CHAPTER
ENERGY

INTRODUCTION

Energy and its impact on our communities in areas such as municipal expenditures, economic development, land use planning, and transportation is increasingly of interest to residents, local officials and business owners. Reliable, affordable sources of energy are critically important to our quality of life and the stability of the economy.

This Energy Chapter presents a framework that can be used to support Town efforts in the areas of energy use, efficiencies and planning. The use of energy for electricity, heating, and transportation is tied to community planning, individual lifestyles, natural resource conservation, and environmental quality. The purpose of this Chapter is to provide some background on energy usage and issues and to identify strategies and tools for energy conservation, energy efficiency, and efficient development. After a brief introduction to the role of energy in planning, there is a summary of New Hampshire's energy profile and sources as well as a series of recommendations for achieving the overall vision of a resilient, efficient community through programs, operational practices, ordinances and regulations. There is also a summary of Boscawen's municipal energy consumption and an overview of potential opportunities for usage and cost savings, energy efficiency improvements and renewable energy options.

Many municipalities in New Hampshire, including Boscawen, have taken action to reduce energy consumption, improve energy efficiency, and investigate renewable energy sources. New Hampshire **RSA 269:1(n)** was adopted in 2008, authorizing municipalities to incorporate an energy section into their master plan that "includes an analysis of energy and fuel resources, needs, scarcities, costs, and problems affecting the municipality and a statement of policy on the conservation of energy."

In a 2007 Town Meeting warrant article, the Town of Boscawen adopted the New Hampshire Climate Change Resolution, along with 163 other communities across the state. The resolution supports efforts to address the issue of climate change, including the establishment of a program to require reductions in US greenhouse gas emissions and the creation of a national research initiative to develop sustainable energy technologies.

In 2011, Boscawen also participated in several energy projects that became available from federal funding through the Office of Energy and Planning (OEP). These projects were funded through OEP's Energy Technical Assistance Program (ETAP) and included energy assessments of municipal buildings and a series of recommendations for energy efficiency improvements.

THE ENERGY LANDSCAPE

Energy efficiency and renewable sources of energy continue to emerge as topics in discussions of energy usage and costs. Many view them as solutions to high energy costs and supply concerns as well as a response to environmental sustainability.

An important concept to remember is that New Hampshire is part of a region and really a world market when it comes to energy. Since 1997, ISO-NE (Independent System Operator of New England) has been managing the regional electricity demand and supply in New England; what we can do as a state and region is influence overall use and fuel choice.

Energy is a very broad topic and also has some specific terms that need to be understood, particularly in the area of renewable energy. Below is a list of definitions that clarify some of the terms used in this Chapter.

1. ***Energy conservation*** means reducing the overall use of energy, particularly wasted energy (such as installing programmed thermostats that turn on the heating or cooling only when a building is occupied).
2. ***Energy efficiency*** refers to the ability to produce the same output or benefit using less energy in the process (such as replacing an incandescent light bulb with a fluorescent one). Anywhere energy is used, there are opportunities to increase efficiency.
3. ***Renewable energy*** describes energy sources and systems that produce power from sources that are unlimited or can be cyclically renewed, such as solar, wind, geothermal, or biomass. Non-renewable energy sources are those with a finite supply, such as oil, natural gas, or coal.
4. ***Renewable Portfolio Standard (RPS)*** was established in May 2007 as RSA 362-F and requires the state's electricity providers -- with the exception of municipal utilities -- to acquire by 2025 renewable energy certificates (RECs) equivalent to 24.8% of retail electricity sold to end-use customers. The RPS includes four distinct standards for different types of energy resources; these are classified as Class I (largest class and includes new and existing renewable facilities), Class II (solar), Class III (existing biomass and landfill gas facilities) and Class IV (existing, small hydro with certain restrictions). See www.puc.gov for a detailed explanation of the classes. What an RPS does is establish a base level of demand but allows the market to determine which renewable energy resources will meet that demand. Initially proposed as a mechanism to support renewable energy development in competitively restructured electricity markets, the RPS model today is now seen to serve other functions such as encouraging fuel diversity and economic development.
5. ***Renewable Energy Credits or Certificates (RECs)*** – are sold separately from the underlying physical electricity and are tracked, traded and sold in the market. As renewable generators produce electricity, one REC is created for every 1 megawatt-hour (MWh) of electricity placed on the grid. RECs represent the "attributes" (environmental, social, and other non-power qualities of renewable electricity generation) of renewable electricity generation from the physical electricity produced,

serving as "currency" for renewable energy markets. Since RECs only represent the non-power attributes, they are not subject to delivery constraints.

6. ***Alternative Compliance Payments (ACPs)*** are made to the state by utilities for every megawatt hour of energy for if their renewable energy quotas are not met. These alternative compliance payments are essentially an assessed fee to those utilities and competitive electricity providers that have not complied with the RPS. If RECs are not available or prices exceed the alternative compliance price, the electrical supplier will often elect to pay the fee, i.e., the alternative compliance payment.

Typically, it makes sense to strive for energy conservation first as using less energy has minimal costs and is fairly straightforward to implement. Improving energy efficiency can also reduce energy use, although it does not always result in lower consumption (for instance, a person who buys a more fuel efficient car may drive the same number of miles, thereby saving energy and money or he or she may drive *more*, which costs the same but does not reduce the amount of fuel used). Finally, constructing renewable energy systems, particularly those where the energy is used on-site, is a valuable strategy for long term energy cost savings and reduction in pollutant emissions.

STATEWIDE ENERGY USE OVERVIEW

Some Quick Facts from U.S. Energy Information Administration, March 2014

- New Hampshire was the ninth lowest per capita consumer of energy among the states in 2011.
- The Seabrook nuclear power reactor, the largest in New England, provided over half of New Hampshire's 2013 net electricity generation.
- New Hampshire's Renewable Portfolio Standard requires 24.8% of electricity sold to come from renewable energy resources by 2025; 16% of New Hampshire's 2013 net electricity generation came from renewable energy.

Energy use in the Central NH Region parallels patterns throughout the state and the northeast. New Hampshire relies on a number of different types of energy supplies – each with its own unique costs. Some important facts to remember:

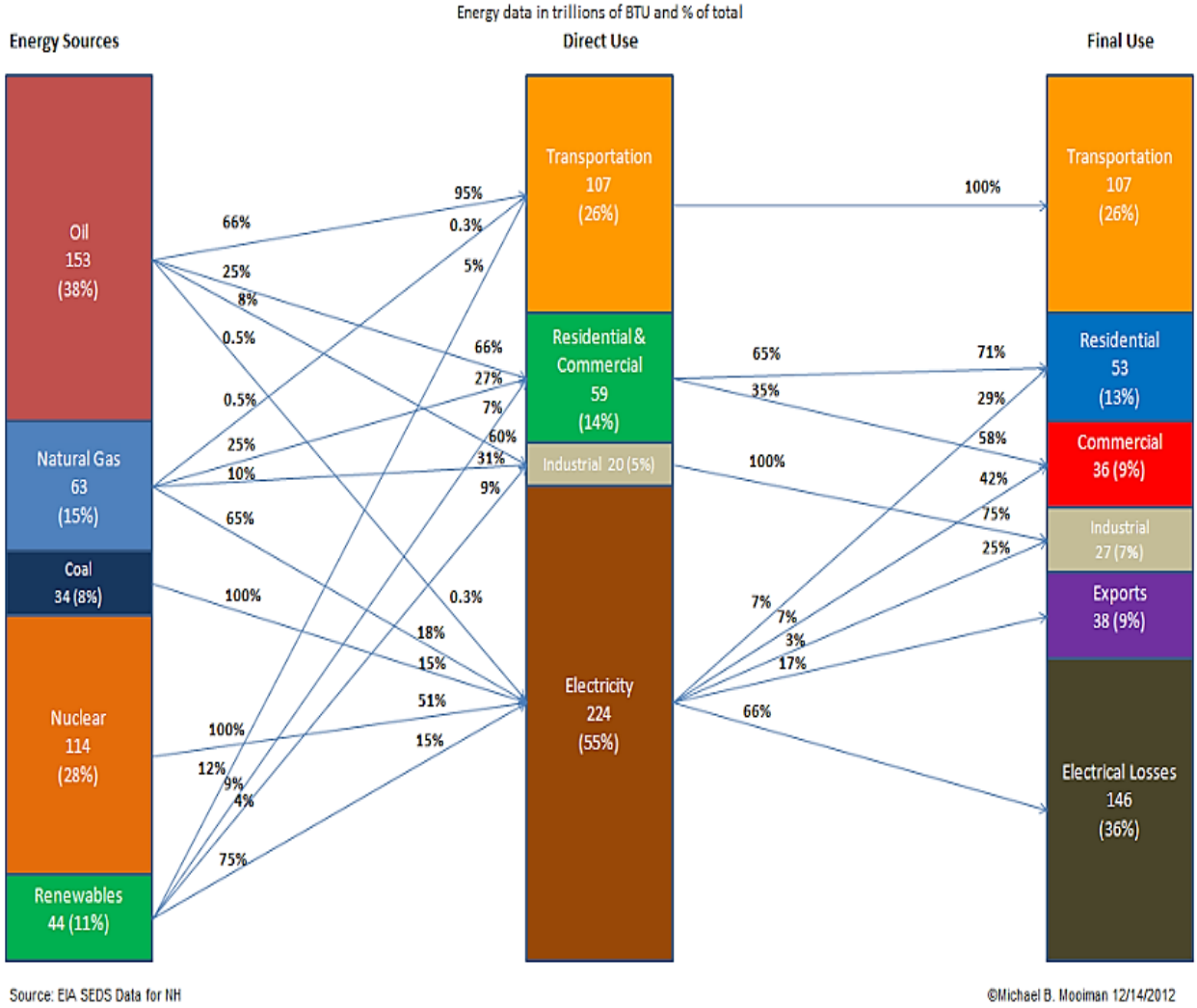
- New Hampshire relies on external sources of energy for nearly 90% of its total energy consumption.
- Population growth has slowed but is still increasing. Household changes are also leading to changes in how energy is used – computers, phones, TVs. Any gains in efficiency may be partially offset by the increasing electric demand associated with the number of devices and appliances per household.
- Energy costs and supply are dynamic; costs are not fixed.
- Demand patterns for energy may decrease, BUT expenditures are increasing due to rising fuel prices.

- Decisions concerning energy supply and usage directly impact individual energy bills and the overall economy.

The biggest challenge in understanding New Hampshire's energy profile is to correctly describe the flow of energy - from its supply, utilization and final usage - as there can often be a misunderstanding of the relationship between energy, generation, consumption, and the final disposition of energy once part of the supply has been converted to electricity and distributed to consumers.

Using 2010 data available from the U.S. Energy Information Agency (EIA), this chart analyzes statewide energy flow and summarizes the key concepts of New Hampshire's energy profile.

Figure 2010 New Hampshire Energy Sources and Uses Analysis



Source: Dr. Michael Mooiman, Franklin Pierce University, Energy in NH Blog

Looking at the column to the left, energy sources, one can see that the largest slice of the energy supply, 38%, came from crude, oil based fuels. The other fossil fuels, natural gas and coal, made up 15% and 8% respectively. Overall, fossil fuels provided 60% of the state's energy sources. Nuclear energy supplied about 28% of the overall total. Renewables – hydroelectric, wood, waste and ethanol in gasoline, represented 11% of the total. It should be noted that a small amount of electricity was purchased from out of state in 2010, but the amount was less than 0.5% and was not included in these figures.

As we follow these arrows for the first two columns, some highlights from the data are:

- → 25% of natural gas is used in the residential and commercial sectors.
- → 65% of natural gas supply is used to generate electricity and it represents 18% of the primary energy supply used to generate electricity.
- → 66% of energy usage for heating households and businesses comes from oil.
- → 25% of the oil supply to the state is used to heat these households and businesses.
- → 15% of the total energy supply for generating electricity is from renewables; 75% of the renewable energy supply is used to generate electricity.
- → 100% of coal and nuclear supply is directed towards electricity generation, making up 15% and 51% respectively of the supply for generating that electricity.

The last column of this chart looks at final use or what happened to all the energy. For electricity, it's important to note that two thirds of the energy that went into production was lost as waste heat. It is sometimes a surprise that electricity generation produces so much waste. One interesting note on this last column is that 17% of the electricity generation is actually exported out of state.

Some notable points from this last column are:

- → 71% of energy for our homes came from mostly fossil fuels for direct heating and hot water applications. The remainder of the energy to our homes is from electricity usage.
- → 58% of energy use for businesses was from heating and 42% is electricity.
- → 36% of energy supplied was lost as waste heat during the generation and transmission of electricity, 9% was exported out of state and transportation consumed 26% of the energy supply.

Now that there is a clearer view of energy flows in New Hampshire, a brief discussion of some of the sources follows.

SOURCES

In this section, there is discussion of the major supply sources such as gas, petroleum and coal. Smaller sources such as kerosene, propane and are not covered. It should be noted that Eversource/PSNH is currently in the process of selling its power plants in New Hamsphire. It is expected that the sale of the power plants, including three fossil fuel plants and nice hydropower facilities, will take place sometime in late 2016 or early 2017.

NATURAL GAS

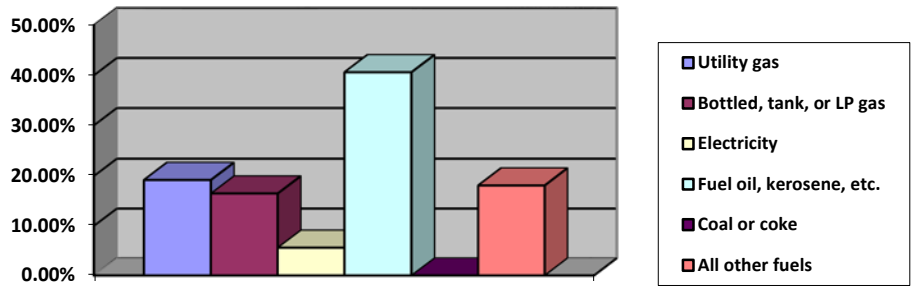
In New Hampshire, there are four natural gas pipelines. The significant line for state residents is the Tennessee Gas Pipeline (TGP) which is owned by Kinder Morgan and brings gas from Texas, Louisiana, and the Gulf of Mexico into New England. This pipeline crosses New York and Massachusetts and distributes gas across a large section of Massachusetts. There are several tributaries off of the main line, one of which branches off near Lowell and heads north through the communities along the Merrimack River and into the Lakes Region.

According to the EIA, "about one in five New Hampshire households uses natural gas for primary home heating. Because of recent differences between natural gas and home heating oil prices, there has been an increase in the number of homeowners who have been switching to natural gas in New Hampshire and throughout New England. However, New Hampshire is still among the lowest states in per capita natural gas consumption, in part because large areas of the state do not have the natural gas distribution infrastructure." Some of the Central NH Region's communities, including Boscawen, are served by Liberty Utilities and are able to heat with natural gas.

Electricity generation from natural gas has increased markedly since 2003 with the commissioning of two large generating stations. As increasing amounts of natural gas are used for electricity, in New Hampshire and in New England as a whole, assurance of natural gas supply is becoming a critical strategic energy issue for the region.

Table[CNHRPC1]
2009 – 2013 House Heating Fuel, by Type
Boscawen

HOUSE HEATING FUEL	
Utility gas	19.2%
Bottled, tank, or LP gas	16.5%
Electricity	5.6%
Fuel oil, kerosene, etc.	40.6%
Coal or coke	0.0%
All other fuels	18.1%
Source: American Community Survey	



PETROLEUM

Nearly half of all New Hampshire households rely on petroleum as their primary heating fuel, making the state and the overall region particularly vulnerable to fuel oil shortages and price spikes during the winter months.

The transportation sector consumes more petroleum products than any other sector. State law requires the use of a biodiesel blend in state vehicles unless the blend costs more than all-petroleum fuel. The state also requires reformulated motor gasoline blended with ethanol in the populated areas of southeastern New Hampshire to limit ozone formation.

COAL (EIA Data)

New Hampshire has two coal-fired generating stations, Schiller at Portsmouth and one in the Central NH Region, Merrimack Station at Bow. Both are owned and operated by Eversource and the Merrimack Station is the utility's largest plant and generates approximately 439 megawatts (MW), enough to roughly supply 190,000 households. One unit of the plant was built in 1960; the other in 1968. In response to a 2006 state law (RSA 125-O), Eversource installed a scrubber system by 2011 that is targeted to capture 80% of the mercury from the coal and reduce sulfur dioxide emissions by roughly the same percentage. The cost of the scrubber system increased from an estimate cost of $250 million in 2006 to $422 million. The Public Utilities Commission (PUC) is currently examining what portion of that cost could be passed on to ratepayers. The Schiller station can burn either coal or oil, and one unit was converted in 2006 to burn woody biomass. Although coal's share of New Hampshire electricity generation has declined in the face of cheaper natural gas, it still typically provides up to one-seventh of net electricity generation.

RENEWABLE ENERGY

SOLAR

According to the U.S. Department of Energy, demand for solar is at an all-time high; in the first quarter of 2012, 85% more panels were installed compared to the first quarter of 2011. Once thought of as not practical in northern climates, solar energy has much potential for providing clean, reliable and safe energy. Solar technologies have proven to be successful in New Hampshire and continue to be a viable option both commercially and

residentially. As technologies continue to improve and costs lower, solar thermal collectors and photovoltaics are becoming more competitive in the marketplace.

The Cost of Solar Energy

The challenges for solar installation include the installation costs and some of the "soft" costs such as permitting and interconnecting the system to the power grid. However, the cost of solar panels or solar modules has been falling significantly, from $76.67/watt in 1977 to just $.68/watt today (www.costofsolar.com) and is expected to continue dropping in the near future. Grid-tie (connected to your electrical utility company's power "grid") has not only become more mainstream but the decreasing price is attributed to many factors, including technology improvements such as the mini inverter. Each panel in an array has its own on-board inverter which eases the effects of partial shading on the panels.

The NH Office of Energy and Planning (OEP) is a recent recipient of a grant as part of the New England Solar Cost Reduction Partnership (NESCRP) from the US Department of Energy's Rooftop Solar Challenge II Program. The intent of this grant is to increase implementation of solar photovoltaic (PV) by driving down its associated costs. Under this grant, NH is focusing on the "soft costs" associated with residential permitting, zoning and interconnection. Statewide model permitting and zoning, a guide to the utility interconnection process, and additional educational resources, including training, will be developed for use by municipalities and made available through OEP's website (www.nh.gov/oep).

Solar Energy Use

In 2013, solar installations in the U.S. accounted for 31% of new electricity generation installed. According to the Interstate Renewable Energy Council, (IREC), residential capacity installed in 2013 grew by 68 percent. A total of 145,000 residential PV systems were installed during that year. Growth in this industry is driven by many factors and certainly varies by sector and state. The federal tax credit is still available, installed costs continue to decline and state and utility rebates all are contributing to the solar market growth. By many standards, this is still an industry that is in its relative infancy when you consider that in 1985 annual solar installation demand stood at 21 MW.

In the Central NH Region, over 17 commercial and industrial solar rebates have been issued, with the largest number of rebates issued in Concord at six. Other communities with rebates issued include Boscawen, Loudon, Chichester, Warner, Bow and Henniker. The largest installation in New Hampshire is currently underway in Peterborough. Funded by a grant from the state's Renewable Energy Fund in 2014, Peterborough will have a 950 kilowatt solar array installation. The installation will be located on the site of one of the Town's former sewage lagoons and is expected to generate one megawatt of electricity annually – enough to power the nearby sewage treatment plant and perhaps other municipal buildings.

The residential market continues to grow as well with small units being installed in domestic homes to supply a proportion of the household electricity needs. More than 1,200 statewide systems have been installed since the PUC established the rebate program in

2009. A good source of information on solar energy for residential homes can be found at http://www1.eere.energy.gov/solar/pdfs/44792.pdf.

As solar systems become more mainstream, there is developing interest in looking at the role of zoning and land use regulations to ensure that solar renewable energy projects are compatible with existing land use regulations. Looking at ways to support renewable energy projects that are not overly restrictive or contradictory to the installation of the systems within the framework of "sound" community development is important. Some potential considerations by communities include whether the systems are considered an accessory use or a conditional use in certain areas, height and setback limitations, scale, and aesthetics (i.e. glare).

Biomass

According to the U.S. Energy Information Administration, nearly 1 in 12 homes in New Hampshire depend on wood products as a primary heat source. New Hampshire is still 84% percent forested and roughly 81% is considered viable timberland. Biomass products such as wood pellets and chips, logwood and briquettes, are an important part of the state's economy and can keep fuel dollars in the local economy.

Since biomass is part of the renewable energy market, there is the opportunity to sell the renewable energy attributes or RECS. As mentioned earlier in this Chapter, these renewable energy attributes or RECs are traded separately from the underlying electricity. New Hampshire was the first state in the nation to create RPS incentive provisions for thermal renewable systems that are equivalent in value to those for renewable electric technologies.

Electricity in New Hampshire is also generated from the combustion of wood by seven major power plants in New Hampshire. In the Central NH Region, Wheelabrator Concord Company operates a waste-to-energy plant that includes two furnace/boiler systems that processes up to 500 tons of solid waste per day. The plant produces high pressure steam capable of producing around 14 megawatts of electricity annually, close to supplying the electricity for 17,000 homes.

Interest in biomass as a source of heating has also been increasing for residential, commercial, and municipal uses, thanks in part to rebate programs and other sources of funding the last few years. New Hampshire's new commercial and industrial rebate program for wood pellet boilers issued 13 rebates in state fiscal year 14; none are located in the Central NH Region. In 2012/2014, five rebates were issued under the residential wood pellet program in the towns of Pittsfield, Warner, Hillsborough, Bow and Canterbury.

Recent data shows that 16 municipal/institutional **wood chip** heating systems have been installed statewide; in the Central NH Region, two systems have been installed, one at the Merrimack Valley School District in Penacook and Pembroke Academy in Pembroke.

Municipal/Institutional **wood pellet** heating systems in New Hampshire now total over 29 systems, including the following locations in the Central NH Region: the New Hampshire Department of Resources and Economic Development's warehouse in Allenstown; Hopkinton town garage; New England College in Henniker; and New Hampshire Audubon in Concord.

Wind Power

While New Hampshire may not have the wind power capacity or potential of other states, there have been three major wind projects approved by the state's Site Evaluation Committee (SEC) and others are in the queue. SEC functions as the state's pemitting authority for the review, approval, monitoring and enforcement of compliance in the planning siting, construction and operation of energy facilities. See www.nhsec.nh.gov/index.htm for more information on the Committee.

Most of the US wind power capacity is from Texas up to North Dakota and the west coast. While the "wind farm" development is an intensive undertaking, there have been advances in in community scale wind turbine technology and the interest continues, albeit on a limited scale when compared to other renewables such as solar and biomass. While Boscawen has a wind ordinance, no applications have been received to date.

Hydropower

Hydropower, or hydroelectric power, is considered to be the most common and least expensive source of renewable electricity in the United States today. According to the U.S. Energy Information Administration, historically, all renewable electricity generated in the United States came from hydropower resources. In NH, close to 30% of renewable electricity is provided by hydropower.

Hydropower technologies use flowing water to create energy that can be captured and turned into electricity. There is a long history of hydro not only in the state but in the Central NH Region.

Below is a list of the current facilities operating in the Central NH Region.

Penacook Upper Hydro – upper and lower falls located on the Contoocook River, operated by Briar Hydro Associates.

Rolfe Canal – Located upstream of Penacook Falls along the Contoocook River, operated by Briar Hydro Associates.

Jackman Hydro – operated by Eversource, the facility is located in Hillsborough on the north branch of Contoocook River. (3.6MW)

Garvin Falls – operated by Eversource, the facility is located on the Merrimack River. (12.4MW)

Geothermal

The common type of geothermal energy uses the more readily accessible soils where the temperature of the ground is 50 to 55°F at 4 or more feet below the surface (below the frostline). This utilization of energy in the ground is more correctly termed geothermal heat pump system, ground source heating or "geoexchange." There are two main components, the heat pump and the circulation system that is drawing the heat from the ground. These systems are becoming more popular but they do have some limitations that can restrict their use. The units can be very expensive with upfront costs in the range of

$20,000-$35,000 or more. The differences between a closed loop and open loop system for well systems tend to be specific to the site in question and requires careful study of the site characteristics.

There are other hybrid type systems that use several different geothermal resources that won't be discussed here but can be found at: www.energy.gov/energysaver/articles/geothermal-heat-pumps.

In New Hampshire, geothermal systems are regulated by the Department of Environmental Services (DES). The Environmental Protection Agency (EPA) requires states to inventory several classes of injection wells. Open loop wells are considered Class V injection wells which needs to be registered with DES. Closed loop systems also are required to register with DES. For more information, see

www.des.nh.gov/organization/commissioner/pip/factsheets/dwgb/documents/dwgb-22-23.pdf.

An example of a large and successful geoexchange project is the Merrimack County Nursing Home (MCNH) in Boscawen, NH. This is a nursing facility that, on average, has about 290 residents and a staff of 425, and is roughly 235,000 square feet.

BOSCAWEN'S ENERGY PROFILE

The first step toward reducing municipal energy use is to establish a baseline for comparison. Boscawen started the process of benchmarking its energy use by completing an inventory of lighting, electrical, and heating fuel usage for several key municipal facilities. With these data as a starting point, the Town can measure the effectiveness of future energy reduction efforts. These data are a snapshot of a recent twelve-month period that demonstrates annual municipal energy demand and the cost for energy expended by the Town for these facilities. The buildings used in the analysis were chosen by the Town due to their level of use and availability of data. A complete energy inventory of all facilities, including presently dormant buildings (former police station, former town offices, former library space, and Old Town Hall), the Merrimack Valley School District and the Penacook/Boscawen Water Precinct, is recommended for future benchmarking. Municipal vehicle fuel usage (DPW trucks, police cruisers, fire vehicles, etc.) should also be monitored and analyzed as part of the Town's total energy inventory.

Table _ displays annual energy costs and **Table** _ shows usage and building efficiency. Using 2010 data over a twelve-month period, the inventory indicates that the Town of Boscawen spent over $50,000 in 2010 to heat and light the targeted municipal buildings and facilities, at a total average cost of $1.85 per square foot. Cost per square foot, or cost use intensity, does not in itself indicate the relative efficiency of the buildings, but rather shows which buildings cost more or less to operate. The sewer pumping station has a very high cost use intensity due to its small structure size. In that case, total cost and overall potential cost savings should be considered more important than the cost per square foot.

Table
Annual Municipal Energy Costs for Targeted Facilities, 2010

Source: Town of Boscawen and Peregrine Focus Energy Inventory Tool

Facility	Electricity Cost	Natural Gas Cost	Oil Cost	Propane Cost	Total Cost	Sq. Ft.	Cost per Sq. Ft.
Municipal Building (Town Offices & Police Department)	$16,087	$2,657	$0	$0	$18,744	13,974	$1.34
Street Lights*	$12,093	N/A	N/A	N/A	$12,093	N/A	N/A
Fire Station	$1,106	$0	$0	$8,000	$9,106	6,237	$1.46
DPW (Town Sheds)	$1,238	$0	$2,946	$0	$4,184	1,632	$2.56
Library (in Municipal Building)	$3,217	$795	$0	$0	$4,012	4,600	$0.87
Transfer Station	$1,511	N/A	N/A	N/A	$1,511	1,020	$1.48
Sewer Pumping Station	$1,250	N/A	N/A	N/A	$1,250	63	$19.84
TOTAL:	**$36,502**	**$3,452**	**$2,946**	**$8,000**	**$50,900**	**27,526**	**$1.85**

**Street light data for the 12-month period from Aug. 2010 to Aug. 2011. All other data for calendar year 2010.*

Table _ and **Figure _** compare energy use by facility. Energy use is displayed both in native units (kWh, gallons, or therms) and converted to a common energy unit, million British thermal units (MMBtus). Site energy intensity is expressed as thousand Btu (kBtu) per square foot. This table illustrates the energy intensity of each targeted facility. The total energy usage for the facilities is 1,550 MMBtu, which, over the total building square footage of 27,526, results in a total average energy intensity of 56.3 kBtu per square foot. Again, the Sewer Pumping Station has a very high energy intensity due to relatively high electricity use for the small structure size. The actual process efficiency of the pumping system is not reflected. Aside from the pumping station, the least efficient facility is the Public Works shed at 112.1 kBtu per square foot. This is higher than average for similar buildings across New Hampshire (which tend to be closer to 80 kBtu/sq. ft.)[1].

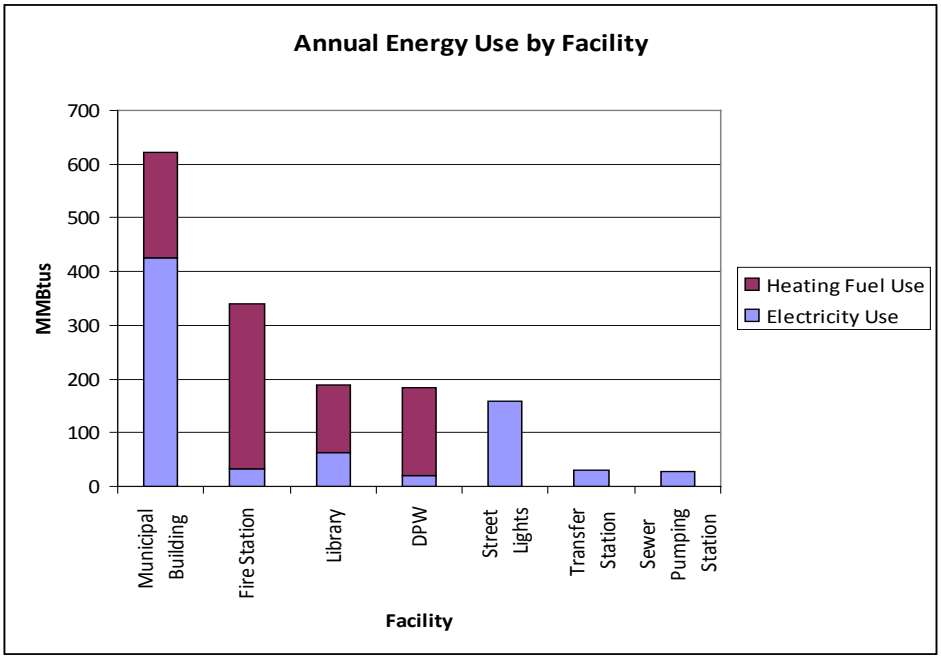
[1] Peregrine Energy Group data collected through the Energy Technical Assistance and Planning (ETAP) program in 2010-2011.

Table
Annual Municipal Energy Use for Targeted Facilities, 2010
Source: Town of Boscawen and Peregrine Focus Energy Inventory Tool

Facility	Electricity Use	Heating Fuel Use	Total MMBtus	Sq. Ft.	kBTU per Sq. Ft.
Municipal Building (Town Offices & Police Department)	125,080 kWh 426 MMBtu	1,971 Therms 197 MMBtu	623	13,974	44.6
Street Lights*	46,235 kWh 158 MMBtu	N/A	158	N/A	N/A
Fire Station	9,483 kWh 32 MMBtu	3,374 gal. 308 MMBtu	340	6,237	54.5
DPW (Town Sheds)	5,737 kWh 20 MMBtu	1,161 gal. 163 MMBTU	183	1,632	112.1
Library (in Municipal Building)	18,640 kWh 64 MMBTU	1,251 Therms 125 MMBtu	189	4,600	41.1
Transfer Station	8,396 kWh 29 MMBtu	N/A	29	1,020	28.4
Sewer Pumping Station	8,711 kWh 28 MMBtu	N/A	28	63	444.4
TOTAL:	**222,282 kWh 757 MMBtu**	**793 MMBtu**	**1,550**	**27,526**	**56.3**

**Street light data for the 12-month period from Aug. 2010 to Aug. 2011. All other data for calendar year 2010.*

Figure
Annual Energy Use for Targeted Facilities, 2010
Source: Town of Boscawen and Peregrine Focus Energy Inventory Tool



According to data collected by Peregrine Energy Group under the Energy Technical Assistance Program (ETAP) in 2010-2011, Boscawen's other targeted facilities have average or below average energy intensity compared to similar municipal buildings in New Hampshire. Additional energy savings are always possible; however, payback periods for improvements may be very long and the investments may not be cost effective if measured in the short term. **It is important to note that Peregrine Energy Group completed a building assessment for the Town in August, 2011 and found few major problems where immediate improvements were warranted.** As municipal facilities are maintained, upgraded, or expanded, energy improvements should be considered and total life cycle costs (ongoing operational costs) associated with more efficient systems should be analyzed. Often, new and very efficient systems or equipment may cost somewhat more up front, but savings are paid back over time with the lower energy use associated with their operation.

PLANNING AND ENERGY POLICY

Energy planning continues to receive increasing attention at the policy level due to rising energy costs and the relationship between energy use, economic activity, and environmental impacts. The principles of "smart growth" support energy conservation and efficiency through thoughtful community design. Compact development patterns, open space preservation, and multi-modal transportation options are core elements which contribute to energy-conscious development while preserving traditional rural character.

When communities are designed so that residential areas are convenient to businesses, services, and amenities, residents are able to complete daily tasks in fewer trips and using less fuel. Compact development allows for greater density while reducing the miles of roadway, water and sewer lines, and other infrastructure needed to serve homes and

businesses. Providing pedestrian, bicycle, and ride sharing facilities means that people have less energy-intensive options for getting around town. Efficient building construction can significantly reduce energy use and operating costs for the life of the building. Finally, local renewable energy production allows property owners to have control of their electricity, heating, and hot water generation without consuming additional non-renewable fuels. Local regulations can support and influenced these elements as a way to encourage a more energy-conscious community.

While many energy issues are outside of local, regional and state jurisdiction, there are several key areas where there are opportunities to impact policy and weigh in on those policies that have a direct connection to municipal affairs. Awareness of state policies and how they can influence local energy planning and available program/project development is important as the region and its communities strive to achieve more energy efficiency.

STATE ENERGY STRATEGY (SB191)

An Advisory Council was tasked with developing a revised 10-year statewide energy strategy, the aim of which is to provide forward-looking guidance on electric, gas, and thermal energy strategies and optimize the ready availability of energy supply, energy affordability, the state retention of energy expenditures, jobs, and the use of renewable energy sources and energy efficiency policies, including demand-side policies.
The four main categories that frame the energy strategy are:

- Advance electric grid modernization;
- Increase investments in cost effective energy efficiency;
- Diversify fuel choice; and
- Increase transportation options.

More detail on the recommendations is available at:
www.nh.gov/oep/energy/programs/documents/energy-strategy.pdf

ENERGY EFFICIENCY RESOURCE STANDARD (EERS)

An EERS establishes specific targets for energy savings that utilities or non-utilities must meet through customer energy efficiency programs. Currently, New Hampshire is the only state in the northeast with no EERS or its equivalent. Nationwide, twenty-six states have an EERS with the strongest requirements in Massachusetts, Rhode Island and Vermont, which all require close to 2.5% savings annually. A long standing recommendation of earlier studies in New Hampshire, there is currently a project underway by the PUC to draft an EERS.

CLIMATE CHANGE ACTION PLAN

A Climate Change Policy Task Force was convened in 2008 and developed a statewide Climate Action Plan in 2009.[2] According to the New Hampshire Climate Action Plan,

[2] *The New Hampshire Climate Action Plan: A Plan for New Hampshire's Energy, Environmental and Economic Development Future*, March 2009, available at http://des.nh.gov/organization/divisions/air/tsb/tps/climate/action_plan/nh_climate_action_plan.htm.

the most significant reductions in both emissions and costs will come from substantially increasing energy efficiency in all sectors of our economy, continuing to increase sources of renewable energy, and designing our communities to reduce our reliance on automobiles for transportation. As stated in the Plan, a response to climate change and our economic future is inextricably tied to how we produce our energy and how much energy we use. [3] The Plan calls for long-term reductions in greenhouse gas emissions of 80% below 1990 levels by 2050, with an interim goal to reduce emissions by 20 % below 1990 levels by 2025. A total of 67 specific recommendations are made to achieve that goal. They include: direct energy savings in buildings, transportation, and electricity generation; natural resource protection; supporting regional initiatives; public education and workforce training; and adaptation to existing and potential climate impacts.

NET METERING

The Public Utilities Commission allows net metering which permits homeowners to receive credit for on-site electricity generation such as from a solar photovoltaic (PV) or wind turbine installation when the generation exceeds household or business consumption. This is accomplished by use of an electric meter that can run both forward and backward so that the host is billed only for the net reading on the meter. The 2012 data shows that over 1,000 installations have taken place through the four utilities, with the most by Eversource.

GROUP NEW METERING

Recently allowed by the PUC, this is a type of metering that allows a group of customers to combine meters as a single billing and to join together to offset their electric bill as a new metered system. While it works similar to net metering, group metering allows one generating source to share the generation with a group of customers within the same utility service area. The benefit of group net metering is that one resident, who may have the ideal location for solar, can now share the renewable energy, and costs, with others.

BUILDING ENERGY CODE

The New Hampshire State Building Code for residential and commercial buildings is now the 2009 International Energy Conservation Code (IECC). A part of the overall building code, the energy code establishes minimum requirements for energy efficient design and construction for both new and renovated buildings. By establishing the minimum requirements, the codes set the baseline for energy efficiency in new construction and major renovations to which further design upgrades and strategies may be compared. A structure built to the 2009 energy code requirements will be 14% more energy efficient than one built to the 2006 code. Likewise, the 2012 code represents a 30% improvement in energy performance over the 2006 code. These represent incremental steps toward the goal of net zero buildings by 2030. Only Durham has adopted the stricter 2012 code in New Hampshire.

Reducing energy usage in New Hampshire buildings is the main goal behind the NH Building Code Collaborative. The goal of the Collaborative is to achieve 90% building code compliance by 2017. It is estimated that New Hampshire is now at <50% compliance.

[3] Ibid., p. 1.

There are online resources available at www.nhenergycode.com as well as publicized training events statewide.

In New Hampshire, residential and commercial buildings represent 50% of the state's total energy consumption. New Hampshire buildings use more energy and emit more carbon dioxide than either the industrial or transportation sectors. (Source: New Hampshire Baseline Residential and Commercial Construction Activity and Associated Market Actors Characterization prepared by GDS Associates, March 2011: www.nhenergycode.com/live/code_docs/roadmap/APPENDIX%20A%20-%20NH%20Baseline%20Construction%20Activity%20and%20Market%20Characterization%20Report%20-%20March%202011.pdf.

STATE LEGISLATION

In New Hampshire, municipalities possess legal powers as enabled by state legislation. A number of state statutes authorize municipalities to take action on energy matters:

- **RSA 672:1, III**: "Proper regulations enhance the public health, safety and general welfare and encourage the appropriate and wise use of land."

- **RSA 672:1, III-a**: "Proper regulations encourage energy efficient patterns of development, the use of solar energy, including adequate access to direct sunlight for solar energy uses, and the use of other renewable forms of energy, and energy conservation. Therefore, the installation of solar, wind, or other renewable energy systems or the building of structures that facilitate the collection of renewable energy shall not be unreasonably limited by use of municipal zoning powers or by the unreasonable interpretation of such powers except where necessary to protect the public health, safety, and welfare."

- **RSA 674:17, I(j)** states that one of the primary purposes of zoning ordinances adopted by municipalities is "To encourage the installation and use of solar, wind, or other renewable energy systems and to protect access to energy sources."

- **RSA 155-A:2, VI** permits communities to adopt stricter measures than the New Hampshire State Building Code, such as requiring new buildings to use highly efficient insulation or to take advantage of passive solar energy.

- **RSA 72:61-72** allows municipalities to offer property tax exemptions on solar, wind, and wood heating energy systems, including solar hot water, solar photovoltaic, wind turbine, or central wood heating systems (not individual woodstoves). Close to 50% (9) of the Central NH Region's communities have enacted renewable energy exemptions:

MUNICIPALITY	SOLAR	WIND	WOOD
Bow	√		√

Canterbury	√		
Chichester	√		√
Deering	√		
Hillsborough	√	√	√
Hopkinton	√		
Henniker	√	√	√
Warner	√	√	
Webster	√		

- **RSA 674:62-66** gives authority to municipalities to regulate the construction of small wind energy systems up to 100 MW and prevents municipalities from enforcing unreasonable limitations on their construction and operation.

- **RSA 53 -** In 2010, House Bill 1554 was signed into law and allowed municipalities to establish energy efficiency and clean energy districts. Once a district is adopted by a municipality, an innovative financing tool called Property Assessed Clean Energy (PACE) comes into play. PACE enables municipalities to set up programs to fund energy improvements in commercial buildings and allows repayment of the investments through property "tax" assessments. It is important to note that the financing is tied to the property, not the building owner(s) and paying for investment through property taxes can allow for more affordable and longer term paybacks.

  Since its adoption in 2010, concerns were raised by federal housing authorities regarding lien positions on residential mortgages. The 2014 amendments to this original legislation address many of these concerns by focusing the program on commercial buildings and clarifying lien positions by requiring agreements between all parties (municipality, mortgage lienholder, property owner and PACE lender). The cap on commercial projects in the original legislation ($60,000) is also revised, now increasing the project size cap to $1 million or 35% of the property and building assessment if the financing comes from the municipality; privately financed projects have no cap. The amendment also allows financing sources to include banks, financial institutions or private investors. It is important to note that municipalities can designate a partner to administer this program as it does have some complexity to it. For more information, see the Jordan Institute's website: www.jordaninstitute.org.

LOCAL ENERGY COMMITTEES

There are currently eight Local Energy Committees (LECs) in the Central NH region – Bow, Henniker, Hopkinton, Dunbarton, Concord, Pembroke, Warner and Webster. Some Committees are working on energy chapters in master plans, inventories or audits of municipal buildings and/or moving forward with special projects such as wood pellets for public facilities. Two communities moved forward with this earlier work and adopted energy chapters – Concord and Warner.

LOCAL ENERGY PLANNING

The Innovative Land Use Planning Techniques Handbook, available on the NH Department of Environmental Services website, contains model ordinance and regulatory language for municipalities to implement a variety of measures addressing sprawl, environmental, and energy concerns. In addition, nearly 100 communities have formed local energy committees (LECs) to advise municipal officials and educate the public about energy issues. Through the statewide Energy Technical Assistance and Planning (ETAP) program, administered by the NH Office of Energy and Planning (OEP) in 2010-2011, many communities have undertaken municipal building energy assessments, master plan energy chapters, energy capital improvement planning, and other actions to achieve energy savings.

RECENT MUNICIPAL ENERGY ACTIONS

The Town of Boscawen has already begun to take steps to conserve energy and increase efficiency at municipal facilities. Several municipal functions were combined and moved to the Municipal Building in 2003 and 2006 to centralize operations. Today, the Town Clerk, Tax Collector, Administrator, Land Use Planning, Finance, Police, and the Town Library are all located at 116 North Main Street. Prior to the move, the building (formerly the school building) was thoroughly renovated, with new HVAC systems, attic insulation, and new windows installed. Programmable thermostats have been installed. Lighting has been upgraded to more efficient fixtures in recent years through Unitil's retrofit program and there is an active program to continue high efficiency light repacement. The Library portion of the building underwent a renovation in 2006, when high efficiency lighting and HVAC systems were installed. The Town is currently working with Unitil to secure an energy audit as well.

The former Town office, police, and library facilities remain dormant until new uses or tenants are located. The Town Hall meeting space is located in the basement of the Congregational Church at the intersection of US 4 and US 3. This space is kept closed except when used for community meetings, and energy use is generally low. The Fire Station, run by a volunteer crew, is also used minimally. Emergency medical services are provided by Penacook Rescue, a separate entity with its own facility. The Public Works Shed, which loses heat through bay doors with entering and exiting maintenance vehicles, is kept at the lowest acceptable temperature during the heating season.

The Merrimack Valley School District (MVSD) operates separately from the Town of Boscawen. Boscawen Elementary School and the regional MVSD Middle and High Schools are all located in Town. As mentioned previously, the School District installed a wood chip heating plant in 2006 to service the Middle and High Schools. In 2009, a connection was installed to the SAU building nearby. The School District was one of the first in New Hampshire to install a biomass heating facility. According to an analysis by the Jordan Institute, the construction of the biomass heating system, along with systemic building renovations and efficiency improvements, have resulted in a 57% reduction in energy use

and a 61% cost savings.[4] In addition to the new heating plant, the School District completed a lighting retrofit for the Boscawen Elementary School in 2009 to install more efficient lighting fixtures. Motors and other systems are replaced with Energy STAR rated equipment in the course of regular upgrades.

At the local policy level, several Town ordinances have been adopted with particular energy impacts. The Town of Boscawen adopted a Small Wind Energy Systems Ordinance in 2009, an Accessory Dwelling Units Ordinance and an Outdoor Lighting Ordinance both in 2010. The Small Wind Energy Systems Ordinance sets compliance standards, construction and removal procedures, and establishes a permitting process for small wind turbines in Boscawen. The Accessory Dwelling Units (ADU) Ordinance accommodates flexible and affordable housing arrangements which can increase density in residential areas without adding additional lots or new structures. However, ADUs are not permitted as freestanding structures, and may only be occupied by immediate family members of the property owner. The Outdoor Lighting Ordinance, also known as a "Dark Skies" ordinance, contains performance standards limiting the brightness of outdoor lighting fixtures and requiring energy efficient lamps. The Ordinance also requires outdoor lighting to include timers, dimmers, or motion sensors to limit unnecessary energy use when the light is not needed.

A Cluster Development provision is also part of the Town's Zoning Ordinance. This allows new subdivisions to be designed so that homes are built closer together and blocks of open space are preserved. With smaller lot sizes and a more compact design, cluster developments can save energy on construction, infrastructure, and service provision. They also result, ideally, in a network of permanently conserved open space that is protected from future development and provides natural ecosystem services necessary for stormwater recharge, floodplain storage, wildlife habitat, and the like.

All of the actions taken to date by the Town and the School District demonstrate Boscawen's interest and commitment to reducing energy use and costs. It is clear that effective facility management and the responsible use of public funds are a priority for municipal managers. With additional energy data benchmarking and continual monitoring, the results of such efforts will be measurable.

ENERGY VISION

The overall vision for Boscawen is a community that supports and preserves its rural character while looking for opportunities to improve economic development, reduce municipal expenditures and promote efficient development that embraces the concept of energy efficiency. Boscawen's energy policies as they relate to energy generation, building standards, transportation and land use development patterns can have a direct impact on the community's vitality and long term sustainability.

[4] Energy Fact Sheet: Merrimack Valley High. The Jordan Institute. Accessed 11/1/11 at http://neep.org/uploads/policy/HPSE/Merrimack%20Valley%20Energy%20Case%20Study.pdf.

OBJECTIVES AND RECOMMENDATIONS

1. To reduce municipal energy usage and costs and improve energy efficiency in municipal operations.

    - Actively monitor municipal energy usage and costs to track progress resulting from energy saving initiatives.

    - Continue to develop departmental energy policies to save energy through behavioral changes (such as programming thermostats, turning out unnecessary lights, and turning off electronic equipment when not in use).

    - Continue to implement building energy improvement plans to increase the efficiency of municipal buildings, and incorporate planned improvements into the municipal budgeting process.

    - Investigate options for renewable energy at municipal buildings.

2. To encourage and support energy-conscious development throughout Boscawen.

    - Review and revise existing land use regulations as necessary to provide for energy-conscious development, such as cluster subdivisions, accessory dwelling units, mixed use, infill development, outdoor lighting, and incentives for green building design.

    - Review adequacy of existing regulations for renewable energy installations such as solar arrays.

    - Identify those development projects in the Transportation Chapter that prioritize development projects with options for energy efficient transportation modes, such as bicycle and pedestrian facilities, access to public transportation, ride sharing, proximity to community amenities, shared parking and driveways, and a highly connective road network.

    - Continue to keep apprised of the Energy Building code and opportunities for education and training offered for code enforcement officials.

3. To inform Boscawen residents and business owners on energy conservation, efficiency, and renewable energy measures and where to find additional information and funding.

    - Maintain information and links on the Town of Boscawen's website and at the library for residents and business owners on home energy saving strategies, renewable energy system installation, business energy programs, available financing, tax credits, green building design, etc.

- Sponsor and/or partner with others on workshops or events on energy conservation, efficiency, and renewable energy, and/or notify residents of regional events.

- Consider establishing an Energy Committee to advise the Town on energy matters and provide resources to residents and business owners relating to energy improvements.

ADDITIONAL ENERGY OPPORTUNITIES

There are a number of actions that Boscawen can take to implement some of the recommendations identified above. A comprehensive strategy could include municipal policy and operational changes, land use regulation revisions, and concerted outreach efforts. As identified in this Chapter, there are several informational resources and programs available that Boscawen could pursue.

Installing renewable energy systems at municipal facilities would reduce the Town's pollutant emissions and increase local energy independence. Other communities in New Hampshire have begun to harness such technologies, such as solar photovoltaics (PV), solar hot water, and biomass systems. For example, the Town of Canterbury installed a solar PV array in 2010 which helps to power three municipal buildings. The City of Concord installed solar hot water panels in 2011 on several fire stations around the city. Renewable systems such as these could be considered for Boscawen's municipal facilities, although site-specific conditions and building use patterns will dictate whether they are feasible and whether there is an attractive payback period for the initial investment.

Another potential system change could be for the Boscawen DPW to replace the existing oil furnace with one designed to burn waste oil collected from Town vehicles and residents. The Town of Bradford has installed such a system at its Highway Department, which burns hotter than standard systems to burn off the extra pollutants in the waste oil. This system has two major advantages: waste oil is basically a free fuel resource, thus reducing operating costs; and it saves the Town from having to otherwise dispose of a waste product. The NH Department of Environmental Services has a grant program available to assist municipalities in setting up oil collection centers, installing waste oil heat systems, and ensuring annual system maintenance.[5]

ACTION ITEMS

The following actions are tied to the goals and objectives identified in this chapter and contain specific tasks that the Town could consider in its continuing efforts to reduce energy consumption. These items address actions both within the municipal government and within the wider community.

[5] NH DES Used Oil Management Program: http://des.nh.gov/organization/divisions/waste/orcb/fms/uomp/index.htm.

Municipal Operations: The Town has already taken steps to reduce energy consumption and costs; however, additional strategies or action could include:

- Regularly track and monitor energy consumption using energy inventory and benchmarking tools to evaluate progress toward goals.
- Consider replacing the DPW heating system with a waste oil system, using used oil from municipal vehicles and residential used oil collected from the Transfer Station.
- Purchase more fuel efficient vehicles, or conversion to cleaner burning fuels such as biodiesel where possible.
- Additional interior lighting assessments to eliminate unnecessary fixtures and retrofit with more efficient lighting where and when cost effective.
- Additional streetlight retrofits.
- Purchase of energy efficient equipment when replacing appliances or systems.
- Reduction of solid waste through purchasing choices (choosing less packaging, reusing items, etc.), recycling, and composting.
- Establishment of a no-idling policy to reduce vehicle emissions, and/or purchase of technology such as idling retrofits that provide auxiliary power while engines are off to reduce emissions.
- Installation and promotion of pedestrian, bicycle, carpooling, and public transportation facilities, in coordination with state and regional programs (such as NH Rideshare, and Safe Routes to School).
- Installation of renewable energy production systems (solar, wind, geothermal, biomass) at municipal facilities, where appropriate and when cost effective.

Public Outreach: In order to effectively share energy information resources with the public and encourage reductions in private energy use, there are several steps that the Town of Boscawen could take:

- Establish a Local Energy Committee to advise municipal officials and work on public outreach efforts.
- Develop energy section on the Town website, including energy saving tips, tax incentive information, available financing and rebates, and other resources.
- Place informational materials in a central location, such as at the Town Library, where residents may pick up hard copies of fact sheets and brochures.
- Organize periodic public workshops or events with other partners where residents on topics such as weatherization, renewable technologies, and financing mechanisms.
- Participate in regional energy committee meetings, workshops, and events to share knowledge and collaborate with counterparts in nearby communities.

Policy and Regulations: If the Town wishes to consider certain revisions or additions to Boscawen's existing ordinances and regulations, the following could be looked at.

- Consider adopting RSA 72:61-72 to offer tax exemptions for renewable energy installations.
- Consider modifying the Subdivision Regulations to require energy efficient building siting and design for passive solar gain, wind protection, and appropriate landscaping (see Innovative Land Use Planning Techniques Handbook).
- Consider adopting a comprehensive Green Building Ordinance which sets energy performance standards for new and substantially improved construction (see Innovative Land Use Planning Techniques Handbook).
- Consider adopting a local Building Code with requirements that exceed the State Energy Code.
- Consider adopting a post-construction stormwater management ordinance that requires design for 100-year storm events.
- Include energy improvements for municipal buildings and vehicle fleets in long-range capital improvements planning discussions, and prioritize such improvements during the annual budgeting process.

This is not intended to be an exhaustive list. No single strategy or action will lead Boscawen to achieving more energy efficiency. The pursuit of both small and large changes will be necessary to reach the desired level of savings. It is also important to note that policy shifts, planning considerations, and behavioral changes are just as important as making system or equipment improvements.

SUMMARY

The overall intent of this Chapter is to provide a general analysis of Boscawen's municipal energy use and to identify strategies for the Town to pursue in the areas of energy conservation, efficiency, clean energy options, and energy-conscious development. The Town is being proactive and is taking steps toward reducing energy consumption and costs. Additional opportunities exist for the Town to continue its efforts, including changes to land use policies, municipal operations, and public outreach. By implementing such changes, Boscawen can save energy and taxpayer dollars, reduce pollutant emissions, and create a community with a strong quality of life. A community that supports energy efficiency efforts also supports sustaining settlement patterns that reduce transportation infrastructure, conserve natural resources and promote open space protection.

As stated earlier in this Chapter, transportation is the leading source of energy use in the state. While it is possible to accomplish both compact design and maintaining rural character, there can be challenges that arise and need to be addressed.

There is also the increasing concern for the aging population at both the local, regional and state levels and its impacts on our abilities to reach destinations - for recreation, health care and social services. This has a direct correlation to the land use patterns and infrastructure of our communities and how we need to get from point A to point B. As New Hampshire's population continues to age, more compact development and transportation

challenges also become pressing critical needs in many of our communities. The link between energy efficiency and transportation is a strong one

As tax credits, rebates and other incentives continue to evolve and hopefully stabilize with a consistent funding stream, it is expected that renewable energy installations will become more prevalent. While there are certainly challenges that still need to be addressed, there are also opportunities to improve on the status quo. A wide range of financial and informational resources exist to help municipalities, business owners, and residents make positive changes in their energy consumption. Taken together, these actions will contribute to statewide energy reduction goals and increased energy independence, while creating economic and environmental benefits.

ADDITIONAL RESOURCES:

ENERGY EFFICIENCY PROGRAMS AND FUNDING SOURCES

In making energy improvements, Boscawen will need to access a variety of funding resources. Broadly speaking, funding sources can come from 1) grants, 2) incentives, 3) loans, or 4) municipal appropriations.

Many organizations as well as state and federal agencies provide numerous incentives and programs for citizens, businesses and local governments to take advantage of energy efficiency measures. While this list is by no means complete, there is an attempt to create a useful source for information on energy efficiency assistance.

Core Energy Efficiency Programs (NH Saves)

The CORE Electric Programs were funded initially by a portion of the System Benefits Charge (SBC) on customer's bills. The Programs represent a portfolio of cost-effective electric and gas programs available to all New Hampshire residents, businesses, municipalities, nonprofits, schools and universities. Recently, the Programs have been supplemented by funds secured by the utilities from the ISO-New England's Forward Capacity Market, and the Regional Greenhouse Gas Initiative (RGGI). Funding for the Natural Gas Utility Programs is through the Local Distribution Adjustment Charge (LDAC) on customer's bills. These energy efficiency programs are administered by New Hampshire's four electric and two natural gas utilities and are intended to assist in making energy efficiency improvements by providing incentives for weatherizing homes, upgrading to more efficient lighting and appliances and purchasing high efficiency gas and hot water systems. Other programs, such as the Large Business Energy Solutions (200 kWh or more; 40,000 therms or more) and a Municipal and Small Business Program, offer incentives for high efficiency electric and gas technologies such as lighting, programmable thermostats, coolers, hot water measures, refrigeration, etc., and are available for businesses and municipalities retrofitting existing buildings, performing retrofits or new construction. There are also education/training opportunities on such topics as the energy code and energy audits.

Following passage of SB 123 in 2013, the utilities were required to set aside $2 million dollars of the RGGI auction proceeds for a municipal program, including school systems. Following the program's development, letters were sent to municipalities in January, 2014. Utility representatives have contacted all community officials as of the writing of this Chapter.

Prior to 2014, the utilities had completed $1.5 million in municipal energy efficient work each year; the dedicated $2 million is allowing them to now do more targeted outreach. The utilities are also supporting the Local Energy Working Group (LEWG), to conduct outreach to municipalities (www.nhenergy.org). Funds are available for municipal customers to assist in hiring a contractor to provide technical assistance to help identify energy efficiency improvement opportunities and to help communities manage a project, if there isn't capacity at the local level. Each utility may have funding via a revolving loan fund to assist municipalities in paying for the improvements.

New Hampshire Pay for Performance

The New Hampshire Pay for Performance (NH P4P) is now in its third year of operation and is funded through RGGI. A recent extension of this Program was granted through state fiscal year 15. The goal of this Program is to address energy efficiency needs of the commercial, industrial and municipal sectors. TRC Energy Services administers the Program and has worked with 45 facilities across the state, totaling more than twelve million dollars in construction. Five projects funded in the Central NH Region include the Hopkinton School District with a heating system upgrade and boiler replacement, Pleasant View Center with lighting and heating upgrades, Comfort Inn with boiler upgrades and insulation and air sealing improvements, Associated Grocers of New England in Pembroke and Bovie Screen Process Printing in Bow with insulation and lighting upgrades. There are many resources available on the website, particularly in the area of audits that can be used as guidance for other communities seeking to pursue energy improvements/upgrades: www.nhp4p.com

Regional Greenhouse Gas Initiative (RGGI) Fund

In 2012, the General Court voted to modify the RGGI program and its associated revenue stream in New Hampshire. The law redistributes all future RGGI income that New Hampshire receives from the carbon allowance auctions from competitive grant programming administered by the Public Utilities Commission to, in part, ratepayers, with the remaining portion going into the existing CORE programs.

Renewable Energy Fund (REF)

Since its inception in July 2009, the Renewable Energy Fund has established five grant and rebate programs that have seen substantial demand and growth over time. The newest rebate program is for commercial and industrial wood pellet/furnace program for non-residential wood pellet heating systems. For more information on the REF rebates, see www.puc.nh.gov/Sustainable%20Energy/SustainableEnergy.htm.

The REF has awarded 1,614 rebates for renewable energy systems, and provided New Hampshire homeowners, businesses, schools, municipalities, non-profit organizations and

other eligible entities with $7,455,536 in funding towards these systems. In addition the PUC's competitive grant program has provided funding for renewable projects featuring technologies from biomass heating systems to hydroelectricity upgrades to photovoltaic, solar hot air, and landfill gas to energy, among others. In 2014, $3.8 million was awarded in grants. The ten projects funded include some of the largest solar projects to date and also include four biomass projects, two hydro, one wind and three solar projects. While none are located in the Central NH Region, they can certainly serve as models for future endeavors in this area. These ten commercial-scale renewable energy projects will move forward with grants ranging from $100,000 for biomass boilers at schools in Walpole and Charlestown to $1.2 million for the installation of a 950 kilowatt solar power array in Peterborough - the largest such array in New Hampshire. Among other grants, a $1 million award will help fund an 8.6 megawatt wind farm in Berlin, while a $300,000 grant will fund a biomass district heating system at the Holderness School.

COMMUNITY DEVELOPMENT FINANCE AUTHORITY (CDFA)

Municipal Energy Reduction Fund (MERF) and Better Buildings

These Programs are managed by the Community Development Finance Authority (CDFA) and are available to help municipalities improve the energy efficiency of their municipal buildings and operating systems. CDFA was awarded $1.5 million in funding from the Greenhouse Gas Emissions Reduction Fund, through the PUC to capitalize the MERF fund and to finance energy improvements to municipal facilities and activities.

Loans to municipalities are structured out of energy savings. The savings are calculated based on the last several years of energy usage and several years of future projected usage. The terms of the loans will be flexible and can be structured as a service contract if desired by the municipality. Eligible activities are improvements to HVAC equipment, air sealing and insulation in walls attics and foundations and installation of alternative energy sources.

Enterprise Energy Fund (EEF)

The Enterprise Energy Fund is another program managed by CDFA and is a low-interest, revolving loan fund available to businesses and nonprofit organizations to help finance energy improvements and renewable energy projects in their buildings. CDFA and its partners were initially awarded $3.5 million in American Recovery and Reinvestment Act funding through the New Hampshire Office of Energy and Planning, to capitalize a revolving loan fund, the Enterprise Energy Fund. An additional $3.1 million was approved in November 2010 for use only in commercial businesses. Funds will be loaned to businesses and nonprofits to reduce their energy costs and consumption; loan amounts can range from $10,000 to $500,000.

NEW HAMPSHIRE BUSINESS FINANCE AUTHORITY (BFA)

Business Energy Conservation Revolving Loan Fund

Administered by the BFA, loans are available to for-profit and non-profit entities to improve energy efficiency in New Hampshire work places. Some of the requirements for the program are a minimum loan amount of $100,000 with a term not to exceed five years.

While no minimum collateral coverage is required, the BFA will seek a security interest in all assets being financed.

FEDERAL TAX CREDITS

Available at 30% of the cost, these tax credits are available with no upper limit through 2016 for existing homes and new construction for geothermal heat pumps, small residential wind turbines and solar energy systems. Installation costs on primary and secondary homes, excluding rentals, are eligible. For residential fuel cells and microturbine systems, 30% of the cost is eligible for the tax credit; there is a cap of up to $500 per 0.5 kW of power capacity and only primary residences can apply. All must meet energy star requirements in order to be eligible for the tax credit:

www.energystar.gov/index.cfm?c=tax_credits.tx_index.

USDA RURAL ENERGY FOR AMERICA PROGRAM

The USDA's mission for this program to aid agricultural producers and small businesses in rural areas to reduce their energy use and expand opportunities for renewable energy. The Program awards grants, guaranteed loans, or a combination of the two to a variety of projects. Eligible communities are those of less than 50,000 population and those not contiguous to a community of 50,000 or more. In New Hampshire, all communities would be eligible except Manchester, Nashua and any abutting communities.

ADDITIONAL REFERENCE MATERIALS

The resources listed below provide additional information guidance on model ordinance language, design standards, and other concepts of energy conscious development.

Energy Resources for Communities

Innovative Land Use Planning Techniques Handbook

This Handbook provides background information, legal references, and model ordinance and regulation language for a number of innovative land use tools available to communities. Model language for energy efficient development, stormwater management, infill development, agriculture incentive zoning, access management, and landscaping is included in the guide. Website address is:
(www.des.nh.gov/organization/divisions/water/wmb/repp/innovative_land_use.htm)

NH Climate Action Plan

Released in 2009, the Plan developed by the statewide Climate Change Policy Task Force in coordination with the NH Department of Environmental Services. The Plan sets a long-term goal for the state to reduce greenhouse gas emissions to 80 percent below 1990 levels by 2050, and an interim goal of 20 percent below 1990 levels by 2025. The Plan focuses on economic opportunities, increasing energy security, and improving environmental quality. A total of 67 recommendations are made in order to achieve the reduction goals. Website address is:
www.des.nh.gov/organization/divisions/air/tsb/tps/climate/action_plan/nh_climate_action_plan.htm

NH Local Energy Work Group

Internet portal to facilitate the interaction between Local Energy Committees across New Hampshire. Local Energy Committees are encouraged to update information on the website pertaining to their committees. Website address is: www.nhenergy.org.

Energy Aggregation

New Hampshire's electric industry functions underneath a deregulated market. This allows the commodity of electricity to be separated from the regulated transmission and distribution services. RSA 53-E allows for residents, business and municipalities to aggregate their electric load together to form a Community Choice Aggregate (CCA). A CCA is a regional entity formed through the legislative body of a municipality, whose purpose is to offer energy services to its members. The Nashua Regional Planning Commission is currently in the process of forming a CCA with over ten municipalities in its planning region. For more details, visit http://www.nashuarpc.org/energy-environmental-planning/energy-aggregation/

Energy Audits

Tools currently available include the Small Town Carbon Calculator (STOCC) developed by UNH and Clean Air-Cool Planet that can total energy use and costs and the Portfolio Manager developed by EPA that tracks energy trends and reports for buildings and water utilities over multiple years (www.nhenergy.org/calculators.html). Many communities struggle with this phase and need consistent assistance in accomplishing this task.

PRIVATE INVESTMENT FUNDING

Besides reliance on the building owner financing the improvements, there is another type of underwriting for larger commercial buildings/owner through an Energy Services Company (ESCO). ESCOs generally guarantee the energy savings and make the upfront investment in energy efficiency.

Energy Services Companies Overview (ESCO)

With a service contract usually between 7 to 20 years, ESCOs have the responsibility for turn-key project development, as well as the technical and performance risks. In addition, the ESCO may make recommendations for retrofits, maintenance services and training, or other conservation measures.

ESCOs have many different corporate and ownership structures; some are large engineering or equipment manufacturers while others may be subsidiaries of oil and gas companies or non-regulated energy suppliers. It is also common for regulated utility companies to own an ESCO.

ESCOs typically engage clients through Energy Performance Contracting (EPC) where the ESCO assumes performance risk, guaranteeing a minimum amount of energy-use reduction. EPCs address the main issue that tends to prohibit facility owners from investing in energy efficiency projects—an inability to guarantee savings and a return on capital investments. The MUSH (Municipal, Universities, Schools and Hospitals) market has been

"fertile ground" for ESCOs for many years and often uses energy performance contracts to implement projects.

When an ESCO undertakes a project, the company's compensation, and often the project's financing, is directly linked to the amount of energy that is actually saved. The comprehensive energy efficiency retrofits inherent in ESCO projects often require a large initial capital investment and offer a relatively long payback period. Debt payments are tied to the energy savings offered under the project so that the customer pays for the capital improvement with the money that comes out of the difference between pre-installation and post-installation energy use and other costs Performance Contracting

The Power Purchase Agreement (PPA)

Renewable energy projects are typically financed separately from energy-efficiency projects, often involving some form of bonding or other debt obligation. However, ESCOs and other providers are offering another tool for financing renewable energy projects: the power purchase agreement (PPA).

PPAs facilitate the financing and implementation of onsite energy installations. An independent power producer, or provider, and a private entity, or buyer, enter into a contract where the provider finances, builds, operates, and maintains a renewable energy system located on the buyer's property and sells back the generated energy. PPAs are contracts in which the service provider pays for 100% of the costs for purchasing, financing, installing, and operating and maintaining a renewable energy system. The developer or an independent financier will own the system itself, while the client makes regular, contractually defined payments to purchase the measurable output of energy from the system. After a set contract term, ownership of the system typically transfers to the client, with all costs for the system plus profit paid to the provider from the regular payments for the energy.

For an institution with a tight budget, the PPA approach can be attractive. Typically, no down payment is required and the PPA shifts the system's performance risk from the client to the service provider. PPAs can also be considered off-balance sheet investments as the building owner does not hold title to the equipment, and payments are made through the operating budget

One reason for utilizing a PPA structure is to capture financial benefits provided by local utilities and tax incentives provided by local, state, and federal governments. Many of these mechanisms are unavailable to public and non-profit entities as they require taxable income from which to deduct renewable energy system project costs. Therefore, a PPA structure in which a school utilizes a for-profit company as the purchaser, installer, operator, and maintainer of the system allows capture of the tax incentive benefits by the for-profit entity.