, but only produced 54 percent of its emissions, while buildings accounted for 34 percent of the Town's energy use and 39 percent of its emissions.

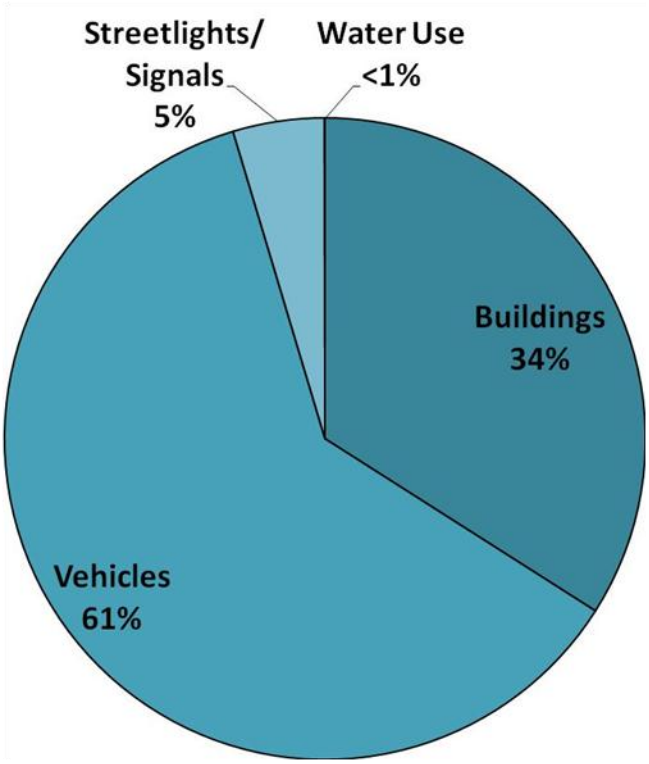
These differences between energy use and greenhouse gas emissions are primarily due to the types of energy sources used by each activity. Electricity, for example, is generally more emissions-intensive per MMBTU than other energy sources. This is because only a portion of the fuel consumed during electricity generation is actually converted to useable electricity – the rest is lost due to inherent inefficiencies in generation and transmission. Buildings and street lights both use electricity as a source of energy, while Town vehicles rely directly on petroleum products. This explains why the emissions of building activities are higher than might be expected based on their total energy use.

The energy consumed by Windham's municipal activities cost the Town $325,661 in 2009 (Table 1). The cost of electricity and heating fuel use in buildings ($133,981), was only slightly more than the cost of fuel for the Town's vehicles ($128,682).

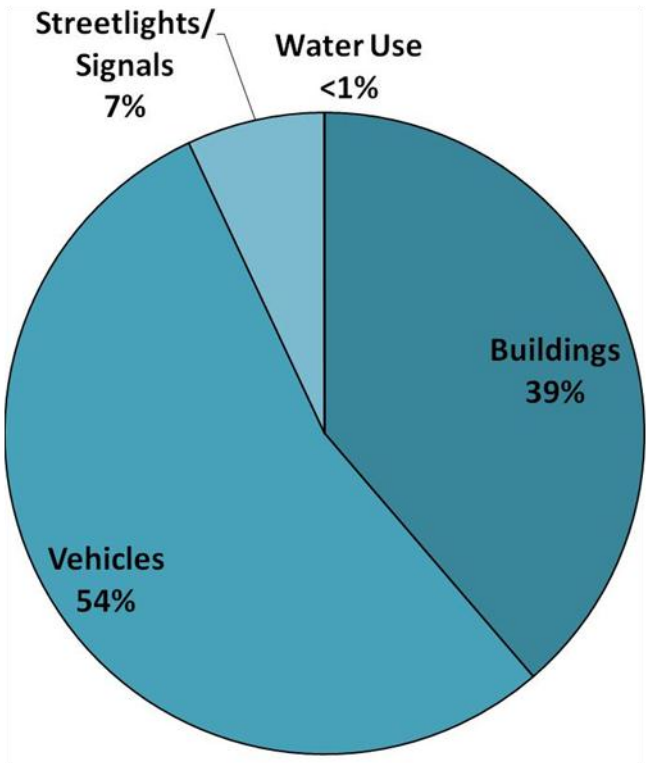
The difference between Town energy use and cost trends is again due to the types of energy sources used by each activity. Electricity is generally about twice as expensive per unit of energy than most other sources. Electricity provided about 47 percent of the energy for Windham's buildings, but accounted for 67 percent of their overall energy costs. As a result, municipal buildings were responsible for 41 percent of Town energy costs while only consuming 34 percent of its energy.

Street lights and traffic signals provide another example of this trend in electricity costs. In total, Windham street lights and signals consumed about five percent of the overall energy used by Town municipal activities, but accounted for a considerable 18 percent of energy costs (Figure 1). These costs reflect both electricity costs for running the lights, and any additional leasing/upkeep fees charged by the street light provider, Central Maine Power.

A similar trend can also be seen with municipal drinking water use. While estimated energy used to provide Windham's municipal drinking water was less than 0.1 percent of Windham's overall use, the costs associated with providing the water represented slightly over one percent of the Town's total energy costs (Table 1).

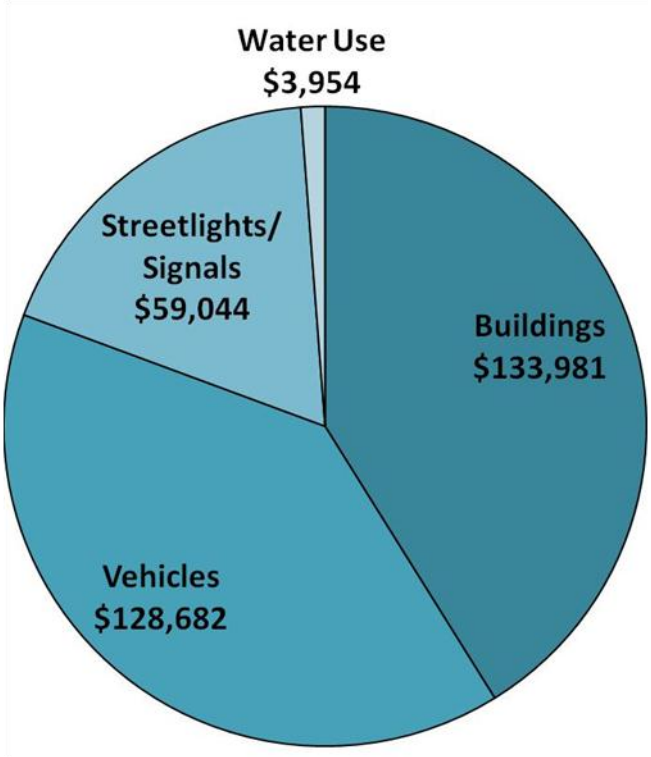


A: Energy Use



B: GHG Emissions

Figure 1: A) Total 2009 Municipal Energy Use by Sector (MMBTU);
B) Total Municipal Emissions by Sector (metric tons CO_2e);
C) Total Municipal Energy costs by sector ($)



C: Costs

Building Performance: Energy Use, Emissions, Costs

Data on electricity and fuel use for each Windham municipal building were gathered and analyzed. The following table shows energy use, greenhouse gas emissions and cost data for individual buildings, calculated using ICLEI's CACP Software 2009. The following figures illustrate the relative energy use, emissions, and costs among the buildings and facilities under the Town's municipal jurisdiction.

Table 2
2009 Windham Municipal Building Energy Use, Greenhouse Gas Emissions, and Costs

Building	Energy Use		Emissions		Energy Cost	
	MMBTU	Portion of Town MMBTU	Metric tons CO2e	Portion of Town emissions	$	Portion of Town costs
Dundee Park	26.1	0.2%	3.2	0.3%	$1,182	0.4%
East Fire Station	327.7	2.1%	24.9	1.9%	$7,284	2.2%
Health Council	47.8	0.3%	5.9	0.5%	$2,210	0.7%
Human Services	268.4	1.7%	23.3	1.8%	$6,720	2.1%
Library	406.8	2.6%	42.0	3.3%	$11,711	3.6%
Maintenance	4.9	0.0%	0.6	0.0%	$323	0.1%
North Fire Station	475.5	3.1%	40.9	3.2%	$11,249	3.5%
Public Safety	1183.7	7.6%	119.4	9.3%	$29,824	9.2%
Public Works	701.8	4.5%	71.5	5.6%	$15,524	4.8%
Roosevelt Ice Rink	0.0	0.0%	0.0	0.0%	$10	0.0%
Sand/Salt Shed	112.3	0.7%	14.0	1.1%	$5,001	1.5%
Skate Park	7.0	0.0%	0.9	0.1%	$402	0.1%
South Fire Station	273.7	1.8%	24.9	1.9%	$7,456	2.3%
Town Offices	1455.3	9.4%	123.6	9.7%	$35,085	10.8%
Total	**5290.9**	**34.0%**	**495.2**	**38.7%**	**$133,981**	**41.1%**

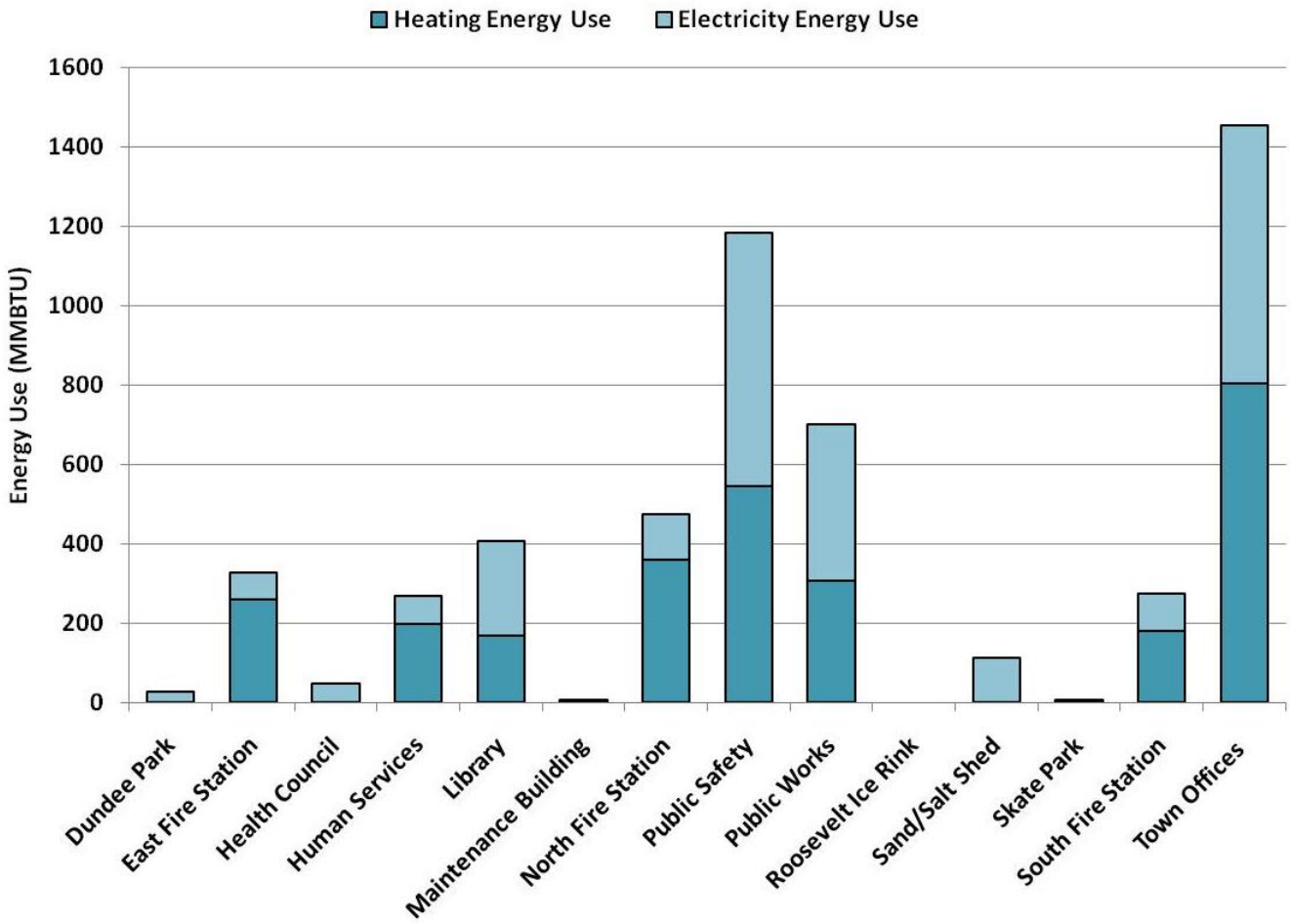


Figure 3. 2009 Windham Energy Use by Building (MMBTU) and energy source

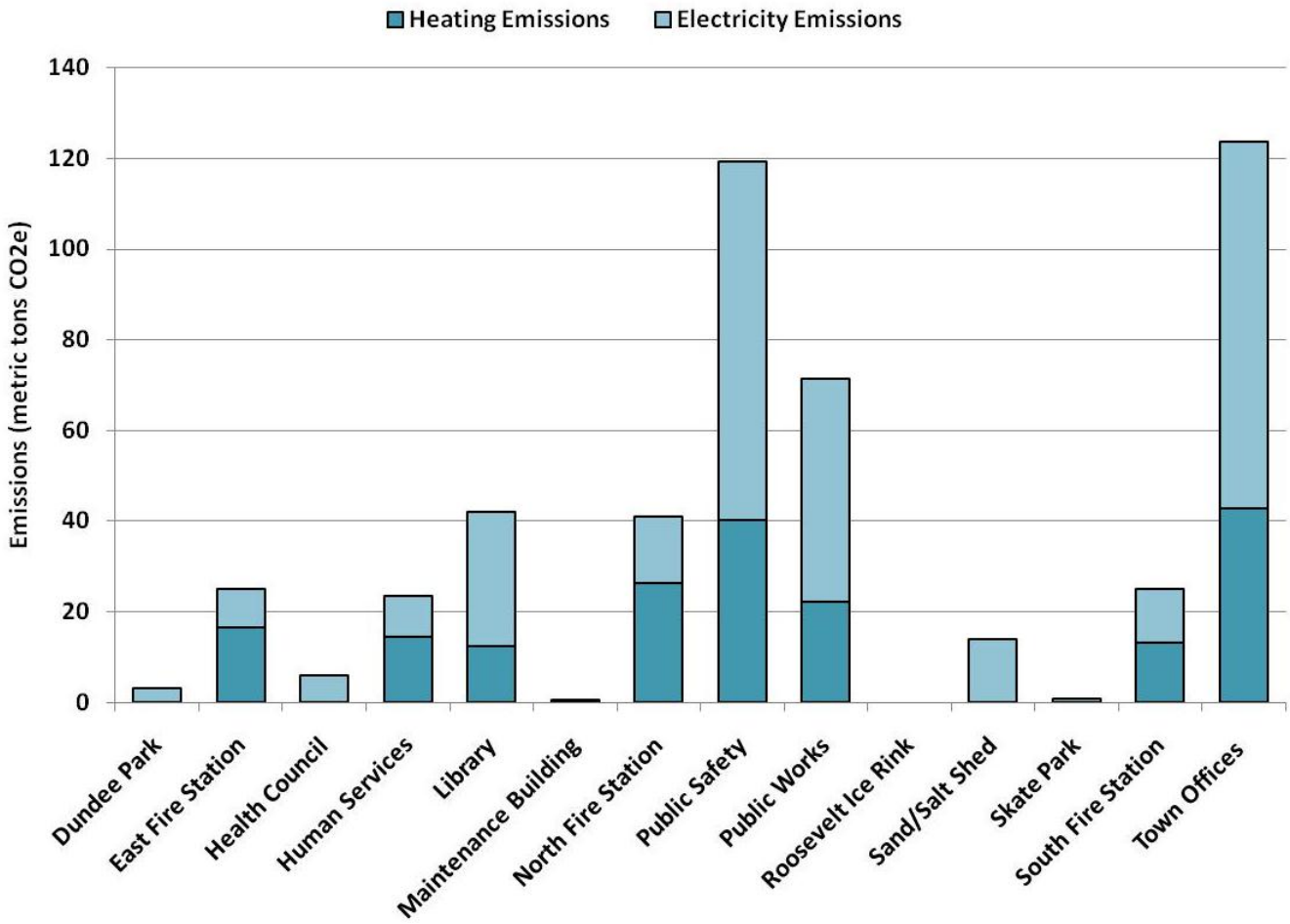


Figure 4. 2009 Windham Greenhouse Gas Emissions by Building (metric tons CO_2e) and energy source

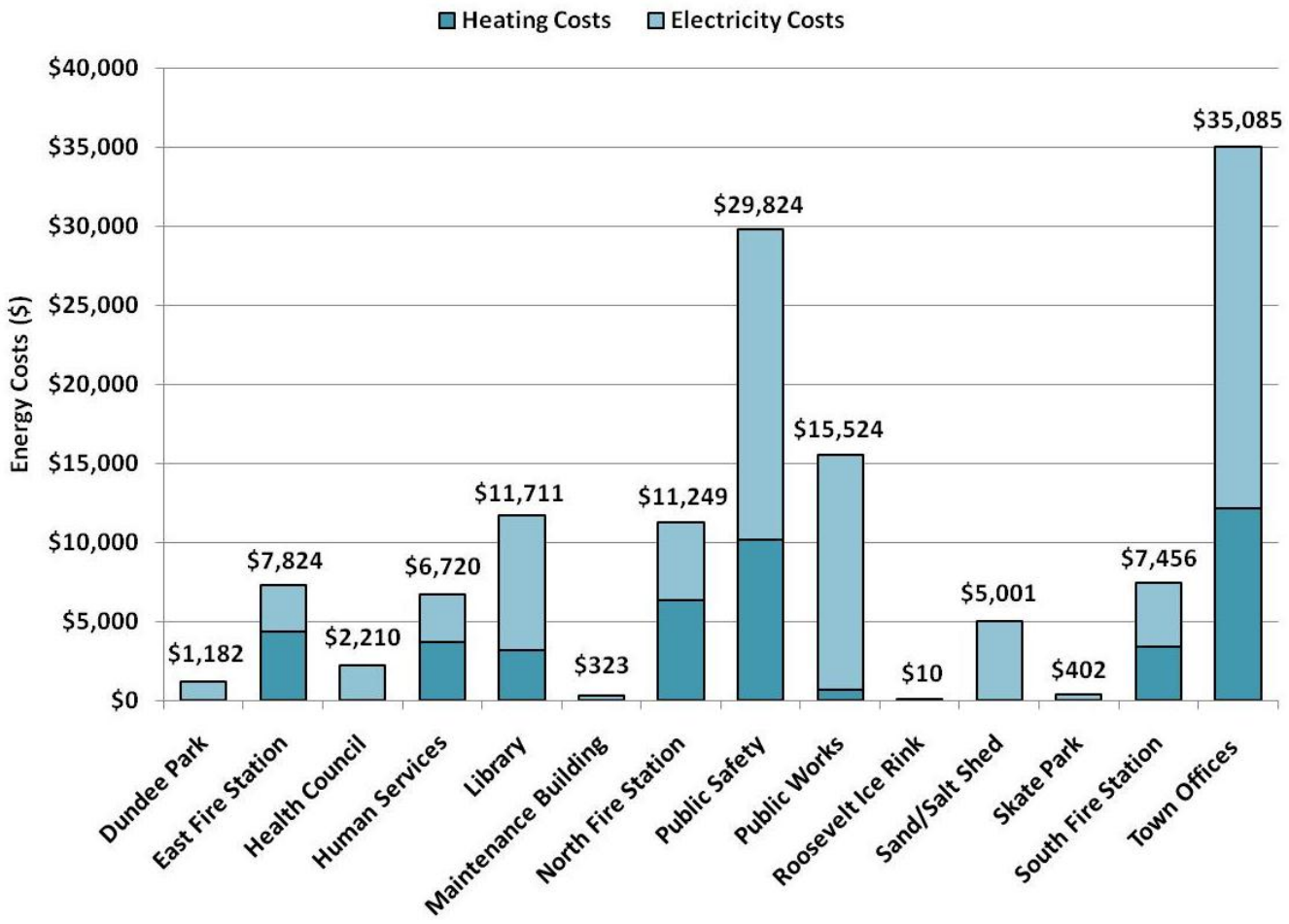


Figure 5. 2009 Windham Energy Costs by Building ($) and energy source

The Windham Town Offices were the Town's biggest energy consumer and emissions producer in 2009, using nearly 1,456 MMBTU of energy and producing over 123 metric tons of CO_2e (Figures 3 and 4). This energy use cost the town over $35,000 (Figure 5).

The Public Safety facility had the second-highest energy use, emissions and costs of all buildings, and produced a disproportionately large quantity of emissions relative to its energy use (Figures 3 and 4). Its total energy costs were $29,824 in 2009 (Figure 5).

The next largest energy consumers were the North Fire Station, Public Works, and the Library. Of these, emissions and energy costs were considerably higher in the Public Works facilities – energy costs for this building reached over $15,500 in 2009.

The South and East Fire stations followed in energy use, along with the Human Services building, and the Sand/Salt Shed. Each cost the town over $5,000 in energy in 2009.

The smallest energy users were the Health Council building, Dundee Park, the Skate Park, and Roosevelt Ice Rink. While emissions and costs were relatively low for these facilities compared to larger energy consumers, together they represent nearly $4,000 in energy costs in 2009 (Figure 5).

Table 3
2009 Windham Municipal Building Energy Use, Greenhouse Gas Emissions, and Costs, by Energy Source

Building	Energy Source	Energy Use		Emissions		Energy Cost	
		MMBTU	Portion of Building MMBTU	Metric tons CO_2e	Portion of Building Emissions	$	Portion of Building costs
East Fire Station	Electricity	68.2	20.81%	8.47	33.95%	$2,928	40.20%
	Propane	259.5	79.19%	16.48	66.05%	$4,356	59.80%
	Subtotal	**327.7**	**100.00%**	**24.95**	**100.00%**	**$7,284**	**100.00%**
Health Council	Electricity	47.8	100.00%	5.95	100.00%	$2,210	100.00%
	Subtotal	**47.8**	**100.00%**	**5.95**	**100.00%**	**$2,210**	**100.00%**
Human Services	Electricity	71.0	26.47%	8.83	37.81%	$3,036	45.18%
	Fuel Oil	197.4	73.53%	14.52	62.19%	$3,684	54.82%
	Subtotal	**268.4**	**100.00%**	**23.35**	**100.00%**	**$6,720**	**100.00%**
Library	Electricity	239.1	58.79%	29.71	70.66%	$8,570	73.18%
	Fuel Oil	167.7	41.21%	12.33	29.34%	$3,141	26.82%
	Subtotal	**406.8**	**100.00%**	**42.04**	**100.00%**	**$11,711**	**100.00%**
North Fire Station	Electricity	116.4	24.48%	14.46	35.37%	$4,935	43.87%
	Fuel Oil	359.1	75.52%	26.42	64.63%	$6,314	56.13%
	Subtotal	**475.5**	**100.00%**	**40.88**	**100.00%**	**$11,249**	**100.00%**
Public Safety	Electricity	637.5	53.86%	79.21	66.34%	$19,685	66.00%
	Fuel Oil	546.2	46.14%	40.18	33.66%	$10,139	34.00%
	Subtotal	**1183.7**	**100.00%**	**119.38**	**100.00%**	**$29,824**	**100.00%**
Public Works	Electricity	396.2	56.46%	49.23	68.87%	$14,854	95.68%
	Fuel Oil	35.5	5.06%	2.62	3.66%	$670	4.32%
	Waste Motor Oil	270.0	38.47%	19.63	27.47%	$0	0.00%
	Subtotal	**701.8**	**100.00%**	**71.48**	**100.00%**	**$15,524**	**100.00%**
South Fire Station	Electricity	94.2	34.41%	11.70	46.98%	$4,066	54.53%
	Fuel Oil	179.5	65.59%	13.20	53.02%	$3,390	45.47%
	Subtotal	**273.7**	**100.00%**	**24.902**	**100.00%**	**$7,456**	**100.00%**
Town Offices	Electricity	650.8	44.72%	80.85	65.39%	$22,917	65.32%
	Natural Gas	804.5	55.28%	42.80	34.61%	$12,168	34.68%
	Subtotal	**1455.3**	**100.00%**	**123.65**	**100.00%**	**$35,085**	**100.00%**
Total		**5140.6**	**-**	**476.6**	**-**	**$127,063**	**-**

A breakdown of the types and amounts of energy used in Windham's buildings is provided in Table 3. High emissions and energy costs are often associated with electricity consumption; as noted previously, electricity is generally a more expensive and emissions-intensive energy source compared to fuels like heating oil or natural gas.

Of the Town buildings that used multiple energy sources, the Library, Public Safety, and Public Works are all notable because over 50 percent of their energy use comes from electricity. Not surprisingly, these were also among the most expensive buildings to heat and light, costing the Town a total of over $57,000 in 2009. Public Works spent nearly $15,000 on electricity alone, representing 96 percent of its overall energy costs. The Town Offices were also another large electricity consumer – electricity made up about 45 percent of their overall energy use, and accounted for about $23,000 in energy costs.

Building Energy Intensity

Energy intensity is one of the most powerful tools 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. Greenhouse gas intensity is calculated by taking the amount of greenhouse gas emissions (measured in CO_2e) and dividing it by the square feet of space. Both can be reduced through operational and energy conservation measures. Cost intensity is also measured per square foot and can provide a useful means for comparison.

Information about the energy intensity of Windham's buildings was derived through EPA Portfolio Manager and CACP Software 2009. EPA Portfolio Manager provides national averages by building type as a benchmark, enabling comparison of building performance. Previous inventories of communities in the GPCOG region were used to provide regional average energy intensity by building type.

Table 4 shows the energy intensity of Windham's buildings as compared to national benchmarks developed by the federal Energy Star's Portfolio Manager program, and averages generated for a small group of communities in the GPCOG region. It also provides the emissions and cost intensity of these buildings (as expressed in terms of metric tons of CO_2e or dollars per square foot of building). While the energy intensity values provide a good starting point, the accuracy of these national and regional averages is variable for several reasons.

Regarding the national averages, Portfolio Manager lacks categories for all building types. Seven of the nine municipal buildings examined fell under various "Other" classification subcategories, meaning that they could not receive an official energy rating from the program. Also, national averages may not provide an ideal comparison for individual buildings that have unique attributes or functions. For example, Windham's Town Offices and Public Works Facilities each serve multiple purposes which do not fit perfectly into Portfolio Manager's currently limited categories. Finally, though Portfolio Manager's national averages do account for climate differences between various regions of the country, these values are not specific to a particular year.

Table 4 - 2009 Windham Building Energy Intensity

Name of Building	Heating fuel(s)	Area (ft^2)	Overall site energy intensity (kBTU/ft^2)[7]			Emissions Intensity (kg CO_2e/ft^2)[8]	Cost Intensity ($/$ft^2$)		
			Windham	US Average	GPCOG Average		Electricity	Heating	Overall
East Fire Station	Propane	5856	56.0	78.0	86.4	4.3	$0.50	$0.74	$1.24
Health Council	Electricity	864	55.4	25.0	n/a	6.9	$2.56	n/a	$2.56
Human Services	Oil	3830	70.1	225.0	n/a	6.1	$0.79	$0.96	$1.75
Library	Oil	7000	58.1	104.0	69.6	6.0	$1.22	$0.45	$1.67
North Fire Station	Oil	8008	59.4	78.0	86.4	5.1	$0.62	$0.79	$1.40
Public Safety	Oil	27276	43.4	90.0	n/a	4.4	$0.72	$0.37	$1.09
Public Works	Oil/Waste Oil	6656	105.4	77.0	111.0	10.7	$2.23	$0.10	$2.33
South Fire Station	Oil	3220	85.0	78.0	86.4	7.7	$1.26	$1.05	$2.32
Town Offices	Natural Gas	10200	142.7	93.6	110.5	12.1	$2.25	$1.19	$3.44
Average	**-**	**8101**	**75.0**	**94.3**	**91.7**	**7.0**	**$1.35**	**$0.71**	**$1.98**

Site energy intensity and Portfolio Manager (PM) national average site energy intensity data generated by EPA Portfolio Manager software and CACP Software 2009.

The GPCOG regional averages come from a very small sample group. As such, these values should be taken as representative of a limited number of communities, rather than the region as a whole. In addition, these values also represent inventories conducted for 2007 and 2009, rather than just 2009 – variations in seasonal weather between these two years are not accounted for in this analysis. Despite these limitations, the graphs below identify areas which may be worthy of attention.

[7] 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 energy is being used on site and fluctuates directly with such variables as how much lighting is being used, how thermostats are kept, etc. It is measured in thousands of BTUs per square foot.

[8] Greenhouse gas intensity is a measure of emissions from energy use on site. It is measured in kilograms of equivalent carbon dioxide per square foot.

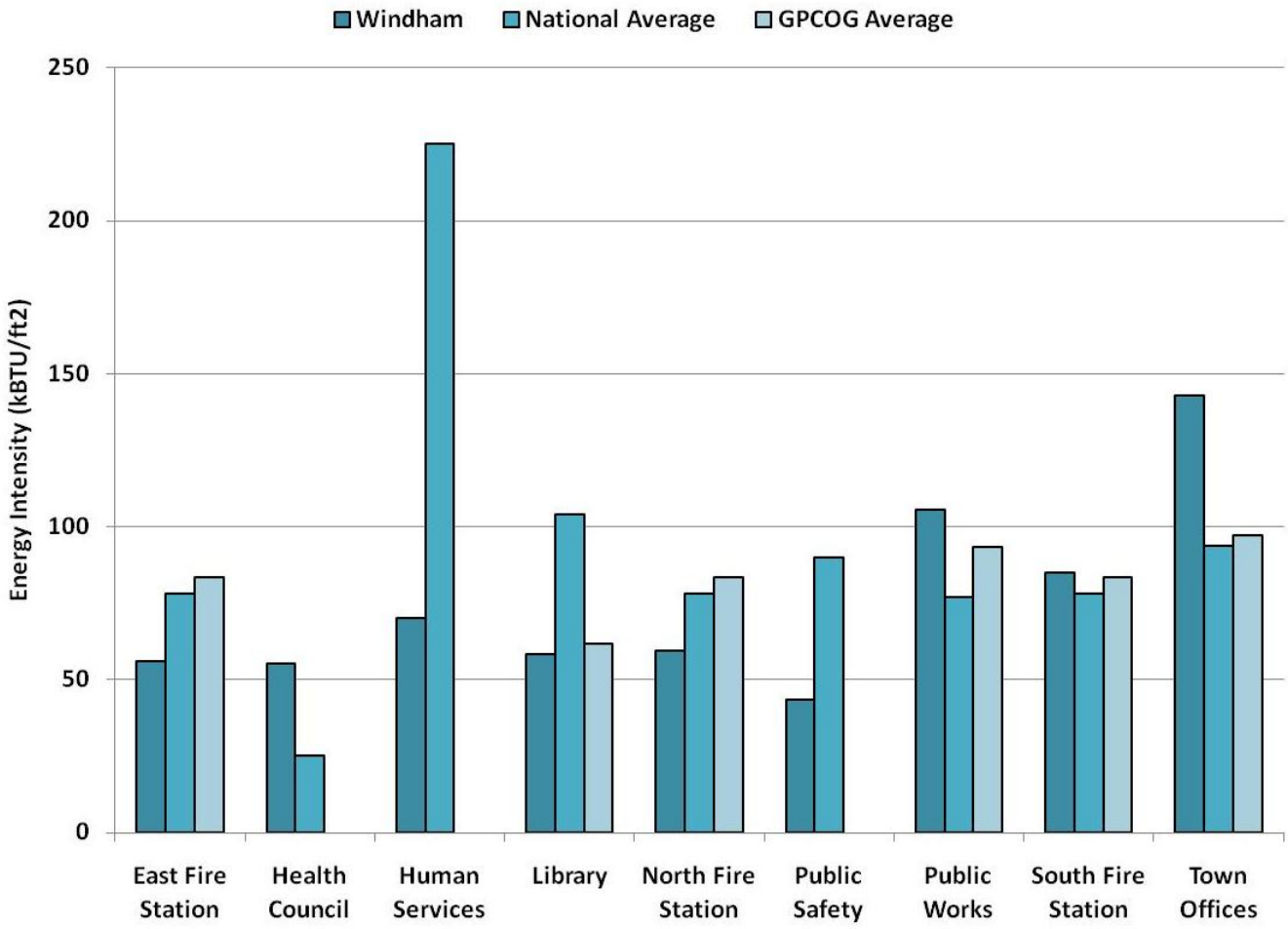


Figure 6. Comparison of 2009 Windham, National, and GPCOG Regional Average Site Energy Intensity by Building Type (kBTU/ft^2)

Figure 6 shows the energy intensity of Windham's buildings as compared to national benchmarks developed by the federal Energy Star's Portfolio Manager program, and averages generated for a small group of communities in the GPCOG region. Figure 7 provides a comparison of the greenhouse gas emissions per square foot for municipal buildings.

When first examining the energy intensities displayed in Figure 6, the most immediately obvious peak occurs with the Human Services building. Because Human Services primarily functions as a food pantry, and has multiple refrigerators and freezers in use, it fell under the classification of Food Sales for the Portfolio Manager software. The large peak (over 200 kBTU/ft^2) represents the national average energy intensity for a Food Sales building, and is over four times as great as the actual energy intensity of the Human Services facility (about 70 kBTU/ft^2).

Of greater note are Windham's Town Offices and Public Works facility. These buildings had energy intensities that were considerably greater than both national averages for their type, and buildings of a similar function in other GPCOG member communities. High energy intensities can often help to identify buildings which may be operating inefficiently, especially relative to other buildings in the same category.

Windham's Town Offices are difficult to evaluate because they represent a large, single building with diverse functions, such as office space and an indoor gym. The building is heated with six separate furnaces, and is only served by a single electrical meter.

Similarly, the Public Works facility encompasses two separate buildings with different functions – the Public Works main garage/work building and a salt shed. Both buildings are lit with electricity, and share the same electrical meter. While the salt shed is also ventilated electrically, only the main garage is heated (using waste fuel oil and diesel, as noted above). As a result, only its floor area has been used to calculate the site energy intensity of the facilities. Without information specific to each of these buildings, it is difficult to judge whether efficiency improvements could be made to these facilities based solely on calculated energy intensity.

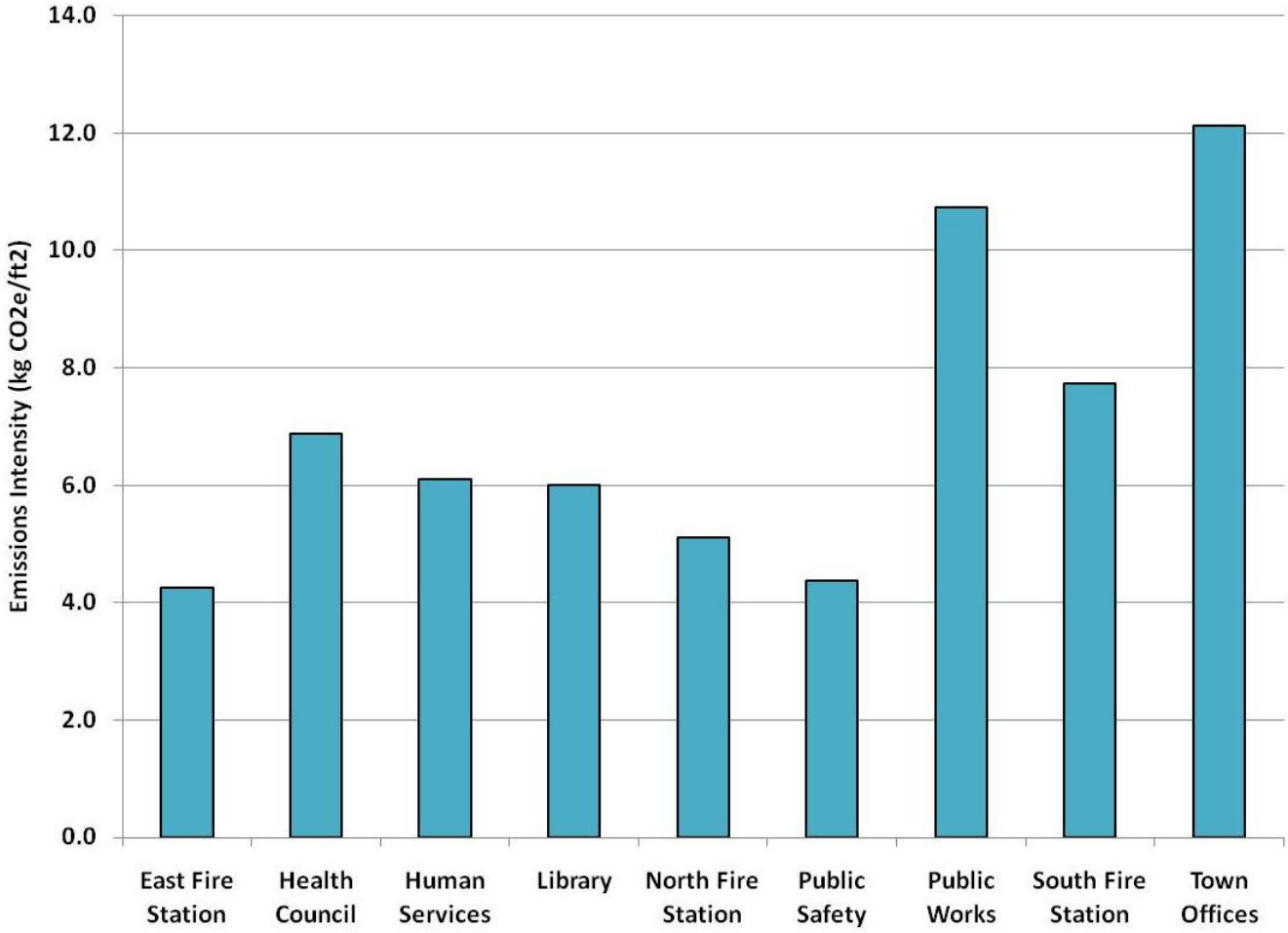


Figure 7. 2009 Windham Building Greenhouse Gas Emissions Intensity (kg CO_2e/ft^2)

Also notable is the Health Council building. Its energy intensity was over twice the national average for unrefrigerated warehouses. Because all of its energy use was in the form of electricity (for heating and lighting), it also has a fairly high emissions intensity (Figure 7).

The South Fire Station has the highest energy intensity of Windham's three fire stations. It is slightly above the GPCOG regional energy intensity average for fire stations, as well as above the national average for buildings of that type (Figure 6). Its emissions intensity is the third-highest among Windham's buildings (Figure 7).

The remaining buildings have energy intensities that are below national or GPCOG averages for those general categories. The North and East Fire Stations, the Library, and the Public Safety buildings are all examples.

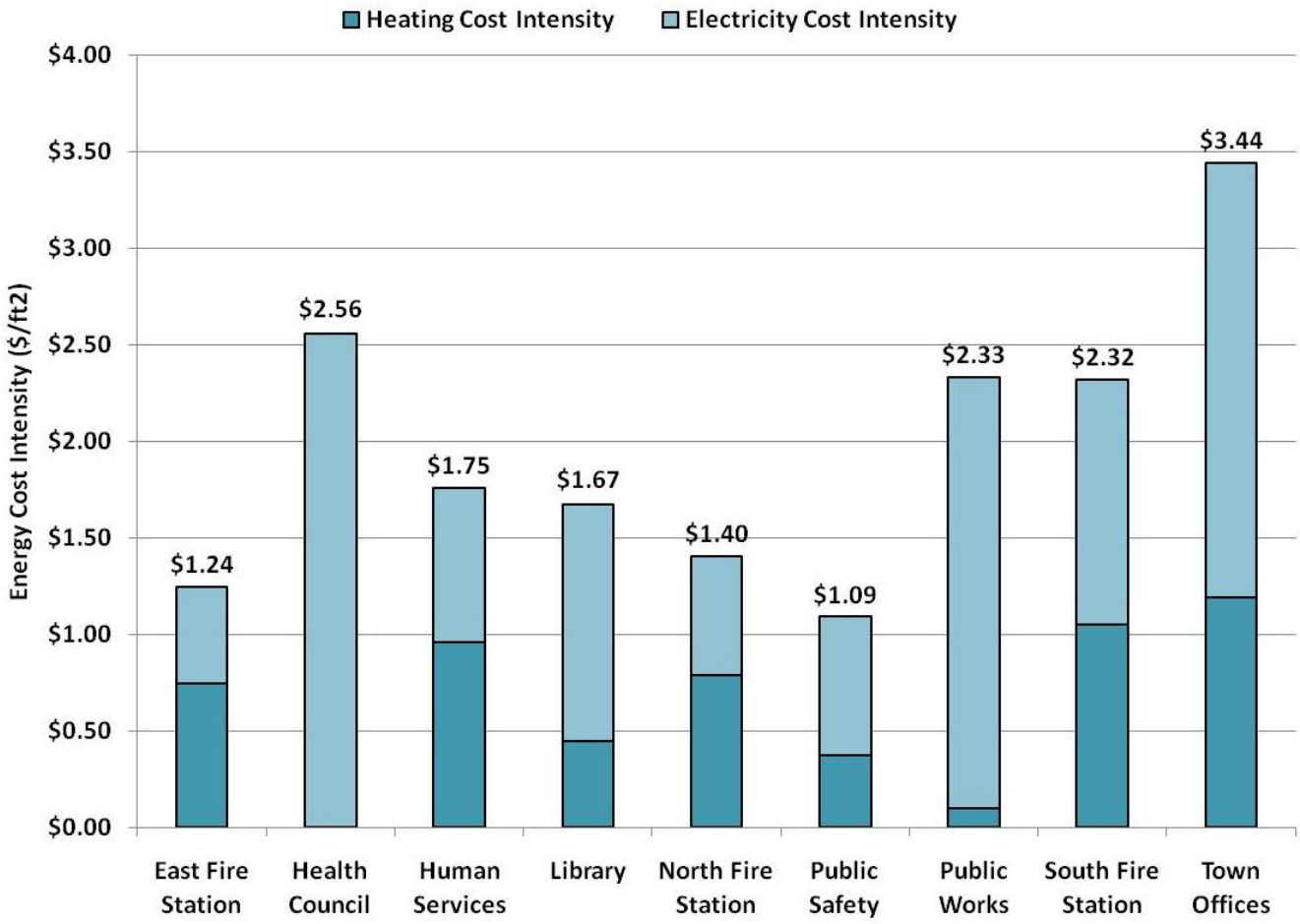


Figure 8. 2009 Windham Building average energy costs per square foot ($/ft^2), by energy source

Figure 8 provides a comparison of the energy cost per square foot for the Town's municipal buildings, broken down by energy source (electricity or fuels). This information can be used as a starting point in determining potential for increased cost savings through energy efficiency improvements.

In line with their high energy intensities, the Town Offices and Public Works also had energy cost intensities that were considerably higher than most other Town buildings. The large difference in their cost intensities is due to Public Works use of waste motor oil, which provides most of the building's heat at no cost.

Also noteworthy are the Health Council and South Fire Station in their energy costs per square foot. The Health Council's high energy cost intensity is due to its small size, and use of electricity for 100% of its energy needs (both lighting and heating). While the South Fire Station's is the smallest of Windham's fire stations, its high energy and cost intensity suggest that it uses more energy than would be expected for a building of its size and function (at least compared to the other Town fire stations). In addition, it also uses electricity for a greater portion of its overall energy than either the North or East stations.

The Public Safety building displays the lowest energy, emissions and cost intensity of Windham's buildings, yet was responsible for nearly as much energy use and cost as the Town Offices (Figures 3 and 5). This discrepancy is due to its size – at over 27,000 square feet, it is nearly three times as large as the Town Offices. It includes two floors of offices, and a below-ground garage. Its lower than national average rating for energy intensity suggests that energy efficiency improvements may not be as easily achieved in this building as compared to others with higher intensities.

Vehicle Performance: Energy Use, Emissions, Costs

Windham's vehicle fleet accounts for 61 percent of municipal energy use and about 40 percent of energy cost. Energy, emissions, and cost data were broken down and analyzed based on department, which is how vehicle fuel use is currently tracked by the Town (Table 5), and displayed in the following graphs (Figures 9 and 10).

Table 5. 2009 Windham vehicle energy use, emissions and cost by department

Vehicle Dept	Vehicles	Energy Use		GHG emissions		Energy Cost	
		MMBTU	Portion of Town MMBTU	Metric tons CO2e	Portion of Town emissions	$	Portion of Town Costs
Code Enforcement	4	106	0.7%	7.7	0.6%	$1,479	0.5%
Fire & Rescue	14	2,041	13.1%	149.1	11.6%	$27,346	8.4%
Parks & Rec	**3**	**88**	0.6%	**6.4**	0.5%	**$1,250**	0.4%
Police	22	2,609	16.8%	188.8	14.7%	$36,216	11.1%
Public Works	29	4,672	30.0%	341.8	26.7%	$62,083	19.1%
Tax Assessor	**3**	**22**	0.1%	**1.6**	0.1%	**$308**	0.1%
Total	**75**	**9538**	**61.3%**	**695.4**	**54.3%**	**$128,682**	**39.5%**

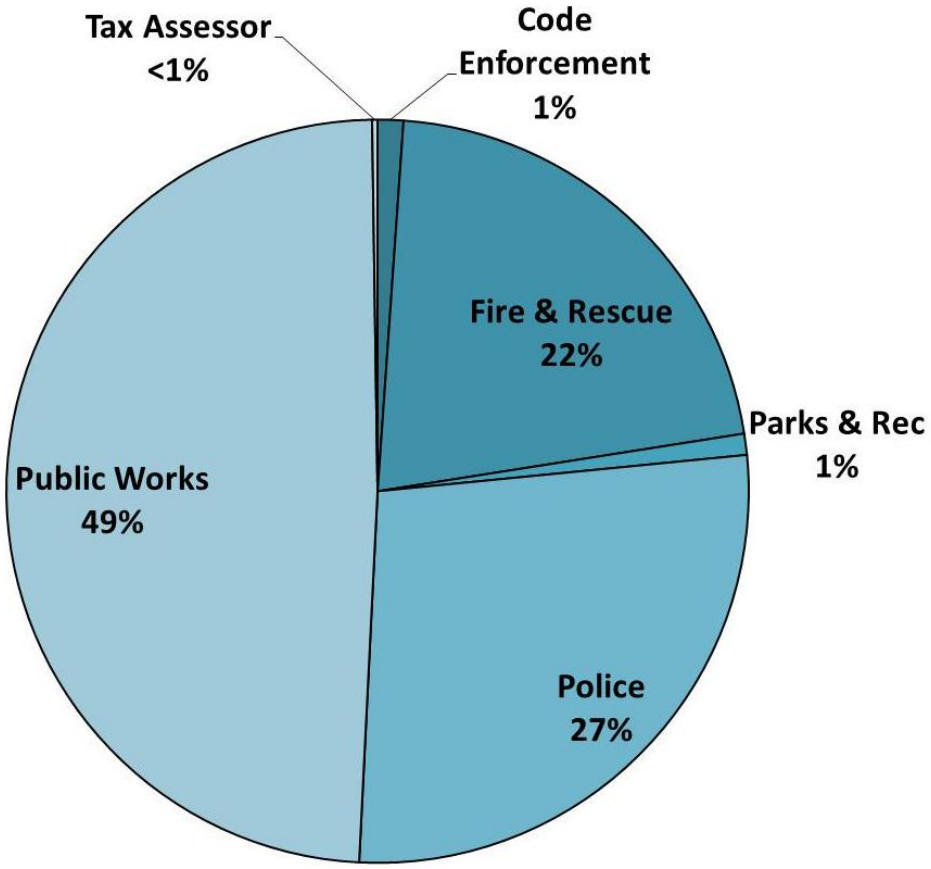


Figure 9. 2009 Windham vehicle energy consumption and emissions by department

Figure 9 illustrates the respective energy use and emissions of vehicles in each Town department (because emissions track energy consumption precisely when comparing gasoline and diesel fuels, separate energy use and emissions graphs are not shown here).

Windham's Public Works Department was the single largest fuel user, accounting for nearly half of all vehicle energy use, and costing the town over $62,000 in 2009 (Figure 10). The Police Department followed with just over one-quarter of overall vehicle energy use and $36,000 in costs. Fire & Rescue accounted for about 22 percent of energy use, and spent over $27,000 in fuel costs. The remaining three departments (Parks & Rec, Code Enforcement, and the Tax Assessor) represented about two percent total vehicle energy use, and about $3000 in costs combined.

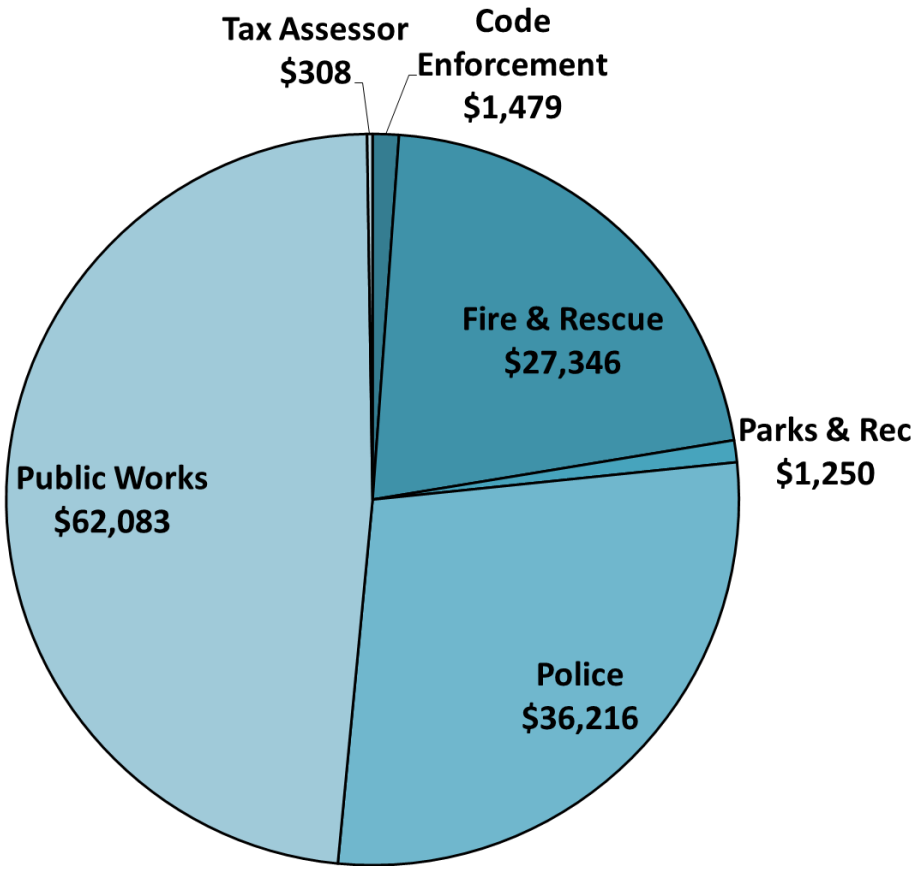


Figure 10. 2009 Windham vehicle energy cost by department

Unfortunately, specific information about the fuel use or activity (such as miles traveled or engine hours) of individual vehicles is not currently recorded for Windham's fleet. Such information is useful for estimating the actual fuel economy of each vehicle's operation during the year when combined with known fuel consumption. These observed fuel economies can be compared to the manufacturers' fuel economy ratings based on each model's specifications. Differences between estimated and observed fuel economy can signal issues that can be addressed to save fuel.

Because such detailed data is not available for this inventory, one way to more closely assess the energy use, emissions and costs of Windham's fleet is to account for the size of each department's vehicle fleet. The following figures compare the average energy use, emissions and cost *per vehicle* within each department. These graphs do not necessarily show how efficient vehicles are – they reflect both efficiency and frequency of use. Energy use per vehicle is useful to see, however, because investments in efficient or cleaner vehicles yield more benefit when those vehicles are intensively used.

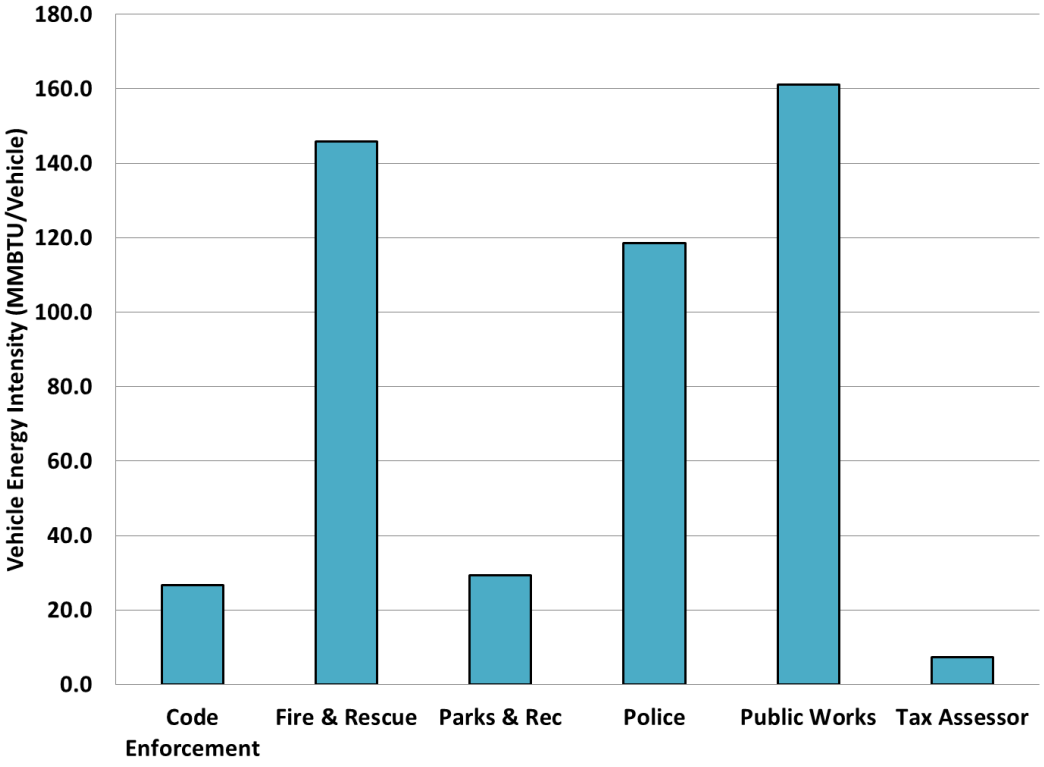
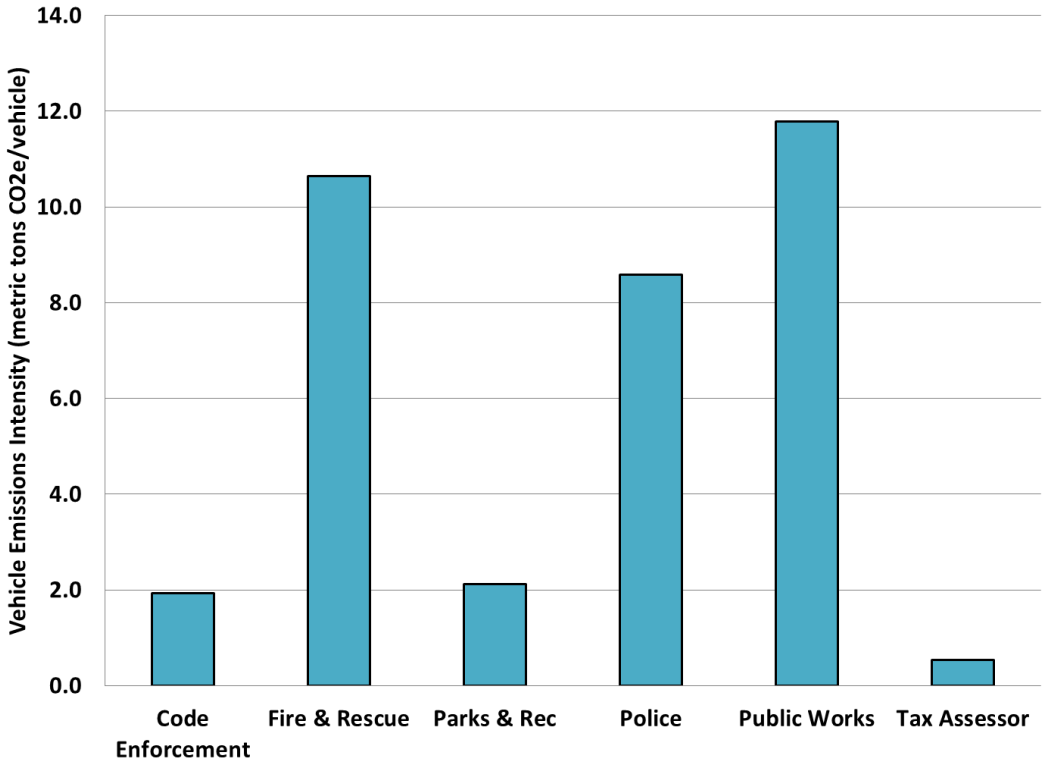


Figure 11. 2009 Windham average vehicle energy intensity by department

Figure 12. 2009 Windham average vehicle emissions intensity by department



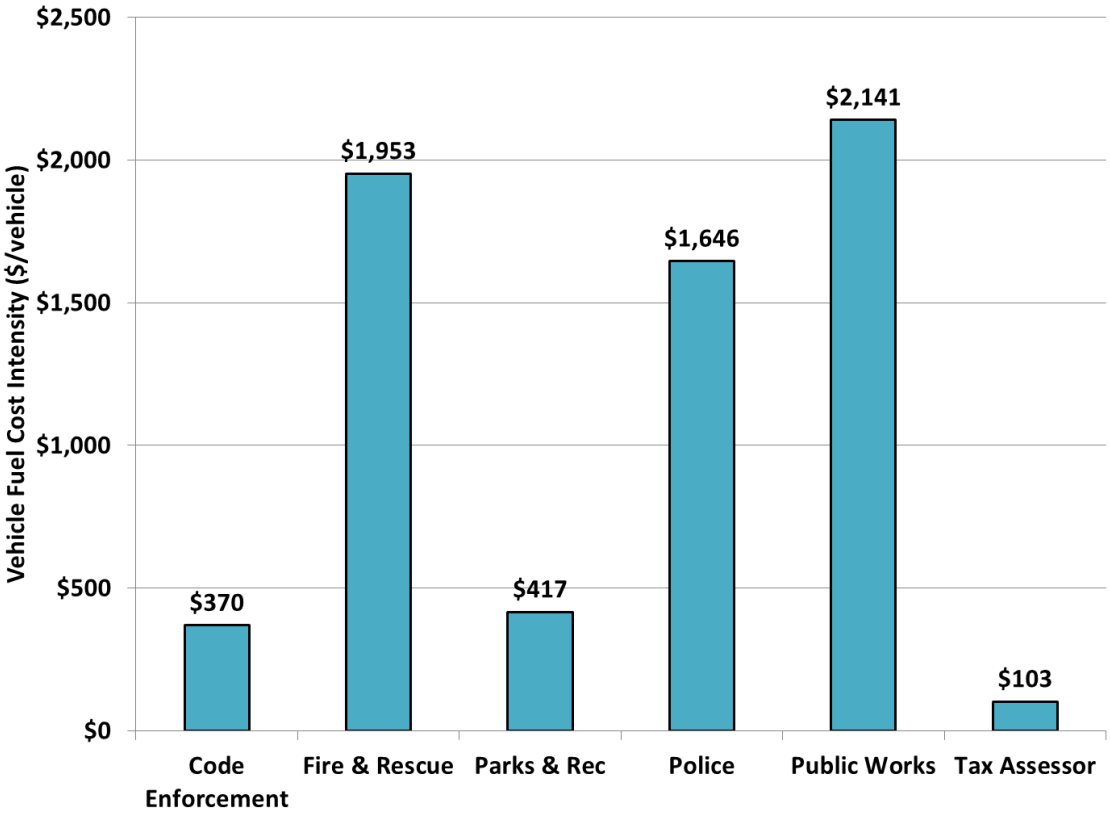


Figure 13. 2009 Windham average vehicle fuel cost intensity by department

Not surprisingly, the Public Works Department represented the highest energy use, emissions and costs on a per vehicle basis – each vehicle on average cost the department over $2,100 annually to fuel. Notably, however, the Fire & Rescue Department accounted for energy use and costs that were almost as high – nearly $2,000 for each vehicle in 2009. The Police Department followed, with 2009 fuel costs at about $1,650 per vehicle. Parks & Rec and Code Enforcement were both close to about $400 in annual fuel costs per vehicle, and the Tax Assessor had the lowest costs at around $100 per vehicle.

The higher per vehicle fuel consumption and costs for Public Works and Fire & Rescue could be due to greater annual miles traveled and workload, to inefficiencies in engine performance or idling, or to a combination of both. Fuel consumption could be spread out fairly evenly over the vehicles in each department, or a few heavily used or inefficient vehicles could be responsible for the majority of the observed fuel consumption. In the future, more quantifiable information on vehicle use and activity will contribute to more insightful analysis.

This analysis nevertheless shows the vehicles that Windham should focus its efforts on in order to realize the greatest gains. Examining the use and performance of the Public Works and Fire & Rescue vehicles, and implementing changes in equipment, maintenance or operation, will likely yield the biggest "bang for the buck."

Street Lights: Energy Use, Emissions, Costs

Windham tracks multiple street and traffic lights under control of the town. Of these lights, the 323 Town street lights were the largest consumers of energy, produced the greatest emissions, and were the most expensive to operate (see Table 6 below). While they accounted for approximately four percent of Windham's energy use in 2009, they represented over 16 percent of costs, at over $165 per light and $53,443 overall. On average, each light consumed about 1.9 MMBTUs of energy in 2009, and every four lights accounted for just under one metric ton of CO_2e emissions.

Table 6
2009 Windham Street and Traffic Light Energy Use, Emissions and Cost by Type

Name of Lights	Energy Use		Emissions		Energy Costs	
	MMBTU	Portion of Town MMBTU	Metric Tons CO_2e	Portion of Town CO_2e	$	Portion of Town Costs
Street Lights	627.3	4.0%	77.9	6.1%	$53,443	16.4%
Traffic Lights	89.2	0.6%	11.1	0.9%	$5,601	1.7%
Total	**716.6**	**4.6%**	**89.0**	**7.0%**	**$59,044**	**18.1%**

Comparatively, the Town's 20 traffic lights made up only about 12 percent of the total energy use and emissions associated with street lights. Together, they cost the town $5,601 in electricity costs in 2009.

Addressing street lights often yields relatively easy cost savings. Other communities in the region have been successful in reducing their number of street lights needed by up to 25 percent. With costs of $165 per light, removing even a few lights could result in annual cost savings.

Water Use: Energy Use, Emissions, Costs

Windham receives the water required for its municipal activities from the Portland Water District. In 2009 the Town consumed 100,500 cubic feet of drinking water for a total cost of $3,954. The energy associated with providing this water accounted for less than 0.1 percent of the Town's total energy use and about 0.3 percent of its emissions. Costs of water purchase and delivery represented about 1.2 percent of Windham's overall energy costs.

Table 7
2009 Windham energy use, emissions and cost due to municipal water use

Service	Energy Use		Emissions		Energy Costs	
	MMBTU	Portion of Town MMBTU	Metric Tons CO_2e	Portion of Town CO_2e	$	Portion of Town Costs
Town Municipal Drinking Water	**3.5**	**<0.1%**	**0.3**	**<0.1%**	**$3,954**	**1.2%**

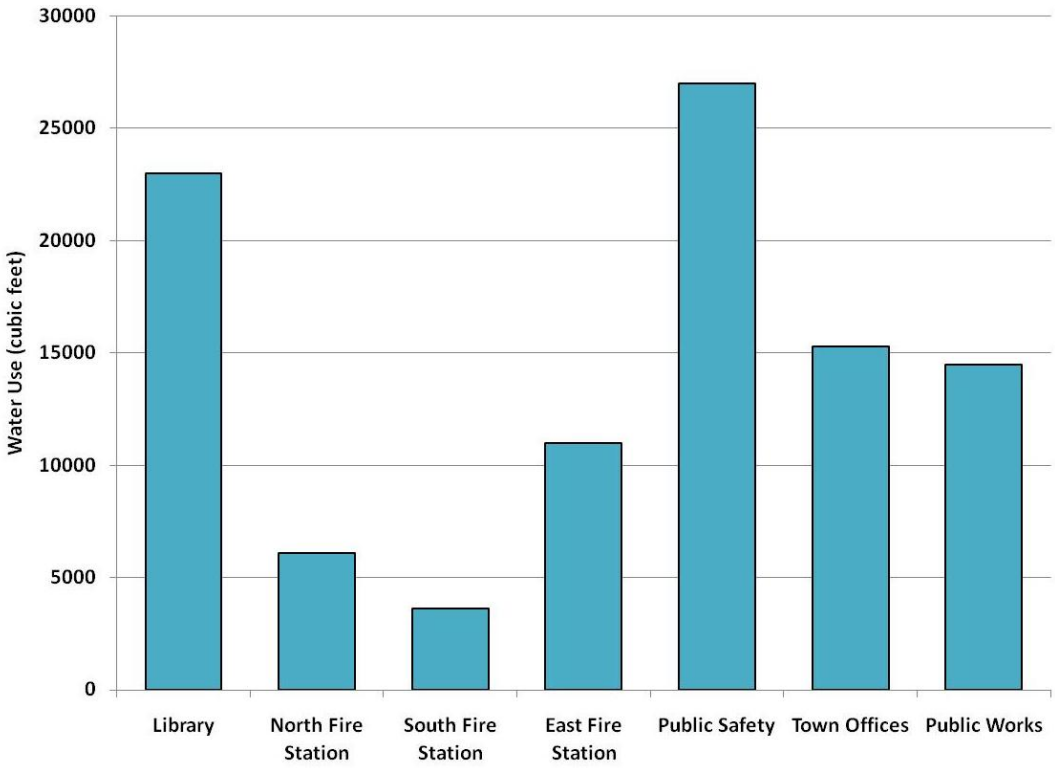


Figure 14. 2009 Windham municipal water usage by building (cubic feet).

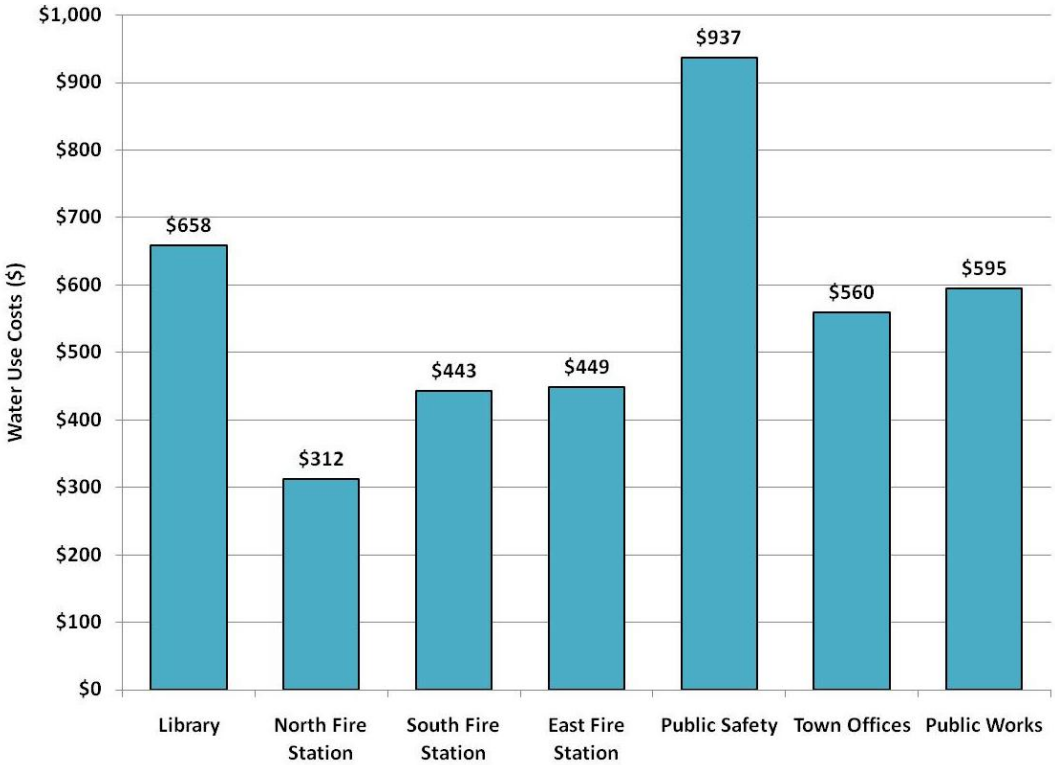


Figure 15. 2009 Windham municipal water costs by building ($).

Figures 14 and 15 represent the water usage and associated costs for the Town's buildings in 2009. Public Safety and the Library were the two biggest consumers, followed by the Town Offices and Public Works. Most notable about these two figures is the discrepancy between water use and cost seen in a few buildings. The South Fire Station, for example, consumes considerably less water than used in the East Station, yet has water costs that are nearly the same.

Priorities and Recommendations

The recommendations in this report are based on baseline data from 2009 and may not perfectly reflect current needs or plans. Nevertheless, they highlight common sense steps that Windham can take to help improve its energy efficiency while reducing emissions and energy costs. They focus on the areas with the most room for improvement, as identified by the CACP and Portfolio Manager analysis.

General Recommendations for Municipal Energy Savings

1. Review existing Comprehensive Plan, Zoning Ordinances, and other town policies for inconsistencies with energy reduction goals, and modify as appropriate.
2. Consider changes in operational policy in municipal buildings. Work with the WEC and municipal employees for guidance on implementing this initiative.
3. Implement buying strategy of Energy Star equipment and environmentally sensitive office products.
4. Consider investigating the feasibility of making natural gas more accessible to the municipal buildings and residents of Windham. Natural gas is less emissions-intensive than most other fuels used for heating – for example, it produces about 28 percent less greenhouse gas emissions per BTU than #2 heating fuel oil. It is also generally less expensive than fuel oil or kerosene per BTU.
5. Evaluate ways to reduce vehicle fleet fuel consumption. This can be done by analyzing routes, usage, implementing a strict anti-idling policy, eco-driving education, right sizing, and replacing older vehicles with hybrids and/or alternatively fueled vehicles.
6. Begin gathering data for 2011. This will allow for a future comparison to the baseline established in this study and an evaluation of progress towards cost and energy reduction goals. Data gathering could be improved by:
    a. Investigating the feasibility of separately monitoring the electricity use of each of the Public Works buildings, and installing sub-meters in the Town Offices.
    b. Tracking individual vehicle fuel consumption, miles traveled/engine hours, and service performed, by year (or month, if possible) in the Town's vehicle fleet.
    c. Begin entering monthly energy bills and vehicle records into simple electronic spreadsheets, to facilitate easier data analysis and repeat inventories in the future.
7. To comply with the Local Government Operations Protocol,[9] add to data tracking:
    a. Refrigerants (hydrofluorocarbons used in fire suppression, vehicle and building air conditioning systems, and refrigerators)
    b. Emissions estimates from open or capped landfills within the Town boundaries

[9] The Local Government Operations Protocol is a standardized set of guidelines that assists local governments in quantifying and reporting GHG emissions associated with their government operations. If national climate legislation allows carbon trading, it is likely that carbon credits will be determined based on analyses that follow this Protocol.

Priorities and Recommendations based on CACP and Portfolio Manager Analysis

Buildings:
Recommendations are listed in order of priority for Windham Energy Committee attention. These differ from the prioritized list for building audits (Item 3 under General Building Actions) because they take into account the likelihood of available, cost-effective energy-saving measures for each building that can be identified and possibly implemented by the WEC.

1. Town Offices: Within the building sector, consider addressing the Town Offices first. This facility represents the largest single energy consumer in the town, consumed the greatest amount of energy per square foot, and costs the town significantly more to operate than any other facility.

The Town Offices are heated with natural gas, which provides about 55 percent of the energy used by the facility. The remaining 45 percent of energy use is due to electricity – not as high as some other buildings, but considerable nonetheless. This electricity use represented 65 percent of Town Office energy costs.

Efforts to address the Town Offices' energy costs should focus first on electricity use. Lighting commonly makes up about 40 percent of a building's total electrical use, so upgrading overhead fluorescent bulbs and ballasts, replacing incandescent bulbs with CFLs, installing occupancy sensors on light switches, and encouraging changes in operational policy have the potential to yield big savings. Air conditioning and ventilation may also account for a large amount of electricity use; professional evaluations of these systems would likely be worthwhile.

Finally, computers and appliances may make up 10 percent or more of energy consumption. Upgrading monitors and large appliances to EnergyStar qualified units, along with instituting power management practices and changes in operational policy, may also lead to energy savings. If electrical sub-meters can be easily and inexpensively installed in various zones of the facility, these would enable more detailed assessment of electricity use, and may help to guide the focus of energy efficiency improvements.

Addressing the space and water heating efficiency of the facility through improvements in the building envelope, thermostat control, and hot water generation and use may also yield considerable savings over the long term, while improving staff and guest comfort as well.

2. Public Works: The Public Works facilities encompass two separate buildings, and had the second-highest site energy intensity of all the Town's buildings. Examination of these buildings for energy-efficiency improvements should also be a priority.

Electricity use made up over 55 percent of the energy use at the Public Works facilities, and accounted for 96 percent of the costs (due to the free supply of waste motor oil for heating). Examining the electricity-consuming equipment and activities that occur in these buildings would help to identify areas where energy efficiency could be increased.

Lighting for these facilities may make up a considerable portion of electricity usage, though to what extent would vary by building. Lighting efficiency may be improved through upgrades to higher-performance fluorescent bulbs and ballasts (such as Super T8s); installation of occupancy/motion sensors; and changes in operational policies. These can all have considerable impacts on electricity usage.

Ventilation systems can also be large consumers of electricity. Having these systems in the Main Garage and Salt Storage Buildings professionally evaluated and serviced could help improve their operating efficiency, and identify if any improvements or modifications would be warranted.

One other potentially large electricity consumer could be vehicle engine block heaters. It is possible that School District buses may be heating their engines in the Public Works facility, in addition to Town-owned vehicles. If these heaters are being used in the Public Works facility, identifying the vehicles and Department/District(s) responsible for their use should be a priority (for both potential energy-saving and accurate billing purposes).

3. Health Council: The Health Council building acts primarily as a medical equipment supply closet. It lacks a foundation, and is the oldest of all the Town buildings assessed (1850). While one of the lowest energy consumers in the Town, it has a relatively high energy use intensity, twice as high as the national average for non-refrigerated storage warehouses. In addition, the building consumes all of its energy in the form of electricity, which led it to have the second-highest energy cost intensity of all of Windham's buildings. It cost the Town over $2,200 in 2009.

Efforts to save energy in this building should examine how the electricity is being used. Electrical heating is generally very expensive, and so it may be worth examining alternative heating for this building (a propane space heater, for example). The building may also benefit from improvements in insulation, which could have a quick payback through energy savings.

Finally, investigate the feasibility of installing passive solar air heaters and/or natural-lighting units that concentrate and transport daylight into the interior of buildings. For example, the City of Saco has had positive, cost-saving experiences with both of these solar building technologies.

4. South, North, and East Fire Stations: Of Windham's three fire stations, the North Station was the largest energy consumer, followed by the East, and then the South Station. However, the South Station demonstrated the highest energy and cost intensity of the three, and compared least favorably to the regional and national fire station energy intensity averages. It uses the greatest portion of its overall energy use in the form of electricity, and is also the oldest, built in 1955 (the North and East Stations were built in 1990 and 1992, respectively). These data suggest that focusing on the South Fire Station first may yield the most cost effective improvements, especially in terms of lighting and appliances.

One potential "shovel-ready" and cost-saving project would be to convert the North Windham Fire Station heating system to natural gas, in order to take advantage of the natural gas available there. Installation of a natural gas "conversion burner" in the current oil boiler has been quoted at $3,950, and could be paid for by grants from Efficiency Maine. The anticipated fuel savings from this conversion are expected to be $3,795 every year.

However, a professional evaluation of the current boiler determined that it has aged beyond its useful life, and may have a short lifespan remaining. Before moving ahead with the boiler conversion, the Town may wish to consider the potential long-term advantages of replacing the entire oil boiler with a smaller, more efficient natural-gas boiler. While a conversion burner may be a more financially attractive option in the short term, a new natural gas boiler will likely achieve even greater annual energy and cost savings, require lower maintenance, and have a considerably longer functional lifespan.

5. Library: The Windham Town Library is one of the Town's largest buildings by floor area, and has the highest percentage of total energy use due to electricity (58 percent) which made up nearly three-quarters of the building's total energy cost. Like the Town Offices, energy efficiency efforts should first look to lighting, ventilation and appliance/computer usage, along with examining potential operational policy improvements (such as shutting off lights in empty sections, or instituting computer power management programs).

6. Public Safety: Windham's Public Safety building is the largest in the town by floor area, and accounted for nearly as much energy use, emissions and expense as the Town Offices. However, its energy and cost intensity were the lowest in the Town, and lower than the national average for public safety buildings. This suggests that improvements in efficiency may not be as easily found there as compared to other Town buildings. Electricity use made up the majority of this building's energy use (54 percent) and costs (66 percent), so efforts to improve building efficiency and costs should start out by examining lighting, ventilation, and appliances that run off of electricity.

Switching to alternative fuels such as biodiesel or wood chips could reduce greenhouse gas emissions from this building. For example, the Town could consider switching to a biodiesel product for its heating (rather than straight #2 fuel oil). Using the biodiesel B20 (a blend of 20 percent biofuel with 80 percent petroleum fuel), the Public Safety facility could reduce its overall emissions by about seven percent. These estimates do not account for any improvements in heating and fuel efficiency due to replacement with a new boiler. Depending on the age and inefficiency of the current boiler/furnace, for instance, savings due to upgrades may be considerably greater.

7. Human Services: This Town building functions primarily as a food pantry, and utilizes multiple refrigerators and freezers. Compared to other Town buildings, it consumed a relatively low quantity of energy, and had an energy intensity that was considerably lower than food sales buildings nationwide. Replacing retired refrigerators/freezers with energy efficient models may be more likely to yield cost-effective savings in this building, as compared to other facilities.

8. The Salt/Sand Shed: Like Health Council, the Salt/Sand Shed is completed powered by electricity, and cost Windham over $5,000 in 2009. Determining how this electricity is used would be the first step in identifying where to focus efficiency efforts. As noted above, lighting and ventilation systems are commonly large consumers of electricity in these types of facilities. Having these systems professionally evaluated and serviced could help improve their operating efficiency, and identify if any improvements or modifications would be warranted.

9. Dundee Park, Maintenance Building, Skate Park, and Roosevelt Ice Rink: These locations are also each powered by electricity, and together they represented about $2,000 in energy costs in 2009. The majority of this electricity usage was likely due to lighting. Consequently, cost-saving efforts should

focus first on evaluating the cost-effectiveness of actions like: installing timers or motion sensors; splitting lighting at each location into separately-controlled zones (to avoid lighting unused areas); and upgrades to more efficient lighting fixtures.

General Building Actions:

1. The Windham Energy Committee should conduct preliminary walk-through audits of all Town facilities. Conducting a walk-through audit is a simple process that can provide a significant amount of information about a building. It will serve as an information gathering tool that will allow the Town to better determine the types of projects that will significantly increase building efficiency and performance. A walk-through audit on these buildings will help Windham choose which building would be optimal for receiving a professional building audit. Information on walk-through tours is available in the Maine Energy Handbook, Chapter 3.2; full report available for download at http://www.pactsplan.org/documents/MaineEnergyHandbook.pdf .

2. Ask Windham 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 identifies relatively fast and inexpensive improvements that will result in cost savings. In-house staff can typically implement many of the operation and maintenance improvements, often without the purchase and installation of new equipment or technology.

Examples of 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.

3. Consider sending Town facility manager to Efficiency Maine's Building Operator Certification training course. The training provides education to facility managers on how to improve energy efficiency, reduce maintenance costs, reduce electric and other fuel bills, and enhance the comfort of building occupants.

> Example: Efficiency Maine reports that their program graduates saved an average of close to 100 Megawatt hours of electricity per year as a result of their training. More information can be found at http://www.efficiencymaine.com/professional-training/building-operator-certification

4. Based on available funding, and the results of the WEC walk-through audits, hire a certified building energy auditor to address the Town's buildings. ASHRAE Level II audits (also known as Decision-Grade audits) would provide comprehensive, quantitative evaluations of building energy use and efficiency, along with identifying specific improvements and assessing the cost-effectiveness of their implementation.

All main buildings would benefit from Level II audits. If resources for audits are limited, and cost savings are the primary goal, consider auditing the buildings in the following order:

1) Town Offices
2) Public Works
3) Public Safety
4) South Fire Station
5) North Fire Station
6) Human Services
7) East Fire Station
8) Health Council*
9) Sand/Salt Shed*

*Due to their greater simplicity, these buildings may not need Decision or Investment-grade audits, but would benefit at least from a walk-through audit to identify obvious issues and potential low-cost improvements.

5. Investigate whether there are any buildings in the town that may still function without heat or electricity, or could be changed to no longer need it.

Example: Lewiston made their Solid Waste transfer facility "cold" by removing offices from the facility and installing a smaller, manufactured office unit that could be heated and electrified much more efficiently for a net cost savings.

6. Investigate whether certain buildings could benefit from having their HVAC systems "compartmentalized" to certain sections of the buildings – only heating office/living space in a Public Works garage or Fire Station, for example, or being able to separately control different building sections.

7. Investigate the feasibility of installing a Town-wide energy monitoring system that monitors the performance of HVAC, lighting, and electrical systems in major town buildings.

Example: Cape Elizabeth has had such a system (Network 8000) in place in their schools since 1997, and has been expanding it to most other municipal buildings to improve both monitoring and energy efficiency.

Vehicles:

1. Begin formally tracking individual vehicle fuel consumption, miles traveled/engine hours, and service performed, by year (or month, if possible).

a. This could be achieved by purchasing a Vehicle Fuel Management System to electronically track individual vehicle fuel consumption, mileage, run hours, idle hours, and fuel.

Example: Portland Water District has been using such a system for at least the last year, with good results; Poland Springs also uses these systems, and rewards employees who reduce their idling time with gas cards; and the Town of Scarborough also recently implemented a similar system.

b. Alternatively, this information could be manually collected on a regular basis within each department, and entered into electronic formats.

In either case, collecting individual vehicle fuel use and activity data on a monthly or annual basis would allow real-world fuel efficiency calculations to be made for every vehicle in the fleet. These individual vehicle efficiency values could be used to assess which vehicles might benefit most from additional maintenance or replacement. Regular fuel efficiency tracking could also indicate if a vehicle may be in need of service if its efficiency unexpectedly drops.

2. Within the vehicle sector, efforts should initially focus on Public Works and Fire & Rescue, which represented the highest per-vehicle energy use and costs among the Town's various departments. These two departments accounted for over two-thirds of all vehicle fuel use, and cost the Town nearly $90,000 in fuel consumption in 2009.

3. Consult the directors of Windham's Public Works, Fire & Rescue, and Police Departments regarding the types of activities that their vehicles perform, their frequency of use, annual mileage, and their maintenance histories. Gathering this information will help determine whether the high fuel consumption of these department vehicles is simply due to their frequent use, or if excessive idling or mechanical issues may be decreasing their efficiency. It will also help identify whether a few heavily used or inefficient vehicles are responsible for the majority of the observed fuel consumption, or whether it is spread out fairly evenly over the vehicles in each department. Finally, it may be useful in identifying whether certain tasks (like local trips or administrative tasks) could be completed with smaller, more fuel-efficient vehicles (known as Right-Sizing).

4. Meet with Town employees from the Public Works, Fire & Rescue and Police Departments (as well as the directors of each) to solicit and discuss their ideas for reducing fleet fuel use and costs. Changes in operational policy for vehicle use can lead to considerable improvements in fuel economy, and the employees who use these vehicles may know them better than anyone else. Asking for their ideas and help can identify new ways to save fuel, and increase individual commitment to best driving practices.

5. Additional steps for reducing fuel consumption would include implementing and enforcing strong anti-idling measures on all vehicles and providing eco-driving training. These can be more effective with signs in designated areas, and decals on Town vehicles to remind employees and residents of the program. Also consider including anti-idling requirements in Town purchase orders and construction contracts.

6. Discuss having Town Departments implement mandatory driving logs for all employee vehicle travel. Each vehicle could require a log, and the purpose, distance and driver of each trip could be recorded. Such a log may help to reduce/discourage unnecessary trips, and could be coordinated with a more formal Vehicle Management System and/or GPS

7. Make it an official town policy to use the smallest, most fuel-efficient vehicle for the task (known as Right-Sizing). Also consider a policy to discourage employee personal use of public vehicles (commuting, running personal errands, etc).

8. Consider formally evaluating the size and content of the Town vehicle fleet, and whether all vehicles owned by the Town are necessary for effective Town operations.

9. The Town might consider purchasing anti-idling technology for certain vehicles. The usefulness of these technologies depends on the activities for which each vehicle is used. For appropriate vehicles, anti-idling technology can significantly reduce idle time and fuel consumption, and lead to considerable cost savings. More information on anti-idling technology and eco-driving training is available from Maine Clean Communities[10] (housed in GPCOG).

10. Future vehicle purchasing: Consider purchasing fuel-efficient passenger cars and/or work trucks as replacements for older vehicles (especially those that are frequently used); smaller, more fuel-efficient vehicles for higher-mileage applications; and hybrids for local travel. In addition, consider requiring that the fuel efficiency of a vehicle, and its lifetime fuel costs, are taken into consideration when purchase decisions are made.

11. Switching diesel work trucks to B20 would also yield significant emissions reductions, though it might not lead to cost savings. Maine Clean Communities can provide assistance with assessing and purchasing alternative-fueled vehicles and advanced vehicle technology.

Street Lights:

1. Windham should consider performing an inventory of all street lights in the Town to determine if there are any that are unnecessary. Each street light removed may save the Town roughly $165 in energy and operation costs every year. Information about how to conduct street light inventories is available from GPCOG and Clean Air-Cool Planet.

Conducting a comprehensive assessment of street lights on record with CMP may lead to the discovery of "phantom street lights" – street lights that the Town pays for but that only exist on paper. Other towns in the region have discovered these "phantom street lights," and have received compensation from CMP for errors in billing.

2. Investigate the possibility of upgrading current street lights and/or traffic lights to higher-efficiency units. This may only be an option for lights that the Town has direct ownership over, rather than CMP.
   Example: Portland and Lewiston both have experience upgrading street lights under their direct ownership.

Municipal Water Use:

1. Focus water conservation efforts on the Public Safety and the Library, the largest consumers. Replacing faucets, toilets, urinals and fixtures with lower-flow models can yield water and cost savings, as can encouraging water conservation with employees.

[10] http://www.gpcog.org/Transportation_and_Land_Use/Maine_Clean_Communities.php.

Additional Notes

The US EPA is currently considering updating its emissions standards for stationary sources, including boilers and furnaces. Currently the Maine Department of Environmental Protection licenses boiler systems that produce over 10,000 MMBTU/hour. The proposed emissions standards changes are currently expected to primarily affect the 10,000 MMBTU/hour systems and above; however, these new standards may have implications for smaller systems as well.

GPCOG has been in touch with Melanie Loyzim and Lisa Higgins at the Maine DEP regarding these proposed standards for boiler/furnace emissions, and the impact that they may have on our member municipalities. Because these standards have not been adopted yet, they may still be changed before implementation. **Ms. Loyzim asked that we encourage towns to contact her in January 2011 (when the new standards are expected to be adopted). At that point she would be able to help towns determine how the new standards would impact their operations.**

The Maine DEP also has specific regulations governing the burning of waste motor oil for heat. GPCOG has been in touch with Melanie Loyzim of the Maine DEP regarding use of waste motor oil in it Town boilers. Ms. Loyzim explained that as long as: (a) Towns were only burning used motor oil that their municipal operations generated (i.e. not taking it from other towns or businesses); and (b) had a new enough boiler (with new enough emissions controls) to adequately combust and/or capture most of the emissions, Towns were probably fine to keep burning it for heat. Again, she encouraged Towns to contact her if any questions arose.

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Air Toxics & Emissions Inventory
ME DEP, Bureau of Air Quality
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List of Acronyms

CACP	Clean Air and Climate Protection (CACP) Software 2009
CA-CP	Clean Air-Cool Planet
CH_4	Methane
CO_2e	Carbon Dioxide Equivalent – a measurement of greenhouse gas emissions that includes other gases such as methane and nitrous oxide.
GPCOG	Greater Portland Council of Governments
EPA	Environmental Protection Agency
ICLEI	ICLEI-Local Governments for Sustainability
GHG	Greenhouse Gas
kBtu	Thousand British Thermal Units
MMBtu	Million British Thermal Units
N_2O	Nitrous Oxide

Appendix 1 - Possible Community Outreach Strategies and Projects

1) Quarterly or annual town-wide event promoting energy efficiency and conservation
    - Invite vendors
    - Efficiency Maine incentives – Explain the many programs
    - GPCOG
    - Education on CFLs use and disposal
    - Cloth Napkin promotion / non-disposable options
    - Could coincide with Election Day, or the annual Town Meeting

2) The creation of a Windham Energy Committee webpage to share online resources relevant to the Town

3) Watt meters to loan

4) Library display of improvements and cost saving

5) School display / Student (and parent) involvement through projects with Windham Energy Committee

6) Town Material swap shop

7) Encourage locally-grown food purchase (This could be a community service project for students). Example: Have a "Green Dinner"

8) Biohazard waste pick-up day

9) Town-wide composting site (may already exist)

10) Develop a community farm sponsored by the town. (Clark Farm / Windham land trust)

11) Conduct energy assessment for the schools – GET STUDENTS INVOLVED – Make it a class.

Projects to consider:

1) Electric or Electric/Hybrid Vehicle – Local use only

2) Wind assessment studies (Water Tower - Cell Phone towers – schools)

3) Windmill / solar farm to accommodate all the towns' energy needs.

4) Cost-effective solar demonstration project: Salt Shed or Skate Park

5) Replacement of CMP street lighting (if possible) (Public owned)

6) Model geothermal project

Appendix 2 – Windham Vehicle Fleet

Table A1. Windham Vehicle Fleet

Department	Vehicle Make	Type	Year	Purchase Date	Use	Fuel Type
Fire & Rescue	Mack	Fire Truck	1981	Spare Pumper	Engine 1	diesel
	Play Mor	20x8 Trailer	1988	9/22/1994	Fire	N/A
	CMC	Pick Up	1991	6/14/1909	Fire - Unit 8	diesel
	International	4900	1995	4/13/1995	Engine 6	diesel
	Continental	6x1 2 Cargo Trailer	1999	9/10/1999	Emerg. Storage	N/A
	Ferrara	Fire Engine	1999	11/2/1999	Engine 5	diesel
	Ford	Crown Victoria	1999	7/8/1999	Deputy Chief (Car 4)	unleaded
	International	Ambulance	2001	4/20/2001	Rescue 1	diesel
	International	Ambulance	2001	4/20/2001	Rescue 2	diesel
	Emergency One	Cyclone Fire Truck	2001	12/30/2003	Aerial Fire Truck - Tower 3	diesel
	HME-TK PL Custom	Squad Truck	2001	1/28/2002	Squad Truck	diesel
	Chevrolet	Silverado 1 /2 ton P/U	2003	12/20/2002	Fire Chief (Car 1)	unleaded
	Remeg	Trailer	2003	1/16/2003	Rescue Boat Tr	N/A
	Emergency One	Typhoon Fire Truck	2004	3/1/2004	Ladder 4	diesel
	Emergency One	Typhoon Pumper	2005	9/25/2006	Engine 7	diesel
	Chevrolet	Pick Up	2006	4/26/2007	Unit 9	unleaded
	E-One	Pumper/Tanker	2007	10/7/2008	Tank	diesel
Police	Corey	Trailer w/Ingersol Com	1986	4/12/2000	DARE	N/A
	CMC	Yukon	1995	7/18/2005	Police	unleaded
	Harvey	Concession Trailer	1998	3/1/1998	Police	N/A
	Chevrolet	Pick Up	2002	10/9/2001	Animal Control	unleaded
	Ford	Crown Victoria	2003	9/11/2002	Police	unleaded
	Chevrolet	Impala	2003	7/24/2003	Police	unleaded

Department	Vehicle Make	Type	Year	Purchase Date	Use	Fuel Type
Police	Chevrolet	Impala	2003	7/24/2003	Police	unleaded
	Chevrolet	Impala	2003	7/24/2003	Police	unleaded
	Chevrolet	Impala	2003	7/24/2003	Police	unleaded
	Chevrolet	Impala	2004	8/18/2004	Police	unleaded
	Harley Davidson	Motorcycle	2006	3/22/2006	Police	premium
	Chevrolet	Suburban	2006	3/22/2006	Police	unleaded
	Chevrolet	Impala	2006	7/5/2006	Police	unleaded
	Chevrolet	Impala	2006	7/5/2006	Police	unleaded
	Chevrolet	Impala	2007	8/16/2007	Police	unleaded
	Chevrolet	Impala	2007	8/16/2007	Police	unleaded
	Chevrolet	Impala	2007	8/16/2007	Police	unleaded
	Chevrolet	Impala	2007	8/16/2007	Police	unleaded
	Ford	Crown Victoria	2008	8/16/2007	Police K9	unleaded
	Chevrolet	Impala	2008	8/20/2008	Police	unleaded
	Chevrolet	Impala	2009	8/29/2009	Police	unleaded
	Chevrolet	Impala	2009	8/5/2009	Police	unleaded
	Chevrolet	Impala	2009	8/5/2009	Police	unleaded
	Chevrolet	Impala	2009	8/5/2009	Police	unleaded
Public Works	John Deere	624E Loader	1989	1/1/2001	VEH#20	diesel
	Morbark	Chipper	1992	1/1/2001	VEH#38	unleaded
	Ford	L8000 Dump w/plow	1994	1/31/1994	VEH #4	diesel
	Ford	L8000 Dump w/plow	1994	1/31/1994	VEH# 7	diesel
	Ford	L8501 Dump	1997	1/14/1997	VEH#6	diesel
	International	4X2 Truck	2000	12/15/1999	VEH #3	diesel
	International	4X2 Truck (Dump)	2000	11/12/1999	VEH #2	diesel
	International	6x2 Truck (Dump)	2000	11/12/1999	VEH #1	diesel
	Cross Country	5HD1 8 Trailer	2000		VEH #34	N/A
	John Deere	Grader	2000	6/24/2000	VEH #26	diesel

Department	Vehicle Make	Type	Year	Purchase Date	Use	Fuel Type
Public Works	Caterpillar	938G Loader	2001	1/1/2001	VEH #27	diesel
	Bobcat	Skid Steer Loader	2001	1/1/2001	VEH #28	diesel
	John Deere	624H Loader	2001	1/1/2002	VEH #25	diesel
	Johnston	J3000 Sweeper	2002	4/20/2002	VEH #23	diesel
	Chevrolet	Impala	2002	7/31/2002	Police	unleaded
	Chevrolet	Silverado 3/4TP/U	2003	12/19/2002	VEH #96	diesel
	Chevrolet	Silverado 3/4TP/U	2003	12/30/2003	VEH #97	diesel
	International	Dump w/plow	2003	2/5/2003	VEH #8	diesel
	Chevrolet	Silverado 3/4 Ton P/U	2004	9/28/2003	VEH#99	unleaded
	International	Dump w/plow	2004	8/8/2005	VEH #9	diesel
	Chevrolet	Silverado 4 X4 P/U	2005	9/15/2004	VEH #84	diesel
	Chevrolet	Silverado 4 X4 P/U	2005		VEH #81	diesel
	TagaLong Trailer	Equipment Trailer	2005		VEH #32	N/A
	International	Dump w/plow	2006	4/26/2007	VEH #1 0	diesel
	International	Dump w/plow	2007	7/9/2007	VEH #1 1	diesel
	International	Dump Truck w/plow	2008	7/31/2008	VEH#5	diesel
	Caterpillar	Backhoe/loader	2009	1/26/2009	VEH# 21	diesel
	Trackless MT	Tractor/sweeper	2009	8/27/2009	VEH# 24	diesel
	International	Dump w/plow, etc.	2010	11/30/2009	VEH# 6A	diesel
	International	Dump w/plow, etc.	2010	12/30/2009	VEH# 7A	diesel
	Ford F550 DRW	Dump Truck	2011	8/12/2010	VEH# 12	diesel
Recreation	Chevrolet	1 5 Passenger Van	1998	6/10/1998	Recreation	unleaded
	Chevrolet	1 5 Passenger Van	1998	6/10/1998	Recreation	unleaded
	Ford	E350 Starcraft	2009	5/4/2009	Recreation	unleaded
Code Enforcement	Jeep	Cherokee	1999	7/1/1999	CEO - VEH #93	unleaded
	Jeep	Cherokee	1999	6/27/2002	CEO - VEH # 89	unleaded
	Chevrolet	Impala	2000	6/22/2000	CEO - VEH #95	unleaded
	Chevrolet	Impala	2004	8/18/2004	TMgr- VEH #90	unleaded

Department	Vehicle Make	Type	Year	Purchase Date	Use	Fuel Type
Tax/Assessor	Ford	Crown Victoria	2001	6/12/2001	Ass'r - VEH #86	unleaded
	Chevrolet	Impala	2004	8/18/2004	Ass'g - VEH #94	unleaded
	Chevrolet	Impala	2004	8/18/2004	Ass'g - VEH #88	unleaded