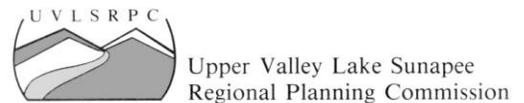


# City of Lebanon, New Hampshire Energy Plan



Prepared by Vital Communities and the Upper Valley  
Lake Sunapee Regional Planning Commission for the  
Lebanon Energy Advisory Committee and the City of  
Lebanon, New Hampshire

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## **Executive Summary**

The City of Lebanon spends about \$1 million of taxpayer money on energy per year. This Energy Plan explains how the City is well positioned to save money by reducing energy use, support the local economy by diversifying energy sources, and improve the quality of life for its residents and surrounding communities.

## **Vision & Purpose**

The long term vision for Lebanon's energy future is to increase energy savings for residents, businesses, and municipal functions, to ensure a robust and stable energy economy, and to reduce the impacts of greenhouse gas emissions that result from a fossil fuel-dependent economy. The purpose of the Energy Plan is to develop near-term outcomes, strategies, and actions that lay a strong foundation for Lebanon's energy future, for the fiscal and environmental benefit and security of the City and its taxpayers. The Energy Plan and planning process aim to:

- Prioritize specific recommendations focused on increasing municipal energy efficiency to save taxpayer money and reduce municipal energy demand, and recommend policies that promote energy efficiency over the long term in the municipal, commercial, and residential sectors.
- Provide a strategic direction for the Lebanon Energy Advisory Committee and build the committee's capacity to advocate and implement initiatives in the public interest.
- Involve citizens in shaping Lebanon's energy future.

Visions for energy savings:

- The City of Lebanon shall be a regional leader in energy efficiency, innovation, and fiscal responsibility.
- The City shall improve the energy efficiency of municipal buildings, municipal vehicles, and streetlights, and it shall promote similar efficiency measures for the commercial and residential sectors in order to significantly reduce the City's overall energy use.
- The City shall explore renewable energy options for purchase and development such as hydro, wind, solar, geothermal, biomass, and methane, within the City's control, to reduce reliance on non-local and foreign sources of energy, and promote similar projects in the commercial sector.
- The City shall address energy-related employee behaviors, such as commuting, turning off lights, waste management, etc., through social marketing and incentives.
- The City and the Lebanon Energy Advisory Committee shall involve the greater Lebanon community in a social marketing campaign that engages citizens in reducing their energy use. Educational techniques could include the following: holding topical community forums; developing visual, easily understood illustrations of the City's energy use; and giving more attention to current and recently completed municipal and commercial energy related projects.
- The City shall comply with the New Hampshire Climate Action Plan, which aims to reduce greenhouse gas emissions 80% below 1990 levels by 2050.

This Energy Plan seeks in part to fulfill these visions by recommending direct actions the City can take to reduce energy use, save money, and improve public and environmental health.

## **Background & Process**

The energy planning process closely follows the Lebanon City Council's Principles for a Sustainable Community (2009). Most relevant to this Energy Plan are three of the seven guiding principles:

- *Environmental Responsibility and Energy Efficiency* - categorized as care for environment, improve energy efficiency of city and reduce carbon footprint, engage community in conservation and sustainable practices;
- *Intelligent, Coordinated Development and Transportation* - control urban sprawl, develop walkable neighborhoods with access to businesses and homes, create balanced/multi-modal transportation systems; and
- *Fiscal Responsibility* - strengthen tax base and enhance property values, reduce taxpayer burden, diversify revenue, meet current needs and long-term goals.

### ***Local, Regional and Statewide Context***

Energy efficiency and renewable investment in Lebanon will help the state of New Hampshire reach its ambitious energy savings goals. Therefore, the goals and strategies of this energy plan are aligned with those of the New Hampshire Climate Action Plan (NH CAP). The NH CAP has chosen a mid-term goal of reducing greenhouse gas emissions 20% below 1990 levels by 2025.<sup>1</sup> Overarching strategies of the Climate Action Plan that are most relevant to Lebanon are to:

- Maximize energy efficiency in buildings
- Increase renewable and low-carbon sources of energy in a long term manner
- Encourage appropriate land use patterns that reduce vehicle miles travelled
- Protect natural resources
- Lead by example in government operations
- Stay connected to larger efforts

Opportunities to stay connected at a state level include two annual conferences: the Local Energy Solutions conference in New Hampshire held each spring and the Vermont Energy and Climate Action Network conference held each winter. At the regional level, several organizations work to strengthen the Upper Valley’s energy independence, such as Sustainable Energy Resource Group (SERG), COVER Home Repair, and Vital Communities. Every May, SERG, Vital Communities, the Upper Valley Lake Sunapee & Southern Windsor County Regional Planning Commissions, and the Two Rivers Ottawaquechee Regional Commission organize a roundtable event for local energy committees.

### ***Lebanon Energy Advisory Committee***

At the local level, the Lebanon Energy Advisory Committee (LEAC) was formed in 2007 by the City Council with 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. The charge was modified in 2009 to include energy conservation measures for City residents and businesses, thereby cutting greenhouse gas emissions and reducing energy costs for taxpayers.

### ***Public Input & Community Support***

The issues and priorities for the Lebanon Energy Plan were established through a number of channels: a public forum on energy in Lebanon, a public survey about Lebanon’s most pressing energy issues, and six months of bi-weekly Lebanon Energy Advisory Committee public meetings, in which attendees discussed the information from the forum and survey. The priorities established in the updated Lebanon Master Plan (2012) and Lebanon City Council’s Principles for a Sustainable Community (2009) also helped the Lebanon Energy Advisory Committee and consultants establish

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<sup>1</sup> New Hampshire Department of Environmental Services, [The New Hampshire Climate Action Plan](#) (Concord: 2009)5-6

the issues in this Energy Plan.

Fiscal responsibility and regional leadership are two key themes addressed throughout the Energy Plan. Data from the survey and comments from the community forum indicate that nearly 75% of the survey respondents believe that energy efficiency improvements should save money. At the public forum, citizens and City staff agreed that the City of Lebanon should lead by example and be the leader in the Upper Valley for energy savings for residents and businesses.

Nearly 50 people attended the public forum in November 2011 and provided hundreds of oral comments and 37 written comments. The public and City staff completed a survey that provided additional written comments, prioritized actions, and generated ideas of other issues to address in the energy plan. The intended outcomes for the community forum and survey project were to involve the public in the energy planning process, articulate broad visions for Lebanon's energy future, give more publicity to Lebanon's existing energy projects, and solicit specific strategies to achieve the broader visions. The public ranked the following energy topics as the most important to address in the Energy Plan:

- Energy efficiency of municipal buildings & operations
- Renewable energy potential
- Transportation- fuel & commuting
- Commercial sector energy efficiency
- Policies promoting energy efficiency and investment

Full survey results and public comments are included in Appendix A and on the LEAC website.

## **Issues & Priorities**

### ***Energy Efficiency***

Improving the energy efficiency of municipal buildings and operations is a great opportunity to save energy and money, as efficiency projects are often less capital intensive and more cost effective than renewable energy projects and usually have a shorter return on investment. Investing in municipal building energy efficiency improves the comfort and function of municipal buildings and public spaces, contributes to a positive environmental legacy, and reduces operating expenses immediately. Transportation – including municipal vehicle fleet and employee commuting - is the second most energy intensive sector in Lebanon, and opportunities for employees and the Department of Public Works to save energy, fuel, and money are abundant.

### ***Renewable Energy***

The price of fossil fuels will continue to fluctuate and destabilize budgets while perpetuating the City's reliance on non-local, non-renewable sources of energy. To stabilize the price and supply of energy and reduce the environmental impacts of fossil fuels, the City of Lebanon should actively pursue opportunities to develop renewable energy sources such as hydropower, wind, solar, biomass, geothermal, and methane regeneration. The City could also purchase renewable energy from utility providers, essentially investing in the development of new, more local renewable energy projects throughout the New England ISO region.<sup>2</sup>

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<sup>2</sup> New Hampshire's electrical supply comes from many sources throughout New England's electrical grid, managed by the New England Independent System Operator (New England ISO).

The state of New Hampshire has no natural sources of fossil fuels. Lebanon, similar to the rest of the state, is largely reliant on nuclear (44%), natural gas (27%), coal (14%), and conventional hydroelectricity (8%) to meet its electricity demands.<sup>3</sup> Nuclear and conventional hydro electricity are sourced in New Hampshire at the Seabrook Nuclear Power Plant and dams on the Connecticut and Merrimack Rivers. However, natural gas and coal are purchased by utilities from Canada and other US states. Locally, the Wilder Dam on the Connecticut River produces 41MW of electricity in Lebanon. Until the 1950s and, in the case of West Lebanon up until 1969, nearly all local power needs were met through smaller hydropower turbines along the Mascoma River.<sup>4</sup>

By investing in local renewable energy production, the City of Lebanon will reduce its reliance on foreign fuel sources, improve air quality for residents, stabilize the price and supply of energy for its many robust businesses, and reflect strong regional leadership. Additionally, investment in local power generating projects fulfills citizens' desires to maintain small town character and quality of life by gradually returning to the small scale, sustainable power sources that propelled economic development and commercial prosperity in Lebanon since its founding.

### **Existing Conditions & Trends**

#### ***Energy Projects & Commitments***

The City of Lebanon is already committed to energy efficiency and renewable energy exploration. One can see this commitment in a number of well-established initiatives, such as the Lebanon Energy Advisory Committee, Lebanon's Principles for a Sustainable Community (adopted by the City Council and endorsed by the City Manager), and the array of energy and cost saving projects supported and implemented by both the Lebanon Energy Advisory Committee and the Department of Public Works. However, a vision for long term success and greater coordination will be beneficial to existing efforts. Current and past projects are detailed below:

- *Mayor's Climate Action Agreement*: in 2009, then-Mayor Karen Liot Hill signed this agreement, which encourages the City to strive to meet or beat the Kyoto Protocol by achieving a 7% emissions reduction from 1990 levels by 2012.
- *New Hampshire Municipal Energy Assistance Program (MEAP)*: the MEAP project partners, Vital Communities, SERG, and Clean Air- Cool Planet, produced a detailed inventory and report of all energy use, costs, and greenhouse gas emissions of municipal buildings, streetlights, and vehicles for 2009. The program supplied an energy audit of the Lebanon Library by SDES group.
- *Streetlight Map*: the LEAC and City Staff are diligently mapping all streetlights in Lebanon in order to make informed recommendations for which lights to remove and which to upgrade to LED or other energy efficient models.
- *Energy Technical Assistance and Planning Program (ETAP)*: the City of Lebanon signed up for the American Recovery and Reinvestment Act (ARRA)-funded ETAP program in the summer of 2011. A building engineer conducted walk-through energy assessments of the 11 most energy-intensive municipal buildings in September 2011. Specific actions to improve the energy efficiency of municipal buildings can be found in Appendix B.

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<sup>3</sup> Institute for Energy Research. "New Hampshire Energy Facts." *Institute for Energy Research*. 18 January 2012. <<http://www.instituteforenergyresearch.org/states/new-hampshire/>>.

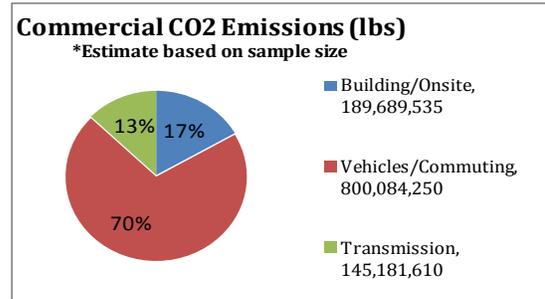
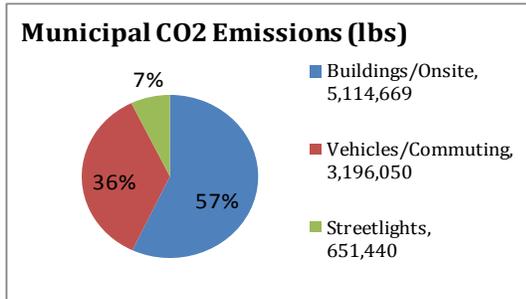
<sup>4</sup> Roger Carroll, *Lebanon, 1761-1994* (Lebanon: Lebanon Historical Society, 1994) 136-7.

- *Smart Commute*: the City of Lebanon is enrolled as an employer in the regional Smart Commute program (administered by the Upper Valley Transportation Management Association and the Upper Valley Trails Alliance), which helps employers promote commuting and mobility options to employees, including carpooling, taking the bus, biking, walking, and telecommuting.
- *Landfill Gas Project*: the Lebanon Solid Waste department is currently working with Carbon Harvest on a project to capture methane gas emitted from waste deposited at the landfill. The electricity produced will be sold to the grid, and the heat by-products will pass under NH 12A in pipes to supply heat to Carroll Concrete.
- *Performance Contract*: the Lebanon Department of Public Works has expanded its contract with Honeywell in order to better monitor the HVAC and other energy use systems of more municipal buildings. This contract may provide opportunities to implement a number of energy efficient upgrades suggested in the MEAP and ETAP reports.
- *Wastewater Treatment Plant (WWTP) Energy Audit*: the WWTP had an energy evaluation done in July 2010, which revealed energy saving opportunities for processes, pumping, and HVAC systems. Decision-makers and designers are using the report's findings integrate energy efficiency improvements during the planned WWTP upgrade.
- *Airport*: the Lebanon Municipal Airport is working to address a number of projects that would increase its energy efficiency, including upgrading its boiler. In the long-term, Airport Management is interested in solar options, and the City is currently exploring green airport technology.
- *LEED Certifications*: the Kilton Library in West Lebanon and the Department of Public Works Administration Building in Lebanon are both LEED-certified buildings. LEED-certified buildings have increased energy efficiency, increased patron comfort, and lowered energy costs.
- *Anti-Idling Policy*: this policy states that no City vehicle/equipment is left running when the driver is not present after proper start procedures occur, nor is idling for more than 10 seconds permitted unless specifically exempt. This policy reduces City operating expenses, lowers emissions, and improves air quality for residents and employees.
- *Lebanon School District*: the school district uses biodiesel in the school bus fleet, installed a wood pellet boiler at Mt Lebanon School, and the new Lebanon Middle School will follow the Northeast Collaborative for High Performing Schools Protocol.
- *Lebanon Energy Plan*: this document is Lebanon's first ever energy plan. The plan reflects the City's existing commitment to a sustainable energy future, and is a resource for all of the City's existing and potential energy uses, projects, and resources.

### ***Energy Use & Cost Inventory***

The 2009 New Hampshire Municipal Energy Assistance Program saw Vital Communities and SERG conduct a comprehensive municipal energy inventory for Lebanon. This included municipal buildings, vehicles and streetlights. The City spends approximately \$1 million on energy costs annually. Lebanon's total yearly energy use is the equivalent of about 2,000 cords of hardwood.

The figures below reflect emissions from municipal and commercial activity from 2009.<sup>5</sup>

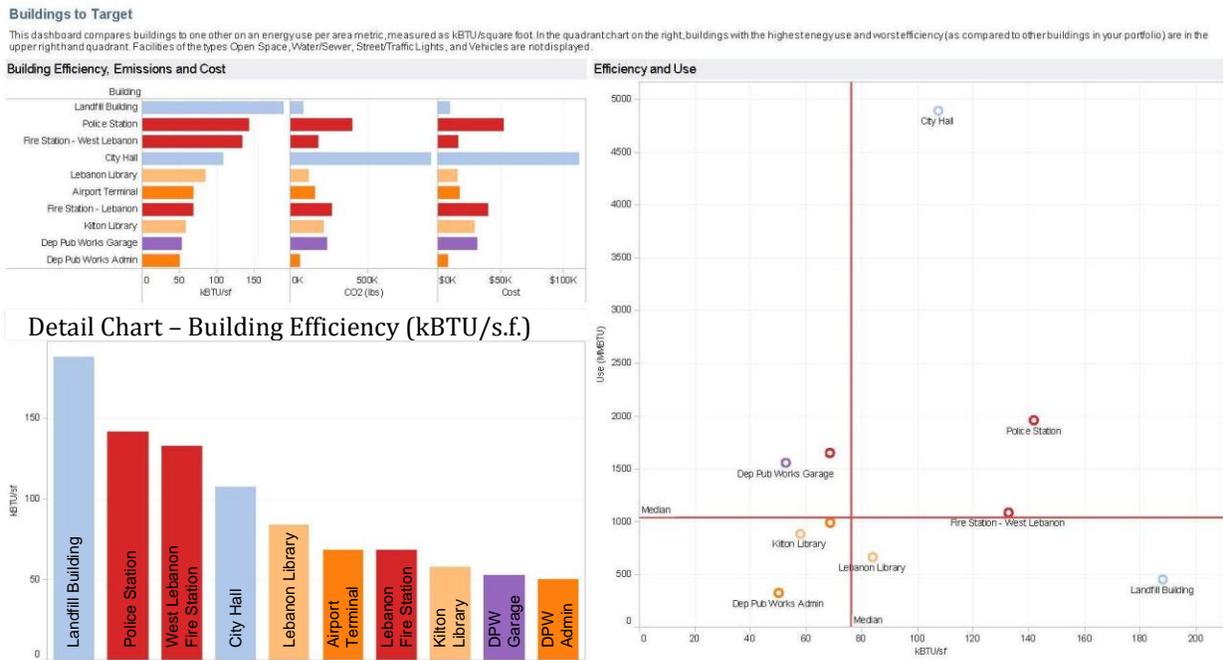


### Municipal Building Energy Inventory

The energy use data (consumption of electricity and fuel) is entered in EPA Portfolio Manager<sup>6</sup> for years 2009-2011 for 12 municipal buildings. It behooves the City and the LEAC to maintain this building energy inventory to measure and track reductions in energy use over time. This tool converts different energy sources to a common measure: the British Thermal Unit (BTU) measured in thousands of BTUs (kBTU) or millions of BTUs (MMBTU). One BTU is the amount of energy required to heat one pound of water by one degree.

The figure provides a snapshot of the most energy intensive buildings in Lebanon for 2009 & 2010.

### Snapshot of Energy Use, Emissions, and Cost by Municipal Building



The above charts provide a comparative energy analysis among 10 of the 12 municipal buildings (excluding the energy intensive water treatment and wastewater treatment plants) for 2009 and 2010. These charts rank the respective building energy efficiency (kBTU/s.f.), carbon dioxide (CO<sub>2</sub>)

<sup>5</sup>This data was collected with the help of Lebanon City Staff, and started through funding by NH RGGI in 2009. The commercial data is in part supplied by a study for Vital Communities by the Tuck School of Business in 2010. Transmission emissions refer to the amount of emissions released through production and distribution of the power itself. For more information on this data, please contact [megan@vitalcommunities.org](mailto:megan@vitalcommunities.org)  
<sup>6</sup> Portfolio Manger is a tool offered by the US EPA that manages energy use data for buildings. More information on this tool is found in Section E12.

emissions, total energy costs, and compare energy use (MMBTU) to building energy efficiency (kBtu/s.f.). The following recommendations are based on these charts:

- The three most recently constructed buildings, the Kilton Library, DPW Garage and DPW Administrative buildings rank as the most energy efficient buildings. The Kilton Library and DPW Administrative buildings are LEED certified buildings.
- Three buildings rank as the highest use, lowest energy efficiency: City Hall, the Police Station, and the West Lebanon Fire Station. These buildings should be targeted for near-term energy efficiency improvement projects.
- The Landfill Building ranks as the least efficient building listed in this comparative analysis. While Landfill Gas Project will likely address this issue and substantially cut energy costs for the all Landfill facilities, it is important to address the building's energy efficiency as part of the facility's regular maintenance program.

These buildings were included in the ETAP building assessment program, which lists prioritized energy efficiency improvements, included in Appendix B.

### **Future Challenges & Opportunities**

#### ***Regional Coordination & Leadership***

The City of Lebanon has a strong commitment to leading-by-example in areas such as energy efficiency to demonstrate cost-effective solutions to citizens, businesses, and other municipalities. As the regional center for the Upper Valley, Lebanon has a tremendous opportunity to benefit from energy savings by residents and businesses. The City of Lebanon should coordinate with the Lebanon School District on energy projects and participate in the many local, regional, and state initiatives underway.

As a regional leader, the City of Lebanon should promote private-public partnerships, and inspire the commercial sector to invest further in efficiency and renewable technology by paving the way. The City should consider an "energy coordinator" position that would manage energy projects, measure savings over time, leverage the work done in different departments throughout the City, and coordinate with regional and state efforts to make Lebanon a model for other municipalities. This position or contract could be paid for by savings incurred through energy efficiency projects.

#### ***Energy Efficiency***

In conjunction with the Energy Plan project, the Upper Valley Lake Sunapee Regional Planning Commission enrolled the City of Lebanon into the New Hampshire Energy Technical Assistance Program (ETAP). This American Recovery and Reinvestment Act funded program supplied the City with an engineer who did two days of valuable walk-through assessments of eleven municipal buildings. The engineer worked with City staff on the assessments and submitted a report to the City and LEAC that details many opportunities for energy savings in low-performing municipal buildings. The report estimates potential energy savings, cost avoidance, and simple payback. The ETAP Project Action List provides the City with opportunities to invest in the energy efficiency of municipal buildings to save money over time, improve air quality inside the building, improve occupancy comfort, reduce carbon emissions, and preserve the historic character of buildings and landscape. The Project Action List and full report is available in Appendix B.

### ***Renewable Energy Opportunities***

The City shall actively pursue opportunities to develop and purchase renewable energy sources such as hydropower, wind, solar, biomass, methane, and geothermal.

#### *Hydropower*

Like many New England towns, Lebanon was born on hydropower. Many dams, wheels, and turbines powered economic development for decades. When grid electricity became widely available and inexpensive in the 1950s, it was often more economical for businesses to tie into the grid rather than produce their own electricity. Most turbines, wheels, and hydromechanical pumps were abandoned. The two existing hydropower stations on the Mascoma River in Lebanon are privately owned, one by Rivermill Hydroelectric, Inc. and the other (on the Glen Road Dam) by Enel North America Inc. The City should encourage the Rivermill complex to improve maintenance of the facility and onsite power generating capacity. The Department of Energy's Virtual Hydropower Prospector identifies a number of environmentally sound sites that could be developed for hydropower without building any new dams, using damless diversions, which the City should investigate further by conducting feasibility studies.

There are a number of opportunities for small hydroelectric and hydromechanical projects at the Water Treatment Plant. Until the 1950s, the Mascoma River provided the energy to hydro-mechanically pump treated drinking water to the top of Reservoir Hill for next to no cost. Since abandoning the hydromechanical pump in favor of an electric grid-powered pump, the City incurs nearly a \$10,000 per month electric bill onsite at the Water Treatment Plant. Three pump stations throughout the City have been identified to have the potential for making onsite power by installing small Cla-val turbines. Details are located in Appendix C.

The Upper Valley Lake Sunapee Regional Planning Commission completed a mapping exercise for renewable energy resources for the Lebanon Energy Plan. The maps and analysis provide an initial City-wide inventory of existing dam sites and assessments of the potential for solar and wind projects. For more detailed analysis and to view the City-wide maps of the dam inventory and solar and wind potential, refer to the end of Appendix C for hydro, Appendix D for solar, and E for wind.

#### *Solar PV*

The City-wide solar analysis identifies locations in the City that may have the highest potential for solar energy production, either for on-site power generation or for distribution through the grid. The analysis and maps show potential for solar production in both January and July, but site-specific solar power feasibility analyses should be conducted by a solar energy specialist if the City decides to investigate candidate locations further.

#### *Wind Power Potential*

The wind power potential map shows limited opportunity for a municipal or small scale commercial wind energy project in Lebanon. Some of the higher elevations in east and northeast Lebanon have moderate to fair wind energy production potential, but likely not sufficient to warrant commercial scale wind energy projects. There is a specific economy of scale for wind turbine projects, which is why utility scale units are so large. However, small-scale residential projects in these areas may be explored further. Location, scale, cost, environmental impacts, yield and sustained wind patterns are important factors to consider potential sites for residential wind energy production. The City could encourage small-scale residential projects through permissive land use regulations or by purchasing an anemometer to test potential sites.

### *Biomass*

Biomass is a relatively untapped renewable energy resource in the Upper Valley for producing heat and electric power. Biomass plants are fed by forest byproducts, agriculture byproducts, and other sources. Properly designed biomass heat and power projects promote sustainable forestry policy, extend the life of local landfills by diverting waste, emit little carbon into the air, and support the local economy. Nearly 80% of the Upper Valley is wooded, and 75% of Lebanon is undeveloped land. The City should explore biomass potential on a small scale, and coordinate regionally to explore the potential for biomass power production in the Upper Valley.

The Kilton Library, Mount Lebanon Elementary School, Lebanon Middle School, and Sachem Village housing in West Lebanon have biomass heating. Several of Lebanon’s employers are exploring biomass as a heating option for their facilities. Lebanon should consider further biomass projects as a viable alternative to fossil fuel burning systems for heating larger facilities. Lebanon should conduct a feasibility study to assess the potential of a downtown Lebanon district combined heat and power biomass project.

### **Transportation**

Transportation accounts for a significant percentage of greenhouse gas emissions and energy use in Lebanon. Indeed, across northern New England, the “transportation system produces more carbon dioxide pollution...than any other part of the region’s economy.”<sup>7</sup> The City of Lebanon should address this major source of pollution through efficient land use planning that promotes all transportation modes, a reduction in municipal vehicle fleet fuel use, and encouraging workplaces, including the City, to engage employees in trip-reduction programs, such as Smart Commute Upper Valley.

### *Commuting*

Commuting accounts for approximately 11% of all municipal CO<sub>2</sub> emissions and represents a significant cost for municipal employees. In spring 2011, the City of Lebanon worked with the Upper Valley Transportation Management Association to collect baseline data on commuting habits and preferences. This survey, given as part of the Smart Commute project, found the following information:

| 2011 Commuting Baseline Data for City of Lebanon Employees only |  |
|---|--|
| Average Daily Commute Distance                                  | 26.6 miles (35 miles is the regional average)                          |
| Average MPG Rating of Employee Vehicles                         | 24.7 miles per gallon  |
| Primary Commute Mode  | 89% - Drive alone<br>5% - Walk<br>4% - Carpool<br>2% - Advance Transit |
| Annual Fuel Use for Commuting by All Employees                  | 49,754 gallons per year  |
| Annual Fuel Cost Incurred by Employees (\$3.60/gallon)          | \$179,114  |
| Annual CO <sub>2</sub> Emissions from Commuting                 | 974,433 pounds   |

The City should aim to lower the drive-alone rate of City employees by 10% over the next three years and improve employee access to commuting options. To achieve this, the City should support

<sup>7</sup> Tony Dutzik, *Cool Moves: Transit in New England and its Role in Curbing Global Warming Pollution*, available at [www.environmentnewhampshire.org/reports](http://www.environmentnewhampshire.org/reports) (direct URL truncated).

a multi-modal transportation system that provides employees, residents, and visitors ways to travel around Lebanon without driving alone. The City should also partner with employers and surrounding municipalities to lower the overall drive-alone rate of commuters in the micropolitan region by 10%.

The City should also consider integrating electric vehicle charging stations in strategic locations. Nissan and Chevrolet now market electric cars, and installing vehicle charging stations within the City might encourage residents, businesses, and employees to use electric vehicles. The electric vehicle charging stations would require consumers to purchase electricity.

#### *Vehicle Fleet*

MEAP data from 2009 show that the City spends about \$275,000 on fuel costs for its municipal fleet each year. This figure does not include vehicle maintenance and secondary impacts such as road wear and tear. The City has begun to address this cost by enforcing an anti-idling policy for Department of Public Works vehicles and machines; however the City should enforce this policy City wide. The City could install idle controls in the municipal fleet to limit the idle time.

The City should consider purchasing biodiesel for the municipal fleet. The Lebanon School District currently purchases biofuel from locally owned Evans Fuel for the school bus fleet since 2006. According to the School District Transportation Supervisor, the buses using biodiesel do not emit strong fumes that regular diesel buses generate, which improves the air quality for students and staff. Since transitioning to biodiesel, the District has had very few fuel filter problems, even less than with regular diesel. The District adds an anti-freeze solution to the fuel to prevent gelling at below freezing temperatures.

#### *Energy Efficient Purchasing Policy*

A sample energy efficient purchasing policy can be found in Appendix F. The policy is based on New Hampshire Executive Order 2005-4, which requires state departments to purchase efficient vehicles (fuel economy of at least 27.5 miles per gallon for passenger and light duty vehicles, 20 miles per gallon for trucks) and Energy Star rated office and building equipment, unless justification is provided.

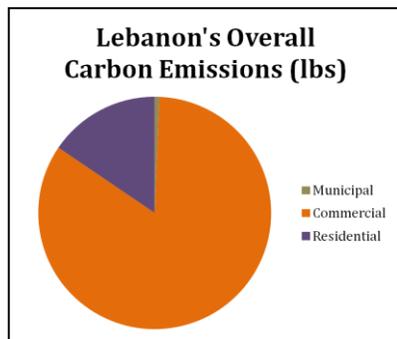
#### ***Commercial Sector***

Lebanon is home to most of the Upper Valley's largest employers. According to the Lebanon NH-VT Micropolitan Statistical Area report (2006)<sup>8</sup>, 13,000 people commute into Lebanon daily to supplement the 5,000 workers travelling within Lebanon for work. In addition, many employees travelling to work in Hanover and Hartford commute through Lebanon, particularly on the NH Route 120 corridor. Between the commuting costs for the workforce and the large energy use onsite at many employers, a tremendous amount of energy is used by the commercial sector in Lebanon. A lot of this energy is used to power buildings and operations, like at Dartmouth Hitchcock Medical Center, or to power industrial processes in manufacturing, like at Timken. The pie chart on page 6, however, shows that 70% of commercial carbon dioxide emissions are generated by vehicle emissions from their employees' commute. The average commute distance for Upper Valley employees is 35 miles round trip. Around 17% percent of commercial emissions are from building and onsite, direct energy use, and the remaining 13% is emissions created through the transmission and production of the energy itself. Because Lebanon's commercial sector uses a tremendous amount of energy, it is essential that the City of Lebanon lead by example and show businesses that reducing energy use onsite, exploring alternative and more efficient energy

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<sup>8</sup> Robert Haslach, "Lebanon NH-VT Micropolitan Statistical Area: a descriptive report," 2006, urban analysis Washington, DC. Page 32.

solutions, and reducing their employees' vehicle miles travelled is essential to significantly reducing energy use and greenhouse gas emissions in Lebanon.



The graph to the left shows the proportions of energy related emissions throughout the City. The commercial sector is the largest user, followed by the residential sector. Even though municipal functions account for only 1% of the overall emissions, this represents \$1million of taxpayer money the City has direct control of. Within the commercial sector, many businesses in Lebanon and throughout the Upper Valley are taking significant steps to reduce their energy use and save money. For example, Kleen Laundromat recently switched to natural gas, which is one of the cleanest burning fossil fuels widely available. Alice Peck Day

Memorial Hospital convenes a group of stakeholders that discuss climate adaptation in the Upper Valley. There are dedicated staff working on energy management and expanding the renewable energy portfolio at Dartmouth Hitchcock Medical Center. Finally, Carroll Concrete in West Lebanon partnered with the City of Lebanon to purchase methane from the Lebanon Landfill to heat their operations. Lebanon should continue to pursue public-private partnerships and promote the energy work being done by Lebanon's large employers.

### **Land Use**

Much of New Hampshire's growth over the last 40 years occurred as dispersed, rural and suburban development. This low-density growth pattern has resulted in increasing travel distances and commuting costs for residents. The New Hampshire transportation sector is the leading sector for carbon emissions and energy costs.<sup>9</sup>

It is important to recognize the impact that land use can have on energy efficiency and energy consumption at the community level. Increasingly energy is being treated as a shared community resource and is subject to planning efforts traditionally reserved for natural or cultural resources. This energy plan is an important step in developing a vision that integrates land use and energy conservation for the health and welfare of the City's residents and visitors.

Energy and land use planning practices can affect both existing built environments and undeveloped lands. Energy-efficient land use planning for developed areas may include broadening potential land uses and encouraging infill development to allow an appropriate mix of uses. Examples of such benefits include allowing small-scale commercial retail uses in a traditionally residential area, which could encourage residents to walk or bike to neighborhood stores rather than drive to regional malls; or encouraging redevelopment of existing buildings that may result in private investment in improving a building's energy efficiency. Energy-efficient land use planning for new developments might include guidance in energy-efficient development practices or incentives (e.g. increased density allowances) for energy-efficient or renewable energy development.

On a regional scale, Lebanon and surrounding municipalities should have regional discussions to coordinate land use patterns that reduce vehicle miles travelled for residents, commuters, and visitors.<sup>10</sup>

<sup>9</sup> New Hampshire Department of Environmental Services, New Hampshire Climate Action Plan (Concord: 2009) 15

<sup>10</sup> Ibid, 22.

### ***Outdoor Lights***

In May of 2009, the Lebanon Public Safety Committee approved a plan to remove some select streetlights over a two-year period. In 2010, the LEAC and City Staff have worked a great deal to identify each outdoor light in the City's control, and map the lights. After completing an inventory of the existing lights the LEAC modified the original proposal. The LEAC proposes to remove 40-50% of the outdoor streetlights in the City and reduce the City's streetlight bill by at least 25%. For the lights that remain, the City should upgrade those lights to LEDs or other more efficient options approved by the utility company.

### ***Rationale for Changes***

In determining which lights are candidates for removal, primary consideration is given to safe vehicle traffic and the safety of pedestrians in high traffic areas. Each light needs to be evaluated in order to determine if it is essential to the safety of the community. In addition, there are other street and decorative lights on the Lebanon Mall that the City owns privately. The City should upgrade these lights to LED or other efficient models as a private investment with relatively quick payback. For the full Streetlight Removal Plan, refer to Appendix I.

### ***Lighting and New Development***

New multi-family residential, industrial and commercial development often require new outdoor lighting for building and parking lot safety as part of the development proposal. The City should consider energy efficiency standards for outdoor lighting and require LED or other energy efficient lighting technologies.

### ***Policy Recommendations***

*Energy Efficient Building Codes:* The New Hampshire State Building Code allows local governments to adopt building codes that are different than the state's requirements if such codes are more stringent than the state code. The state code is currently an adoption of the 2009 International Energy Conservation Code (IECC). The City of Lebanon could adopt a more recent IECC, preferably 2012, which includes several improvements over previous versions. New, cost-effective energy-saving requirements include required programmable thermostats and increased minimum insulation levels. Please refer to Appendix G for more detailed analysis and case study.

*Property Tax Exemption for Renewable Projects:* The Lebanon City Council should consider a resolution to adopt NH RSA 72:61 et seq. ("Property Tax Exemption for Renewable Energy") as a tax-neutral incentive for renewable energy development. Originally passed in 1976, this tax exemption covers the added property value of a newly installed renewable energy system and does not reduce the tax revenue from a property itself. This tax benefit is attractive to building owners who wish to install renewable energy systems but find the added taxable property value – and resulting tax payment - a disincentive.<sup>11</sup> It is attractive to the City as a revenue-neutral and flexible means to support renewable energy generation. Please refer to Appendix H for more detailed analysis and case study.

### ***Local Food & Agriculture***

Lebanon residents and businesses that purchase local food support the local economy and help preserve the working landscape. Lebanon has several farms that produce food and goods sold to local markets and restaurants. Several farms mark the Lebanon landscape, making products such as apple cider, dairy goat products, vegetables, and fruits. Farms within a 25-mile radius to Lebanon

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<sup>11</sup> Database on State Incentives for Renewables and Efficiency, "New Hampshire Local Option – Property Tax Exemption for Renewable Energy," at [http://www.dsireusa.org/incentives/incentive.cfm?Incentive\\_Code=NH01F&re=1&ee=1](http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NH01F&re=1&ee=1). Retrieved December 26, 2011.

city center provide access to many more local foods and meats that could supply Lebanon restaurants and City functions with more local food choices. The Lebanon Farmer's Market runs weekly in the summer months at Coburn Park, and now includes a monthly Winter Market. As food has been shown to travel an average of up to 1500 miles from the farm to the table in the US, purchasing locally grown food in the Upper Valley can reduce fuel and transportation impacts associated with shipping and packaging food. Generally, the closer the farm is to Lebanon, the less fossil fuel is used to transport food to local markets. The City should continue to support and promote a robust network of local farmers at the Lebanon Farmer's Market, consider expanding market sites to larger employers, source local foods at City sponsored functions, and consider establishing more community gardens in City neighborhoods.

To search detailed listings for local food outlets in Lebanon and the greater Upper Valley, visit the Valley Food and Farm online searchable guide at [www.vitalcommunities.org/agriculture](http://www.vitalcommunities.org/agriculture). The Upper Valley Lake Sunapee Regional Planning Commission is doing a food source mapping study, and more information can be found at [www.uvlsrc.org](http://www.uvlsrc.org).

### ***Education & Outreach***

LEAC maintains a website that can be linked to on the City of Lebanon's website, and has up to date information about meetings, current projects, and local resources. LEAC has sponsored Button Up New Hampshire workshops in the past and should continue to coordinate opportunities to educate Lebanon residents on ways to save money and be more energy efficient.

LEAC and City management have the opportunity to encourage City of Lebanon employees to save energy and money through their behaviors. Behavior change campaigns for City employees could focus on commuting habits, turning off lights and appliances, controlling space temperatures, composting, and recycling.

### ***Financing***

The City shall actively pursue federal, state, regional, and grants for projects identified in this plan. Other creative financing mechanisms shall be considered as well, such as an "Energy Fund" to support municipal, residential, and commercial energy initiatives.

At the time of this report there are limited funds or opportunities for municipalities to receive outside funding to promote energy efficiency improvement programs. The following programs review funding options other than traditional financial tools including municipal bonds or direct lending. These funding sources are not a guarantee for success, but they may help the City identify financing vehicles. It is important to note that the City is paying for energy regardless of whether there is a commitment to improve municipal energy efficiency.

### ***Capital Improvements Program***

The Capital Improvements Program (CIP) applies to any municipal construction or improvement project that exceeds \$50,000 in total costs. The Energy Plan lists many "shovel ready" projects, particularly energy efficiency projects for municipal buildings and small hydropower projects that will likely qualify for the City CIP. The Lebanon Energy Advisory Committee should advocate for certain energy saving projects to be included in the City's CIP.

### ***Energy Fund***

The City of Lebanon should consider forming an "Energy Fund" that consists of monetary savings realized out of efficiency projects. The Energy Fund could be used to finance other energy savings

projects, and/or pay for a part time energy coordinator to manage the City's energy use, measure savings, and apply for funding for energy savings projects.

#### *Consolidating Energy Efficiency Projects*

Many individual energy efficiency projects do not qualify to be listed in the CIP (e.g. upgrading building lights or temperature controls) and often are listed as part of the facility maintenance budgets for the individual City Departments. Coordinating and combining these small-scale energy efficiency projects among Departments into one contract could help the City realize an overall savings through economies of scale. This approach would be for well-defined energy efficiency or maintenance projects that may not be covered under a Performance Contract.

#### *Performance Contract*

New Hampshire municipalities are allowed to finance large energy efficiency projects through an Energy Savings Performance Contract agreement with an Energy Services Company (ESCO). Currently the Lebanon Landfill project has an energy savings performance contract with an ESCO, Carbon Harvest. The ESCO helps design the project and purchases and installs the necessary equipment. In exchange for paying for the upgrades and equipment upfront, the ESCO receives a share of the cost savings that result from the energy efficiency work.

The City of Lebanon has a building performance contract with Honeywell. Currently Honeywell is expanding the number of municipal buildings that can be monitored for building performance and energy use by the Department of Public Works administrative offices. The City should research and consider whether Honeywell can finance specific energy efficiency projects through Energy Saving Performance Contracts.

#### *Municipal Energy Reduction Fund*

New Hampshire's Community Development Finance Authority's Municipal Energy Reduction Fund is available to help municipalities improve the energy efficiency of their municipal buildings, street lighting, water and sewer treatment facilities, and where appropriate, electrical distribution systems. The goal is to reduce energy usage and costs. CDFR is currently accepting applications from New Hampshire Municipalities through an online grants management system for funding through the Municipal Energy Reduction Fund.

#### *Planning Grants*

Local and regional governments often apply for and receive funding for planning efforts to continue progress for municipal energy efficiency (This Energy Plan is funded by one such grant.). In 2011 the nine regional planning commissions in New Hampshire received significant funding from the US Department of Housing and Urban Development to develop individual regional plans and a statewide development plan.

#### *Ongoing Grant Updates*

The US Environmental Protection Agency lists many potential funding resources for energy projects here: <http://epa.gov/statelocalclimate/state/activities/financing.html>

#### *Aggregate Power Purchasing*

A group of communities and and/or larger utility users (e.g. large employers, school districts, large commercial power consumers) can coordinate to aggregate their electric supply accounts and negotiate lower power generation rates than are offered through the existing regional power supply companies. By aggregating the power demands among the City and other partners (e.g.

DHMC or the Lebanon School District facilities), the group of public and private entities are in a position to potentially save up to 30% on power generation costs.

### ***Measuring Progress***

It is important to set up systems to track progress toward the stated goals and visions in the Energy Plan in order to measure energy and cost savings.

Twelve of Lebanon's most visible and energy intensive municipal buildings are tracked in the EPA Portfolio Manager online tool. The tool requires specific building characteristics like square footage and year built, electricity statements and fuel consumption records to calculate a baseline. The Lebanon Energy Advisory Committee and Vital Communities have been collecting and analyzing this information since the baseline data was collected in 2009 through the NH Municipal Energy Assistance Program and allows users to see changes in energy use and track fiscal savings over time. It is highly recommended that the City maintain this free tracking system.

The Lebanon Energy Advisory Committee recommends reducing the number of kilowatts per taxpayer per year and reducing the number of gallons of fuel per taxpayer per year to show per capita energy use reductions from the baseline.

The Lebanon Energy Advisory Committee will work to suggest other tools and metrics to the City for tracking energy savings over time that might include indicators such as employee behaviors changes like increased carpooling, increased residential recycling, increased vendors and local food purchased at the Farmer's Market, investment in renewable energy projects by residents and businesses, and increased public private partnerships. Additional research by the LEAC should consider metrics for measuring the impacts of renewable energy generation in terms of economic impact and price stability.

### ***Sharing Success***

It is important to share the successes of the LEAC and the City internally and publically. The City should consider ways to share what it's doing with energy efficiency and renewable energy projects with residents, businesses, institutions, and visitors throughout the Upper Valley and State of New Hampshire. By sharing success and spreading positive messages about saving money and energy, the City can catalyze further efforts and inspire others to act. The City could publish an annual energy savings report, maintain an energy related presence in City e-newsletters, social media, and websites, keep state agencies and elected officials updated on the progress, and continue to discuss progress, challenges, and best practices with other regional energy saving advocates.

*Overall long-term goal: Lebanon is a leader in energy efficiency, renewable energy reliance, and innovation across municipal, commercial, institutional, and residential sectors.*

**Outcomes, Strategies, Actions** (for matrices in the Lebanon Master Plan, outcomes in italics, strategies lettered, actions bullets)

*I. The City's buildings are energy efficient and new construction and redevelopments adhere to energy efficient standards.*

A. The City shall maximize energy efficiency in municipal buildings and encourage efficiency in commercial and residential buildings.

B. The City shall develop guidelines to encourage energy efficient construction.

- Assess and execute as many ETAP Project Action List items as possible
- Adopt Energy Efficient Building Code policy
- Revise existing subdivision and site plan regulations to be more energy efficient
- Educate taxpayers about dollars saved over time when money is invested in energy efficiency

*II. The City relies upon as much local renewable energy as possible.*

A. The City shall actively pursue opportunities to expand its use of renewable energy sources, such as hydropower, wind, solar, geothermal, and consider purchasing renewable energy from utility companies if offered.

B. The City shall encourage the commercial and residential sectors to invest in renewable energy.

- Adopt a tax-neutral Property Tax Exemption for renewable energy projects
- Conduct feasibility studies on the sites for solar power potential based on the Solar Map
- Assess the feasibility of solar domestic hot water in new and existing municipal buildings
- Look into alternative ways of assessing wind power generation potential
- Encourage residents that benefit from moderate to fair wind power potential to explore small scale residential wind power projects
- Assess feasibility of implementing the recommendations of the hydropower study to improve energy efficiency for the municipal water and wastewater systems
- Encourage Rivermill Hydroelectric, Inc. to improve onsite efficiency and power capacity at the Rivermill Dam
- Be involved in any hydropower development proposals along the Mascoma River
- Consider moderate-scale district heating systems in new or existing office and industrial parks. These district heating systems could be based on a public/private partnership to cost-effectively implement high-efficiency heating among multiple buildings.
- Research potential for possible public private/partnerships to develop biomass or liquid natural gas district heating and power plant projects in areas like business and industrial parks, downtown Lebanon, or downtown West Lebanon
- Participate in regional discussions about opportunities for biomass heat/power and liquid natural gas
- Continue to take advantage of geothermal resources in new construction, similar to Kilton

- Study the feasibility of ground-source-heat pumps in new and upgraded municipal buildings
- Encourage businesses to invest in renewable energy generation

*III. There is a culture of energy efficiency and conservation within the City's municipal, commercial, institutional, and residential communities.*

A. The City shall actively pursue federal, state, and regional funding and grants for projects identified in the Energy Plan. Other creative financing mechanisms shall be considered to support municipal, residential, and commercial energy initiatives.

B. The City shall encourage municipal departments, residents, businesses, institutions, and visitors to support the local economy and preserve the working landscape by purchasing local food.

C. The City shall conduct and support education and outreach efforts to increase local and regional understanding of the importance to reduce energy use and demand, curb reliance on fossil fuels, and protect the environment.

D. The City shall explore opportunities to collaborate with local and regional partners, including the Lebanon School District and neighboring communities, to develop regional energy initiatives including aggregated power purchasing, expanded commuter engagement, and other opportunities to reduce energy use and costs.

- Develop behavior change campaigns for city employees, for example to increase carpooling and recycling
- Host and promote "Button-Up New Hampshire" workshops
- Develop a public education campaign about energy topics including an online and social media presence
- Advocate for projects that reduce the City's energy consumption and/or introduce renewable energy resources in the Capital Improvement Program
- Investigate opportunities for interdepartmental coordination and funding of energy efficiency maintenance projects in existing municipal buildings
- Establish an 'energy fund' to set aside funds to finance further energy savings projects
- Maintain a list of "shovel ready" energy-related projects to take advantage of potential future funding and grant programs offered by federal and state agencies
- Create or contract an 'energy coordinator' position
- Expand the work of the Lebanon Garden Committee to establish community gardens
- Conduct outreach to promote and strengthen Lebanon's Farmer's Market
- Use and promote local food at City events
- Research technical programs to add in Lebanon School curriculum to involve students in energy efficiency and conservation

*IV. The City's residential, commercial, and institutional sectors privately invest in energy efficiency and renewable energy projects.*

A. The City shall take active steps to encourage residents, businesses, and institutions to invest in efficiency and renewable technology.

B. The City shall pursue public-private partnerships to save money and generate energy.

C. The City shall work with area businesses and institutions to leverage educational opportunities.

- The Lebanon Energy Advisory Committee should advocate for and the City Council should pass a more stringent energy efficient building code policy.
- The Lebanon Energy Advisory Committee should advocate for and the City Council should pass a tax neutral property tax exemption policy for renewable projects.
- Encourage the use of natural gas at local businesses (ex: Kleen Laundry)
- Explore shared natural gas delivery with other municipalities and businesses
- Explore shared biomass power production opportunities (ex: Unity, NH)
- Continue to explore partnerships with the private sector to maximize energy savings on specific projects (ex: Landfill project)
- Demand rigorous commissioning and review for energy efficient opportunities on all projects

*V. Lighting throughout the City is efficient, cost-effective, and restores dark skies.*

A. The City shall maintain a current map and inventory of all exterior lights.

B. The City shall reduce the number of overall lights in its control to save taxpayer money and reduce energy use and night-sky pollution associated with unnecessary lights.

- Develop an ordinance to require energy efficient lighting for all new designs and projects
- Develop fair criteria for light removal
- Remove all unnecessary lights
- Upgrade existing lights to LED or other efficient models
- Refer to what other municipalities have done to maximize light removal and public satisfaction
- Use cut-off lighting techniques to reduce light pollution of necessary lights
- Incorporate land development regulations that require high efficiency lights for site plan review and development.

*VI. The City of Lebanon has an economically sustainable, multi-modal transportation network, and municipal vehicle fleet.*

A. The City shall develop a multi-modal transportation system that provides employees, residents, and visitors ways to travel around Lebanon without driving alone.

B. The City shall reduce emissions and costs of vehicles and machines in the municipal fleet.

C. The City shall improve access to commuting options for City employees and partner with employers and surrounding towns to expand access to all regional commuters.

- Institute a policy that requires the purchase of energy efficient vehicles and equipment, and insert language into City Request for Proposals and Qualifications
- Consider installing electric vehicle charging stations, for example at park and rides
- Continue support of Advance Transit and promote new routes where appropriate
- Establish new and participate in a regional network of park and ride facilities that connect to transit lines
- Institute a City wide Anti-Idling Policy based on the current policy issued by the Department of Public Works
- Purchase biodiesel fuel from local vendors for diesel machines and vehicles
- Assess the travel patterns of the municipal fleet and identify more efficient routes

- Examine ways to work with other employers, including the Lebanon School District, to leverage the tools and experience of the Smart Commute program
- Implement recommendations of the *City of Lebanon Sustainable Transportation Plan (2011)*, developed by the Upper Valley Transportation Management Association and Upper Valley Trails Alliance through the Smart Commute program
- Set up an internal carpool matching system to help employees who live near one another share rides
- Examine the feasibility of offering employees a compressed work week (four ten-hour days per week, for example)
- Adopt a telecommuting policy and promote working from home to appropriate employees
- Advocate for wide-reaching broadband service to improve telecommuting options
- Continue to work with the Upper Valley Transportation Management Association to market commuting options and engage employees in a behavior change campaign
- Assess the costs and benefits of offering employees a commuter benefit (extra time off for not driving alone, for example)
- Continue to promote walking and biking in municipal employee wellness programs

*VII. The City of Lebanon provides easy access to transportation systems and concentrates activities, amenities and commerce to enhance quality of life, retain small town charm, and increase energy savings.*

A. The City shall explore ways to allow residents and visitors to reduce vehicle miles travelled throughout the City.

B. The City shall assess the current grounds care and landscaping practices within the City's control and explore more sustainable methods with less reliance on fossil fuels.

C. The City shall explore ways to increase residents' and businesses' access to recycling and local foods.

- Establish park and ride facilities that connect to transit lines
- Assess feasibility of bicycle rental stations throughout the City, located near bicycle lane networks
- Develop sustainable methods for grounds care and landscaping
- Incorporate green infrastructure -such as street trees, buffers and parks- in road, neighborhood and commercial design, to diminish stormwater runoff, enhance soil capacity to absorb stormwater, enhance the aesthetic value of the landscape, reduce greenhouse gas emissions, reduce the need for traditional stormwater management techniques and reduce energy demands from the urban heat island affect
- Develop land use plans, policies, and regulations to encourage energy efficiency and renewable energy resources for renovation of existing structures and new construction
- Sustainably manage Lebanon Town Forest land to provide high-value locally produced wood products, improve recreational use, and wildlife habitats
- Promote locally produced foods and products
- Promote the Lebanon Farmer's Market and encourage participation by local vendors
- Provide compost disposal at City facilities
- Designate locations for community gardens throughout the City
- Design edible and native plant based functional landscapes throughout the City
- Set up centrally located recycling drop off stations throughout the City that are walkable, visible and attractive