## NH Municipal Energy Assistance Program

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

# Municipal Greenhouse Gas and Energy Use Baseline Report for the Year 2009

## Lebanon, New Hampshire
## 18 May 2010

Jeffrey H. Taylor & Associates, Inc.

CLEAN AIR COOL PLANET

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# Municipal Greenhouse Gas and Energy Use Baseline Report
# Lebanon, New Hampshire

## Introduction, Process & Acknowledgements

This report summarizes greenhouse gas emissions and energy use for the City of Lebanon, NH 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 following analysis of municipal energy use is based on data gathered from the municipality's utility bills for building electricity, building heating fuel, streetlight electricity, and municipal fleet vehicle fuel. Supporting data were also collected including building dimensions, hours of operation, number of streetlights, and vehicle types. The data were then analyzed using two software tools, Portfolio Manager software provided online by the US Environmental Protection Agency (EPA) and the Small Town Carbon Calculator (STOCC) software developed by the University of New Hampshire and Clean Air-Cool Planet.[1] The STOCC software provides comparative information between the various sectors of municipal energy use (buildings, vehicles, and streetlights) while the Portfolio Manager software provides in-depth analysis of energy performance in individual buildings. The energy use per square foot is presented for each building, and Portfolio Manager allows for comparison of this metric to buildings of similar types across the US and in New Hampshire specifically.

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

The MEAP Report authors thank Marc Morgan, Lebanon Solid Waste Manager, who collected much of the data used in this report and provided thoughtful recommendations. About four weeks before the final project presentation, the MEAP project team held a meeting with the Lebanon Energy Advisory Committee to discuss ways to collaborate on identifying the final pieces of data and compiling the report. The MEAP process was modified to accommodate the size and complexity of Lebanon. The most energy intensive municipal and public buildings were selected for detailed analysis in STOCC and EPA Portfolio Manager. Twelve of these buildings are analyzed individually. The remaining buildings are analyzed by department, which are categorized by Airport, Civic (libraries, City Hall, Parks), Fire, Highway (Public Works), Police, Sewer (wastewater treatment), Solid Waste (landfill), and Water (water treatment, all pumps). These departments are comprised of aggregate totals of city owned vehicles, city operated lights and the remaining municipal buildings, pumps and plants.

Municipal Collaborator(s): Marc Morgan and the Lebanon Energy Advisory Committee (LEAC).

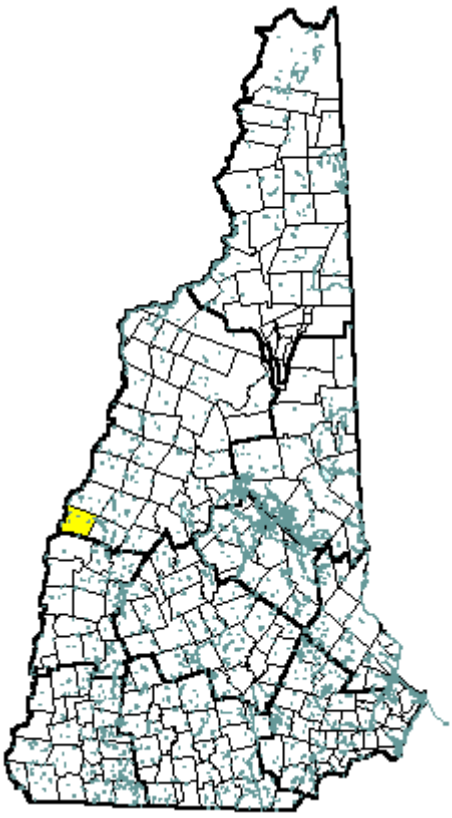
This report was written by Megan Shannon. Contact: megan@vitalcommunities.org or 802.291.9100 x 109.

### List of Acronyms

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

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

**Municipal Overview**



Town population: 12,806 (2008)
Area of municipality: 40.3 square miles
Population density: 317.5 persons per square mile
Number of municipal buildings: 12 of significant use and energy consumption
Total area of 12 municipal buildings: 154,796 square feet
Average site energy intensity of 12 municipal buildings: 108.57
Number of street lights: 858 outdoor street lights
Number of vehicles in fleet: 92
Number of municipal employees: 220 in municipal services
Municipal budget in baseline year: $52,928,516
**Total cost of municipal energy use in baseline year: $1,025,574**
**Total municipal energy use in baseline year: 31, 604 MMBtus**
**Total municipal CO2 emissions in baseline year: 6,257,658 lbs**

**Community Profile, Town History and Development**

The name Lebanon comes from the biblical cedars of ancient Lebanon, a Semitic word meaning white that refers to the nearby mountain with perpetual snows on its summit. Established in 1761, the name for this town was probably selected by the many early settlers who were from Lebanon, Connecticut, including Eleazar Wheelock, founder of Dartmouth College. Lebanon was the original location of the Indian Charity School, later to be Dartmouth College. In 1781, Lebanon was one of the towns that attempted to join Vermont, but later returned to New Hampshire. Lebanon was incorporated as a city in 1957.[2]

Lebanon serves as the regional hub for the Upper Valley. New Hampshire's largest employer and the largest regional employer, Dartmouth Hitchcock Medical Center, draws a significant amount of traffic into Lebanon daily. While Lebanon has a population around 13,000, the city's infrastructure serves many more. For example, the landfill serves 28 other towns in the region. Additionally, Lebanon has an extensive water department and sewer system, as well as a regional airport.

**Current Community Involvement**

The Lebanon Energy Advisory Committee was established by the City Council in July 2007. The City Council provided and issued the following charge: To identify opportunities and make recommendations to the City Council with regard to reducing energy use, increasing energy efficiency, exploring alternative energy usage and reducing pollution, to the environmental and fiscal benefit of the City. Charge modified on 2/18/09 to include: To promote energy conservation measures for city residents and businesses, thereby cutting greenhouse gas emissions and reducing energy costs for taxpayers.

The LEAC is organized by Five Citizen members appointed by the City Council for five year terms. Two Council representatives, one Planning Board representative, one Lebanon High School Student representative, one Thayer Engineering School faculty member or student, four at large citizen representatives and three alternate citizen members (alternates added on 2/18/09). Terms will be for two years. The LEAC generally meets the 3rd Tuesday of the month at 6 pm in the Lebanon Library.[3]

[2] *The Community Profile Section was taken from the New Hampshire community profile website as was the Municipal data:* http://www.nh.gov/nhes/elmi/htmlprofiles/pdfs/lebanon.pdf *and other numbers generated by STOCC and the EPA Portfolio Manager.*
[3] *Information on LEAC was taken from the web http://lebanonnh.virtualtownhall.net/public_documents/LebanonNH_BComm/Energy.*

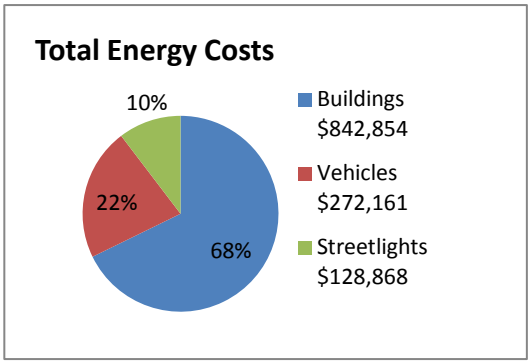
## City of Lebanon Municipal Energy Analysis Executive Summary

This report presents the inventory part of MEAP with a set of recommendations for buildings, streetlights and fleet vehicles that will result in energy and cost savings. The report also suggests a way to repeat the MEAP data collection and analysis process.

**Basic Findings**

*Municipal energy costs, use and emissions by sector:*

- Municipal Energy **Costs** ($):Buildings 68% ; Streetlights 10%; Vehicles 22%
- Municipal **Energy Use** (MMBtus): Buildings 60%; Vehicles 33%; Streetlights 7%.
- Municipal **Emissions** (CO2): Buildings 64%; Streetlights 8%; Vehicles 28%.




*Buildings of greatest significance:*

- **City Hall,** the **Police Facility** and the **Lebanon Library** are the most energy intensive, energy demanding and costly buildings in Lebanon.

**Recommendations – Overview**

*Prioritize Building Efficiency Efforts*

- Concentrate audits and improvements on buildings of greatest significance for highest return on investment.
- Evaluate departments as *systems* to determine efficiency, particularly Wastewater and Water Treatment.

*Vehicle Fleet Monitoring*

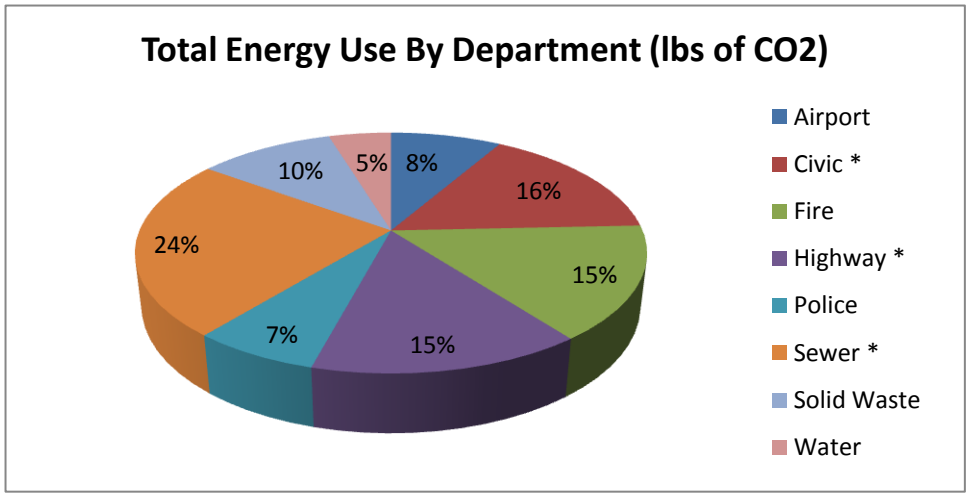
- Adopt a "No Idling" Policy for all city vehicles and machines.
- Create a log of miles traveled/hours run for municipal vehicles and machines by department to closely track use patterns and fuel consumption and costs.

*Streetlight Improvement*

- Use LED lights when upgrading streetlights to significantly reduce costs and maintenance.
- Consider removing certain streetlights to cut energy use, save money, and reduce night light pollution.

*Utilize Established Programs*

- Continue to inventory buildings in Portfolio Manger to sustain benchmarking efforts and view changes in energy use as building improvements are made.



## Municipal Sector Analysis

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

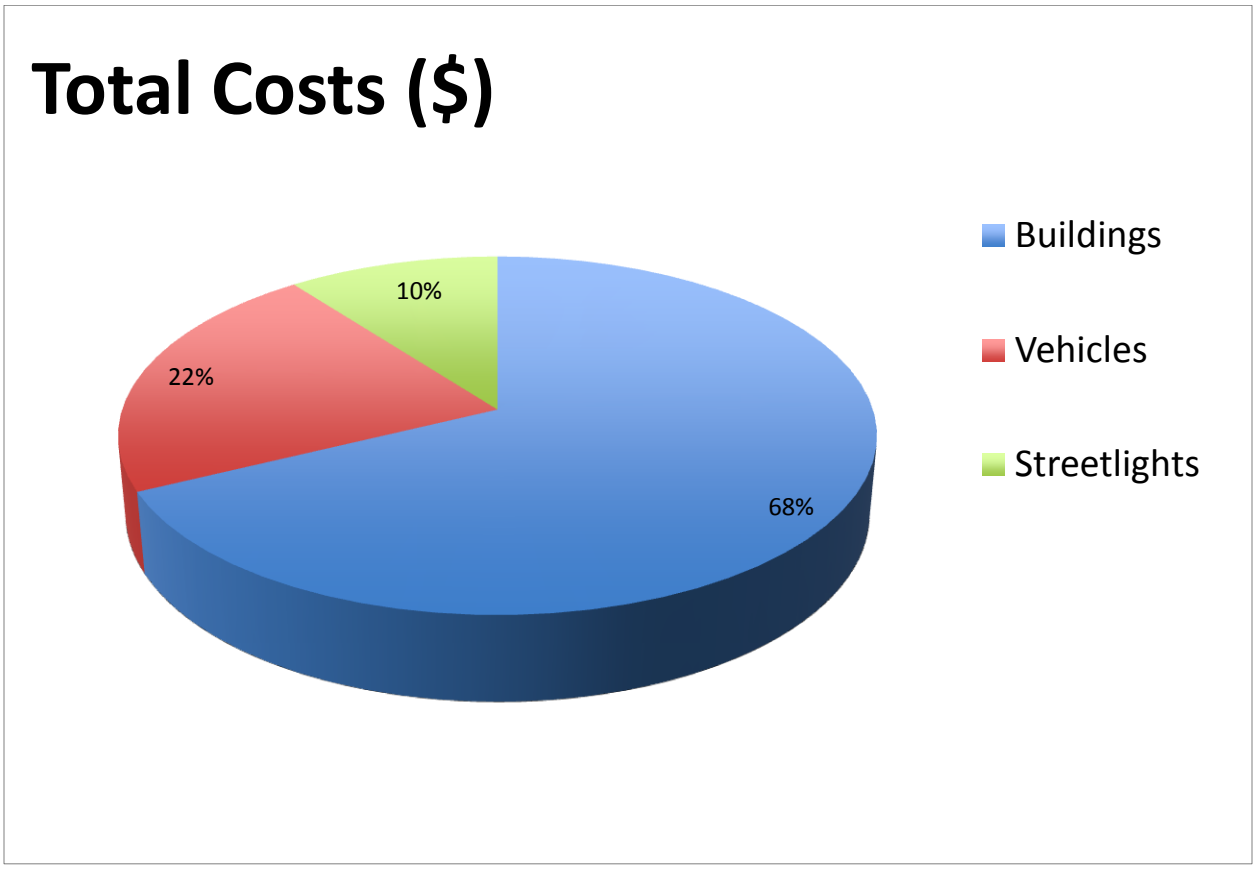
**Table 1. Energy costs, carbon emissions, and use by municipal sector**

| | Buildings | | Vehicles | | Streetlights | | |
|---|---|---|---|---|---|---|---|
| | # | % of total | # | % of total | # | % of total | Grand Total |
| Cost | $842,854 | 68% | $272,161 | 22% | $128,868 | 10% | $1,243,883 |
| CO2 (lbs) | 5,114,669 | 64% | 2,221,617 | 28% | 651,440 | 8% | 7,987,726 |
| Energy (million BTUs) | 25,601 | 60% | 13,942 | 33% | 2,914 | 7% | 42,456 |

Generated by STOCC Software

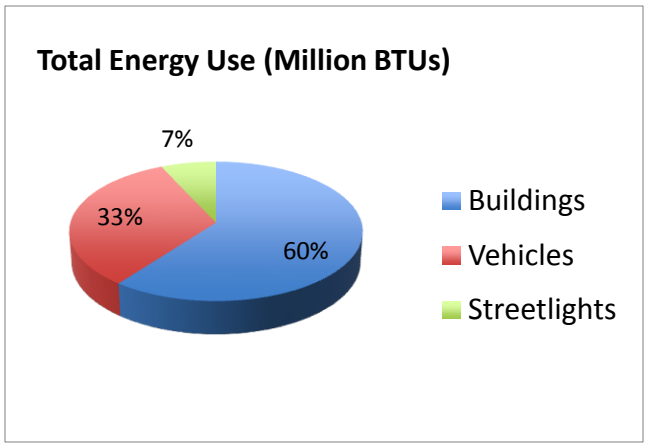
## Snapshot of Municipal Energy Costs, Use and Emissions by Sector

Graph 1 a. Energy Costs by Municipal Sector

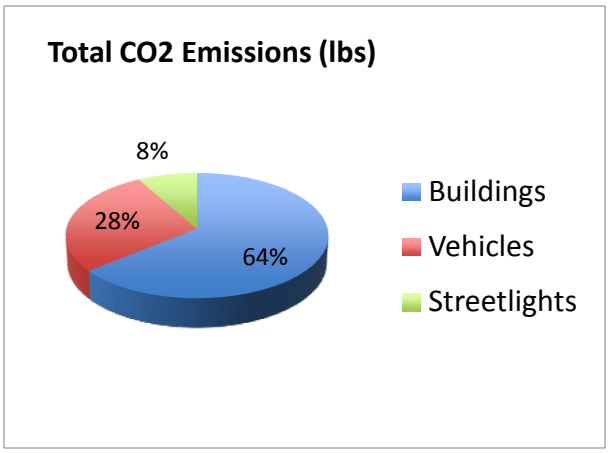


## Snapshot of Municipal Energy Costs, Use and Emissions by Sector (Continued)

Graph 1b. Municipal Energy Use (MMBtu)




Graph 1c. Municipal Carbon Equivalent Emissions (lbs)




The charts above reveal that energy costs, energy use, and carbon emissions are most substantial in Lebanon's municipal buildings. On average, 64% of the costs, use, and emissions for the city are based in building consumption – which is anticipated in a city like Lebanon. While the energy use of streetlights is only 7% of the total, the cost is disproportionate at 10% of the total energy costs. This is because the price of energy per BTU is lower for vehicles than it is for buildings and streetlights. One contributing factor to the increased cost per BTU of buildings and streetlights is their electricity consumption. Electricity is typically more expensive per BTU than fuel energy, which is displayed above in the disproportionate percentage of the cost of streetlights versus streetlight energy use.

While the costs and energy use of the vehicle fleet and streetlights are comparatively small to building costs and energy use, often vehicle and streetlight based consumption are fairly reasonable to address. For example, energy committees can push for "No Idling" policies among municipal vehicle fleets, and campaign to remove streetlights and replace remaining lights with LEDs throughout the city. When addressing building energy consumption, audits and weatherization upgrades tend to require more funding and organization.

## Lebanon Building Performance: Energy Use and Energy Intensity

**Table 2. Energy Use and Intensity, by municipal building** Energy use data generated by STOCC; energy intensity data generated by Portfolio Manager.

| Name of Building | Heating Fuel Type(s) | Area (Sq. Ft.) | Energy Use: Electricity (million Btu) | Energy Use: Heating Fuel (million Btu) | Total Building Energy Use (million Btu) | Site energy intensity (kBtu/sq ft)[4] | EPA Average Site kBtu/sq ft for building type | NH Average Site kBtu/sq ft for building type |
|---|---|---|---|---|---|---|---|---|
| **City Hall** | Oil | 45,486 | 1501.55 | 3315.14 | 4816.69 | 105.8 | 66 | 69 |
| **DPW (New)** | Propane | 35,986 | 175.79 | 1584.10 | 1759.88 | 49.1 | 77 | 57 |
| **DPW (Old)** | Oil & Propane | 12,484 | 220.82 | 1441.65 | 1662.47 | 133 | 77 | 57 |
| **Fire Station (S. Park)** | Oil & Propane | 26,064 | 271.79 | 1001.52 | 1273.31 | 52.9 | 78 | 59 |
| **Fire Station (Rt 4)** | Propane | 1,800 | 28.75 | 140.38 | 169.13 | 96.6 | 78 | 59 |
| **Fire Station (Main St.)** | Oil & Propane | 8,172 | 126.01 | 722.31 | 848.33 | 103.7 | 78 | 59 |
| **Landfill Building** | Oil | 2,400 | 85.17 | 482.57 | 567.74 | 236.4 | 77 | 57 |

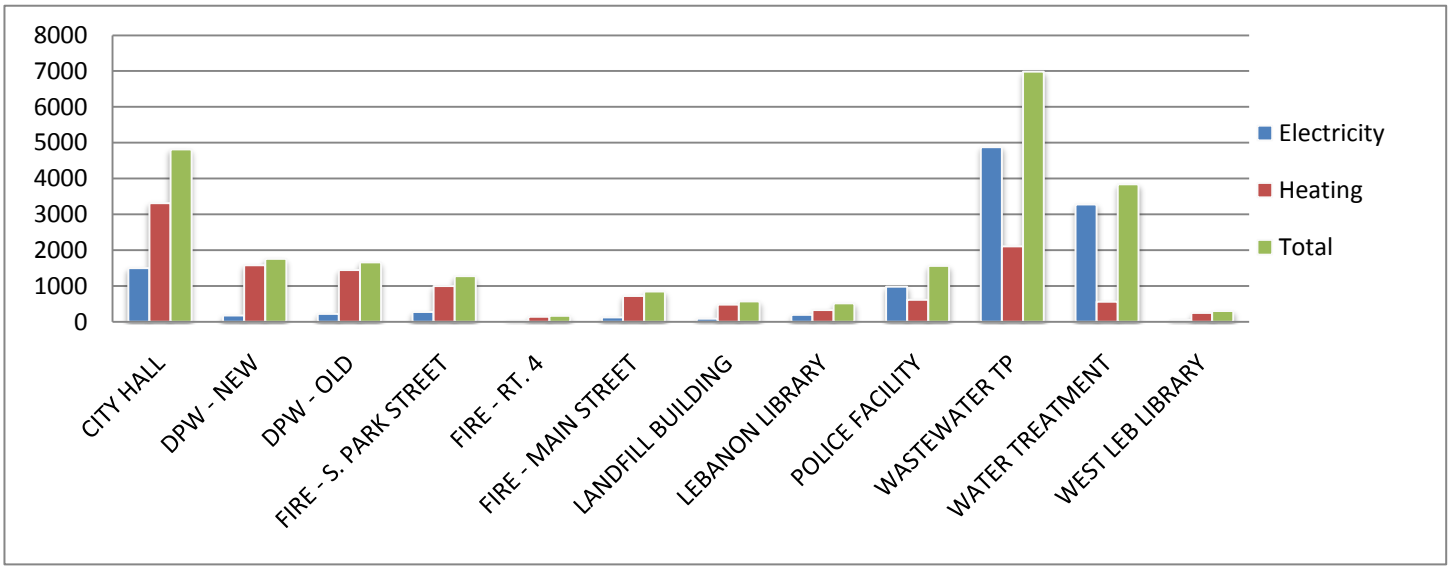
[4] Site energy intensity = amount of energy expended per square foot *on site* to heat, cool, and electrify the area. This measure relates to how much is being used on site and fluctuates directly with how much lighting is being used, how thermostats are kept, etc.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Lebanon Library** | Oil | 4,154 | 191.99 | 327.19 | 519.18 | 124.9 | 104 | 69 |
| **Police Station** | Oil | 13,812 | 982.11 | 617.78 | 1599.90 | 115.8 | 78 | 59 |
| **WWTP** | Oil | n/a | 4873.70 | 2108.34 | 6982.05 | n/a | n/a | n/a |
| **Water Treatment Facility** | Oil & Propane | n/a | 3278.93 | 561.20 | 3840.13 | n/a | n/a | n/a |
| **W. Lebanon Library** | Oil | 4,438 | 54.49 | 245.41 | 299.91 | 67.5 | 104 | 69 |
| **Average** | **Oil & Pro** | **15,480** | **982.59** | **1045.63** | **2028.23** | **108.57** | **81.7** | **61.4** |

Due to the amount and complexity of Lebanon's building infrastructure, the buildings in Lebanon with the highest municipal use and energy consumption were chosen for closer examination and detailed analysis. Twelve buildings were selected, and the remaining are categorized by department, which is explored and analyzed later in this report. Table 2 examines the top 12 municipal buildings in Lebanon, based on energy use and energy intensity for 2009.

## Snapshot of Energy Use by Building

**Graph 2a. Energy Use for Electricity, Energy Use for Heating, and Total Energy Use in Municipal Buildings (MMBtu)**

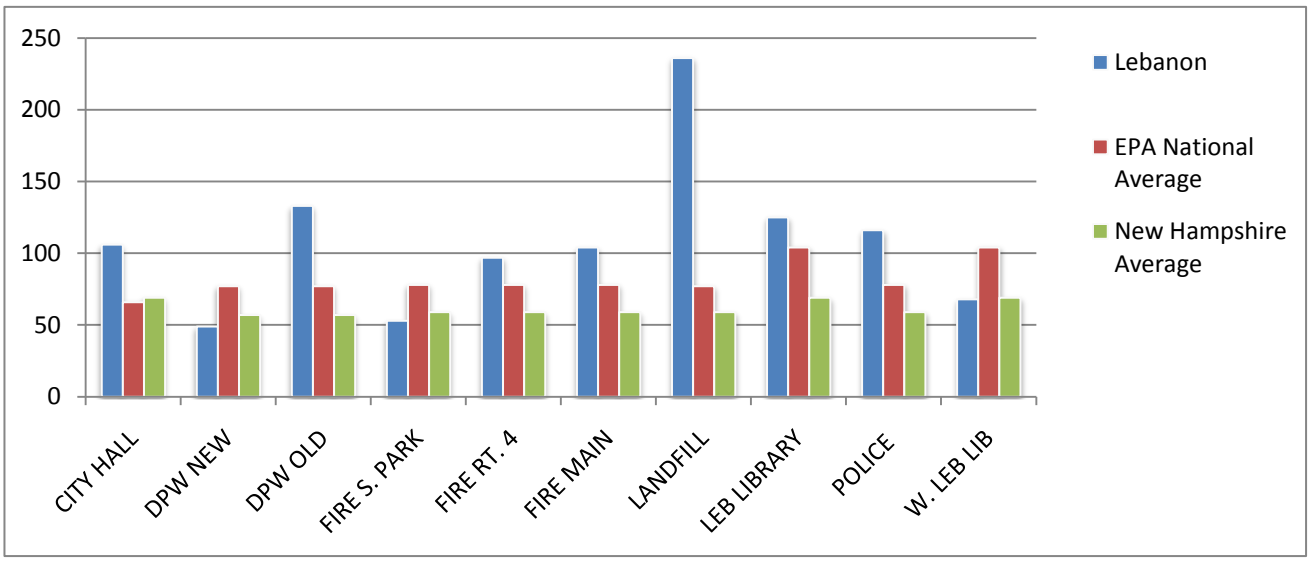



Graph 2a compares energy use for selected Lebanon municipal buildings. The total energy use is measured in millions of British thermal units (MMBtu) and is broken down between the amount of energy used for electricity and heating. Energy use is compared across buildings based solely on the total amounts of energy consumed, and does not take the size or space use of the building into consideration. Graph 2b following explores energy use adjusted to building specifications.

Heated buildings use a higher proportion of energy for heating, with the exceptions of the Water Treatment Facility and the Wastewater Treatment Plant, which are electricity intensive. The Wastewater Treatment Plant is the highest consumer of energy, with City Hall and the Water Treatment Facility following. The average energy use for the top 12 municipal buildings is 2028.23 MMBtus. The WWTP (6982 MMBtus), City Hall (4817 MMBtus), and the Water Treatment Facility (3840 MMBtus) are all well above average, with the rest of the buildings well below average energy use. City Hall is the largest of the analyzed buildings, and is used for a variety of municipal and community functions.

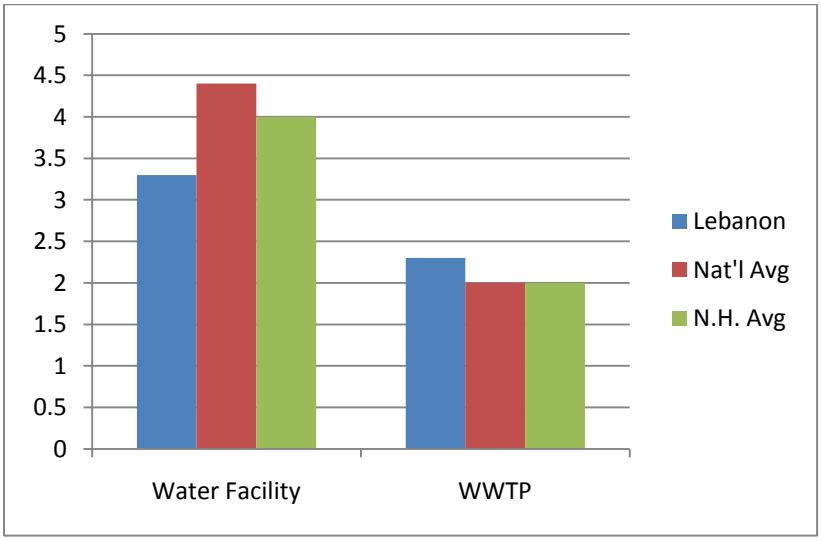
## Snapshot of Energy Use by Building, Continued

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




The Landfill building has the overall highest site energy intensity, followed by the old Department of Public Works facility, the Lebanon Library, the Police Station and City hall. Energy intensity measures the relative energy efficiency of particular buildings. Site energy intensity is calculated by taking the amount of energy used in the building (a total aggregate of heating fuel and electricity) and dividing it by the square feet of space. It can be reduced through behavioral and energy conservation measures. The most cost-effective opportunities for saving energy on site involves behavioral changes (such as keeping lights and computers turned off; turning down thermostats) and energy conserving technologies (such as compact fluorescent bulbs and motion sensor lighting).

**Graph 2c. Site Energy per Flow and Average Site Energy per Flow for Type of Water Treatment Facility (kBtu/gpd)**




Municipal facilities that handle water and sewage are calculated differently than other buildings. The Water Treatment Facility and the Wastewater Treatment Plant are analyzed using electric and heat data, but instead of using square footage to calculate site energy intensity, flow data is used. For the Water Treatment Facility, the average flow of water, measured in millions of gallons per day, is divided by the total energy use to come up with energy intensity. For the Wastewater Treatment Plant, average flow of influent, effluent and the Biological Demand Concentrations are incorporated along with energy use to calculate the energy intensity of the facility. Average flow (mg/d) is affected by pump efficiency, the regularity of water and sewage flows, the pump's ability to manage the flows, and the average flow versus the flow rate at

which the facilities are designed. According to Graph 2c, the average energy intensity for Lebanon's Water Treatment Plant is above average, while the flow for the Wastewater Treatment Plant is below average.

The buildings of greatest importance in this section are facilities that have high energy use illustrated in Graph 2a AND have high site energy intensity as illustrated in Graphs 2b/2c. Based on this comparison, the overall lowest performing buildings and thus the highest priority are City Hall, the Police Facility and the Lebanon Library. These three buildings are recommended for immediate attention due to the consistent inefficiency of all three buildings across energy use, site intensity and cost per square foot categories. The Landfill Building has the highest site intensity and costs the most per square foot, but the building uses little energy comparatively and most of the energy consumed is heating fuel. The high amount of heating oil used may be decreased by addressing the heating plan for the Landfill building garage versus the Landfill building offices. The old Department of Public Works building is consistently inefficient across the analytical categories; however, this building has been replaced and may be scheduled for demolition. Finally, the WWTP and Water Treatment Facility are both high energy users and contribute significantly to the overall building costs. However, these two facilities are more difficult to address because the inefficiencies in water systems are complex. It is recommended that a future investigation into the efficiency of the WWTP be pursued for potential significant cost savings.

## Building Performance: Costs and Emissions

**Table 3. Energy Cost and Emissions, by municipal building** Emissions data generated by STOCC software.

| Name of Building | Area (Sq. Ft.) | Energy Cost ($) | Energy Cost per Square Foot | Energy Emissions (lbs of CO2) | Energy Emissions per Square Foot |
|---|---|---|---|---|---|
| **City Hall** | 45,486 | $147,236 | $3.24/SF | 933,339 | 20.5 lbs/SF |
| **DPW (New)** | 35,986 | $39,571 | $1.10/SF | 266,611 | 7.41 lbs/SF |
| **DPW (Old)** | 12,484 | $43,111 | $3.45/SF | 278,448 | 22.3 lbs/SF |
| **Fire Station (S. Park)** | 26,064 | $36,128 | $1.50/SF | 233,231 | 8.9 lbs/SF |
| **Fire Station (Rt 4)** | 1,800 | $4,646 | $2.58/SF | 27,123 | 15.1 lbs/SF |
| **Fire Station (Main St.)** | 8,172 | $22,451 | $2.75/SF | 149,938 | 18.3 lbs/SF |
| **Landfill Building** | 2,400 | $15,178 | $6.32/SF | 100,439 | 41.8 lbs/SF |
| **Lebanon Library** | 4,154 | $18,396 | $4.43/SF | 103,746 | 24.9 lbs/SF |
| **Police Station** | 13,812 | $61,994 | $4.49/SF | 360,412 | 26.1 lbs/SF |
| **WWTP** | n/a | $281,825 | n/a | 1,629,951 | n/a |
| **Water Treatment Plant** | n/a | $167,933 | n/a | 955,560 | n/a |
| **W. Lebanon Library** | 4,438 | $8,380 | $1.89/SF | 54,047 | 12.2 lbs/SF |
| **Average** | **15,480** | **$70,571** | **$3.18/SF** | **424,404** | **19.75 lbs/SF** |

Table 3 is a secondary means of analyzing buildings through energy cost per square foot and energy emissions per square foot. The average energy cost per square foot is $3.18, with the Landfill Building, Police Station, Lebanon Library, the old DPW and City Hall at or above this average. Buildings with the highest costs are not necessarily the most expensive overall, when the size of the building is taken into consideration. While the new Department of Public Works facility appears much less expensive on a per square foot basis than the old DPW building, the overall costs are not significantly different due to the size of the new facility (almost 200% bigger). The average energy emission per square foot is 19.75 lbs/SF, with the Landfill Building, Police Station, Lebanon Library, the old DPW and City Hall all above average.

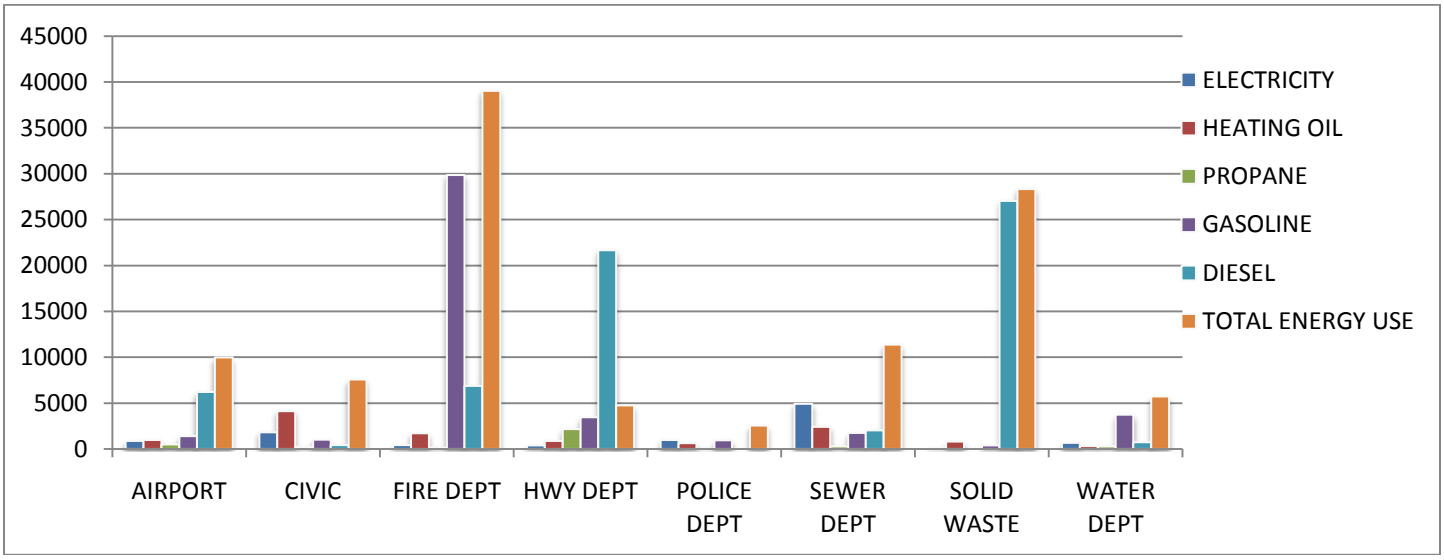
## Lebanon Municipal Performance by DEPARTMENT: Energy Use and Energy Intensity

**Table 4. Energy Use and Intensity, by municipal department.** Energy use data generated by STOCC; energy intensity data generated by Portfolio Manager.

| Sector | Heating Fuel Types (all electric) | Energy Use: Electricity (million Btu) | Energy Use: Heating Fuel (million Btu) | Energy Use: Vehicle Fuel (million Btu) | Total Sector Energy Use (million Btu) | Sector Energy User Rank (1 high, 8 low) |
|---|---|---|---|---|---|---|
| **Airport** | Oil, propane, diesel | 890 | 1483 | 1034 | 3408 | **6** |
| **Civic** | Oil, propane, diesel | 1831 | 4316 | 184 | 6275 | **4** |
| **Fire Dept** | Oil, propane, gas, diesel | 427 | 1864 | 1113 | 6988 | **2** |
| **Highway Dept** | Oil, propane, gas, diesel | 397 | 3025 | 3436 | 6859 | **3** |
| **Police Dept** | Oil, propane, gas | 982 | 633 | 938 | 2553 | **7** |
| **Sewer Dept** | Oil & propane | 4914 | 2670 | 502 | 8086 | **1** |
| **Solid Waste** | Oil, gas, diesel | 128 | 788 | 3800 | 4715 | **5** |
| **Water Dept** | Oil, propane, gas, diesel | 660 | 593 | 571 | 1823 | **8** |
| **Average** | **Oil, propane, gas** | **1279** | **1922** | **1447** | **5088** | |

Due to the complexity of Lebanon's building infrastructure, the rest of the physical plants owned and operated by the City of Lebanon are categorized by department and comprise the aggregate energy use totals. The Sewer Department is the highest energy consumer, largely due to the inclusion of the WWTP demands in the departmental total. Of greater significance is probably the Civic Department, which includes the energy use of City Hall. The libraries are also included in the Civic category. Appropriately, the Civic Department has two buildings of high priority- City Hall and the Lebanon Library.

**Graph 3. Energy Use for Electricity, Energy Use for Heating, Energy Use for Vehicles and Total Energy Use in Departments (MMBtu)**



## Analysis: Priorities and Custom Recommendations

**Low Performing Buildings:** Buildings are evaluated across three important categories to determine poor performance. 1) Energy Use: total energy use combining electricity and heating fuel into MMBtus; 2) Site Energy Intensity: takes energy use over square footage; 3) Cost per square foot: While some buildings appear very expensive overall, often these buildings are very large and when calculated are not necessarily more costly based on the square footage. When evaluated across these categories, the buildings that are at consistently ranked high overall are **City Hall, the Police Station and Lebanon Library**. These are the priority buildings for audits. MEAP authors are aware of a previous audit conducted in City Hall but are uninformed to the major recommendations. Additionally, internal audits of the Landfill building are recommended as well as an examination of the efficiency of the Wastewater Treatment Plant.

**Streetlights:** Removing unneeded streetlights and replacing the remaining with LED's is a straightforward project for Energy Committees to take on. Return on investment is generally high. Creating a map of all the streetlights is also a good start for taking an inventory of lights that may not work or may need immediate servicing. Please refer to the "How to guide for streetlight removal and upgrading" in the appendix of this report for more information.

**Vehicles:** After a "No Idling" Policy was established in 2008 at the Lebanon Landfill, vehicle fuel consumption dramatically decreased. Installing a "No Idling" Policy for all Lebanon owned vehicles and machines would certainly reduce vehicle related costs and emissions significantly. Additionally, consider creating a vehicle fleet record by department to track mileage and consumption. This process can show unncessary use of vehicles and machines when all use must be logged. Tracking costs despite the constant fluctuation of fuel prices can give an idea of what the city spends on vehicle fuel for budgeting purposes and allow for comparing fuel efficiency when considering vehicle replacement.

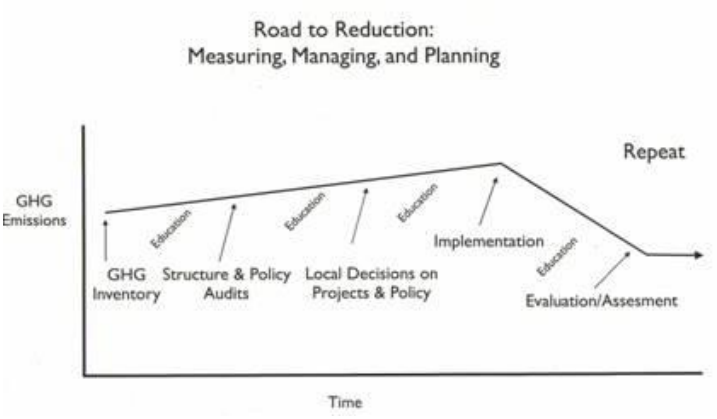
**Energy Fund:** At the Enfield selectboard presentation of the MEAP Final Inventory Report, Energy Committee members suggested to the town manager that an "Enfield Energy Fund" be established. This fund would be created using money saved from electric and heat bills from buildings that are audited and upgraded, as well as from electric bill savings after LED lights are installed in streetlights, funded by the EECBG. The fund could support further investment in building retrofits, lighting upgrades and fleet monitoring. The fund was approved by the selectboard. While this process will not be as easily attained and approved in a city government, it is suggested that the LEAC consider ways to centralize funds from money saved from lighting upgrades or building improvements as a result of the MEAP process and other projects.

**Inventory Process Sustainability:** Annual collection and input of inventory data will be helpful for ongoing assessment of Lebanon's energy use. In some cases, municipal Energy Committees have taken on the inventory process. MEAP project coordinators have authored data collection resources to aid in this process. We realize that the data collection and inventory process are daunting and time consuming in a complex municipality like Lebanon. Thus, limiting the collection, as in this report, to the 12 largest energy demanding buildings and then by department, will make the ongoing inventory process easier and more manageable. After the building audit is completed, perhaps the LEAC could volunteer to sustain benchmarking of the audited building. This process could track energy and costs saved after recommendations from the audit are materialized.

**Renewable Energy Potentials:** The City of Lebanon should explore renewable energy sources. It is recommended that potential sources be investigated further in the Energy chapter of Lebanon's Master Plan. However, some other municipalities have done work on renewable energies that could be immediately pursued by Lebanon. For example, the town of New London uses a significant amount of biodiesel in its vehicle fleet. The biodiesel is purchased from Evans Motor Fuels in Lebanon (http://www.evansbiofuel.com/). Additionally, numerous municipalities, including Brattleboro, Vermont, are using landfill gas for combined heat and power. Ongoing investigation into landfill gas at the Lebanon Landfill looks promising.

## Analysis: General Recommendations for Municipal Energy Savings

- Review existing Master Plan, Zoning Ordinances, and other city policies for inconsistencies with the goal to reduce energy usage.
- Implement a behavioral change program in municipal buildings with municipal employees. Work with MEAP partners SERG and Vital Communities for guidance to implement these initiatives.
- Implement buying strategy of Energy Star equipment and Products and environmentally sensitive office products, and implement awareness campaigns to encourage thoughtful consumption of equipment and products.
- Evaluate ways to reduce fuel usage of the vehicle fleet. This can be done by analyzing routes and usage and enforcing a strict anti-idling policy.
- Find alternative energy sources to reduce escalating fossil fuel prices and emissions. Investigate payback for possibly installing: a small Combined Heat and Power unit, biomass heating system or geothermal heat pump.
- Encourage recycling and composting to the greatest extent possible, in order to divert the amount of municipal solid waste (organic matter) going to landfill.




### Next Steps

Once this draft inventory is finished, the MEAP project partner, SDES Group, will work with Lebanon to identify a low-performing building and to carry out an energy audit for that building. The selected building will receive a Decision Grade or Investment Grade energy audit. The audit will culminate in a set of recommendations for building retrofits and renovations that will guide the town to reduce the building's energy use.

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

In 2010, the City of Lebanon received EECBG funds to craft a municipal Energy Plan. The Energy Plan should incorporate the recommendations and inventories provided in this report, and continue to work with MEAP partners to sustain the process. There is also a possibility for the continuation of the Municipal Energy Assistance Program with Lebanon, and to continue to provide support in the inventory process, analysis of data, and aid in implementation of action based recommendations.

## Methods

### Greenhouse gas inventory approach

Data collection for this inventory involved collaborative efforts between the Clean Air-Cool Planet staff, which organized the data collection process over all, and the local town representative volunteers. To collect the data in each town, data sheets were developed based on the software/program that was used for data processing. We used **2009** as a baseline year to collect the fuel and energy consumption information. Data sheets were sent to the town representative, who then collected and accessed the data. Follow-ups were done on a regular basis to

make sure that the inventory progressed, the data collection process was effective, and the data needed was accurately collected.

**Data processing and data analysis**

To process the data collected, we used two types of fuel and energy assessment software. The first was the Small Town Carbon Calculator (STOCC) software used to quantify and estimate the amount of energy used and the greenhouse gases (GHG) generated from the energy usage. The STOCC software allowed us to make a municipal energy assessment by municipal sector (buildings, vehicles, streetlights), and ultimately by municipal department (Airport, Civic, Highway, Fire, etc). The second was the EPA Portfolio Manager Benchmarking Program, used to assess the energy consumption and GHG emissions generated in specific buildings, based on square footage. The energy data for Lebanon exists in many places. The electric meter data were downloaded from the utility at the National Grid website. Heating and vehicle fuel consumption were provided by city staff. Flow information was provided respectively by the managers of the Water Treatment facility and the Wastewater Treatment Plant. Space use data, such as building square footage and building construction years, was retrieved on the City of Lebanon's Property Assessment online database. The networking for this process was provided by Marc Morgan.

The current paths for retrieving energy use information for the City of Lebanon could be improved by clarifying and streamlining the sources and availability of data. Making the inventory process simple is the most sustainable way for continuing this project. Therefore, MEAP project assistants are committed to following up the city and LEAC until the process is more centralized.

By repeating the process of generating this data (and even recreating a similar report each year), the City of Lebanon will significantly increase its readiness for state and Federal funding for energy and cost saving projects. Enclosed with the report are supporting materials for continuing the inventory process. A list of resources - municipal contacts, information providing websites and databases - is enclosed, as is a detailed guide to using STOCC and EPA Portfolio Manager.

*For any further questions concerning the data collection or this report, please contact Energy Project Assistants Megan Shannon (megan@vitalcommunities.org) or Laura Chesnut (laura.chesnut@gmail.com)*

*For any further questions concerning the MEAP general project, please contact the MEAP project supervisors Bob Walker (robert.j.walker@valley.net) or Gabe Zoerhide (gabe@vitalcommunities.org)*