

New Hampshire Handbook on Energy Efficiency & Climate Change

(Volume II – Revised August 2009)



Taking Good Ideas to Good Projects:
Putting New Hampshire on the Road to a More Sustainable Energy Future



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Preface

The New Hampshire Handbook on Climate Change & Energy Efficiency was produced as a tool in support of the mission of the NH Local Energy Committee Working Group, which is: “to provide collaborative guidance and technical support to New Hampshire Local Energy Committees seeking to reduce energy use and greenhouse gas emissions within their communities”. Errors and omissions are the responsibility of the authors. Recognizing the rapidly changing landscape of municipal energy challenges, solutions and financial tools, Clean Air-Cool Planet will endeavor to continue work with others on the LEC Working Group in order to provide periodic updates and refinements to this handbook. Handbook volume II follows the volume I, which was written to answer the immediate needs of emerging local energy committees. Volume II is now provided to help local governments and LECs measure and manage their energy consumption. It is our hope that together both handbooks provide people with a framework and tools for local energy planning.

---Roger Stephenson, Vice President for Programs, Clean Air-Cool Planet

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Chapter 1

Introduction to the New Hampshire Handbooks on Climate Change and Energy Efficiency

During the autumn months of 2006 a movement began to grow in New Hampshire aimed at putting town's across the State on the record in support of effective actions by the President and Congress to address the issue of climate change. With the help of countless volunteers across the State, 164 communities voted to pass the *New Hampshire Climate Change Resolution* that calls on the federal government to prioritize climate change policy. Taking a step further, in an effort to also act locally, the resolution included the statement:



“In addition, the town of _____ encourages New Hampshire citizens to work for emission reductions within their communities, and we ask our Selectmen to consider the appointment of a voluntary energy committee to recommend local steps to save energy and reduce emissions.”

This simple call for action has spawned a monumental shift across the region and energized (pun intended) local citizens and community members to do their part, volunteer, and create their community's Local Energy Committee (or LEC). As of this release, dozens of communities have, in one form or another, created a working LEC.

This handbook, the second volume in the two volume series, attempts to further assist LECs in taking the next step - helping committee members discover and reduce energy consumption and emissions within their community and public buildings. The Local Energy Committee Work Group, established for the specific purpose of assisting developing LECs, is providing these handbooks in response to many questions and concerns raised by LECs across the state. To clarify where to go for the information you or your committee might be seeking, we have provided brief descriptions and outlines of the two handbook volumes that highlight the various topics discussed in each volume. The authors strongly encourage the reader to read Handbook Volume I first to gain an understanding of the structural options available to LECs and the facts behind climate change.

1.1 Handbook Volume I

Released during the summer of 2007, Volume I, largely modeled off a similar handbook created by the Vermont Energy & Climate Action Network includes a substantial level of baseline knowledge to help a committee form. Among other information, the reader can find information regarding the impact and facts behind climate change, the various formation options available to a developing LEC (including a model bylaw), resources available to LECs, and how to develop strategies to reduce emissions and energy consumption in your community.

Information in Volume I includes:

- Climate Change and its Impacts on NH
- The Climate Change Resolution and Supporting Organizations
- Local Energy Committees
- Assembling a Committee
- Committee Structures
- Sample Mission Statements
- Thoughts on Research and Inventories
- Setting Goals
- Developing Your Message
- Implementing Strategies
- Energy Baselines
- Building Efficiency
- Model Bylaw: NH Town Energy Committee



1.2 Handbook Volume II

In an attempt to take the reader beyond understanding climate change and the formation of an LEC, Handbook Volume II provides information on how citizens and LECs can begin gathering energy information, the steps to conduct simple energy audits on municipal and school buildings, and what resources are available to assist in bringing energy efficiency efforts/projects to fruition. Volume II provides New Hampshire citizens and LECs throughout the State with a robust suite of resources and tools to transcend local efforts from the idea stage to completed projects. The first half of this handbook provides information on how to identify where your committee currently is within the LEC Roadmap Process, how to gather relevant information, and how to use that information to set the benchmark to improve upon. The second half takes you through the various forms of technology now available and types of projects your committee can carry out with the help of your local officials, along with the various financial and technical resources available to your committee. So let's get started!

1.3 Getting Started: Determining where you are on the LEC Roadmap

To assist your committee in understanding where you might be in your efforts, we created an LEC Roadmap to help you understand where you are in your progress as a committee and provide a broad look at where you may stand in the full spectrum of options available to you. The Roadmap is a tool that can help guide your efforts forward, as well as identify items you may have overlooked. After you review the first handbook, the Roadmap should be the next step in understanding the most beneficial steps to your committee's progress. From here you will be able to organize the next steps needed to carry out your important work (as well as keep your sanity!).

The Local Energy Committee Working Group highly recommends that committees follow the Roadmap progression established in this roadmap to help structure your efforts in a succinct manner. This will also assist any outside entities providing your committee with assistance to understand where your committee has been to date.

1.3.1 How to Use the Roadmap:

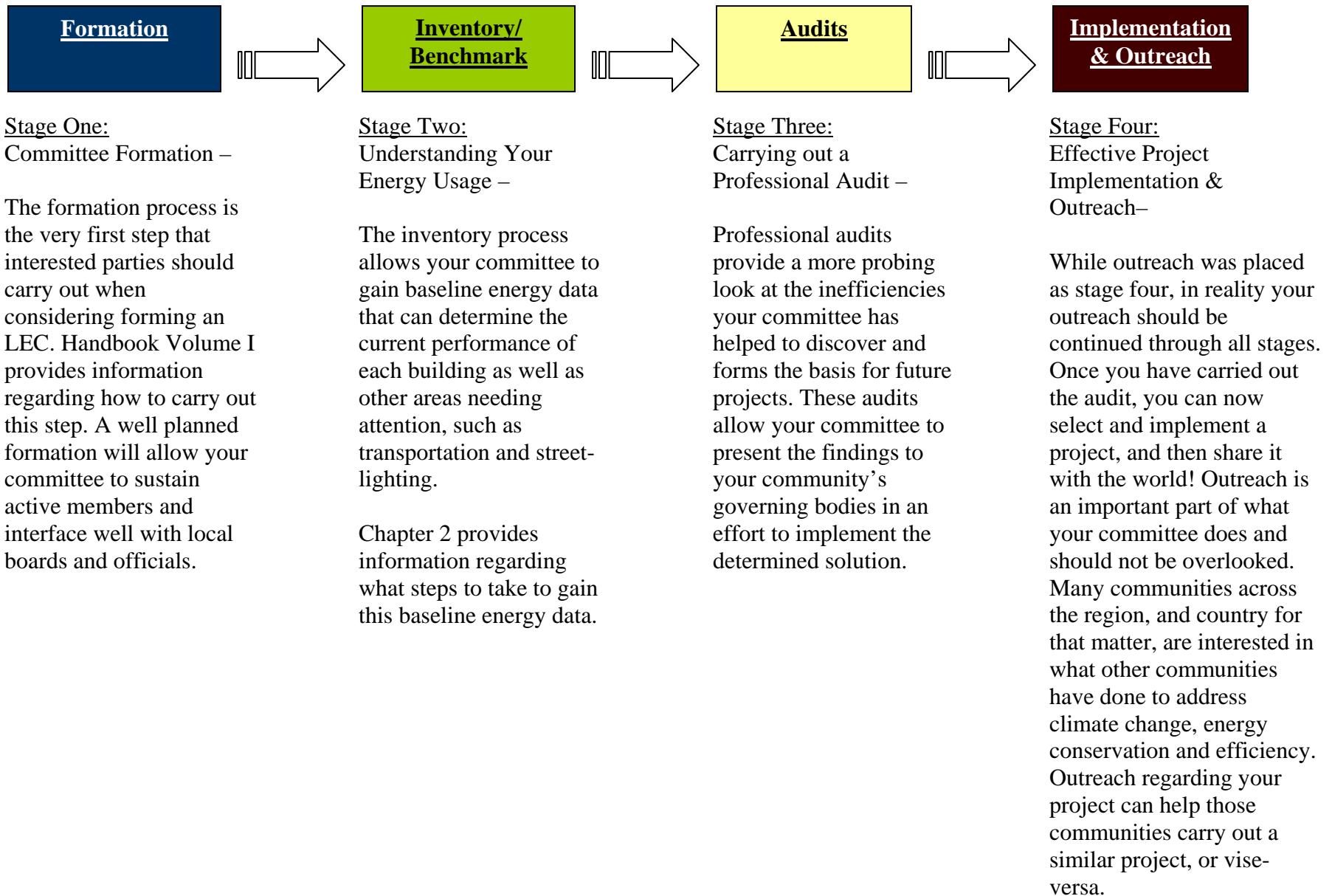
To effectively understand where your committee might lie within the roadmap, first determine which of the four primary stages you feel your committee falls into. Once you have determined this, look to that stage's expanded steps to determine your committee's position within that stage. This allows you to discover what actions your committee can take next, as well as what actions you may have missed along the way.

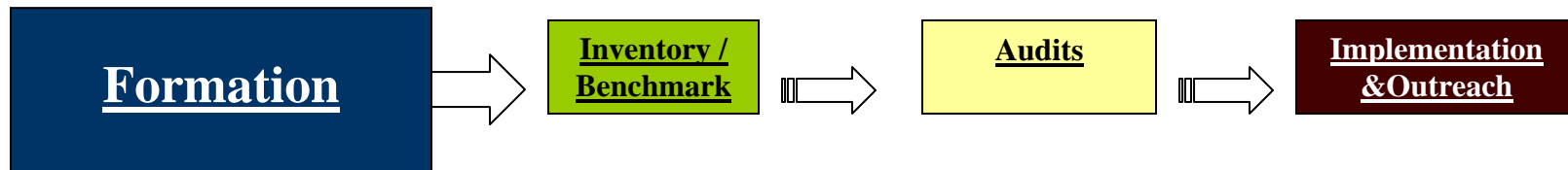
For example:

- Our committee *has*:
 - Presented the New Hampshire Climate Change Resolution to our Select Board
 - Gone through the formation process and determined our structure
 - Recruited committee members
 - Crafted and have an accepted mission statement
 - Formed goals
 - Done some outreach to the community about the committee
- Our committee *has not*:
 - According to the steps, we have not carried out any benchmarking or our municipal facilities

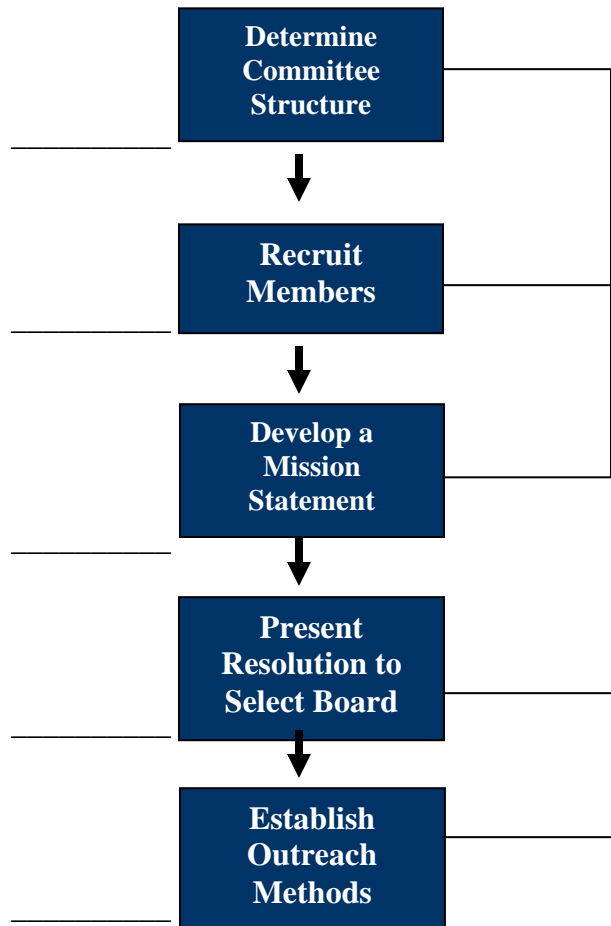
In this example, the Roadmap has shown this LEC what they have accomplished and what the next step for their committee can be. If your committee has accidentally missed a step along the way, simply bring it the attention of your committee members to discuss how to carry out that step. Revisiting a missed step may allow you to gain a better insight into your future efforts, without having to discover that later on.

LEC Roadmap





Complete



Resources

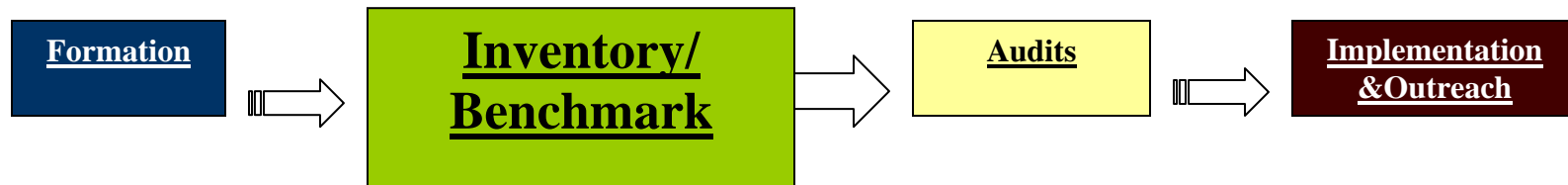
Refer to Handbook Volume I & www.nhenergy.org

Clean Air-Cool Planet

Local media, newsletters, nhenergy.org, outreach to other local organizations, etc.

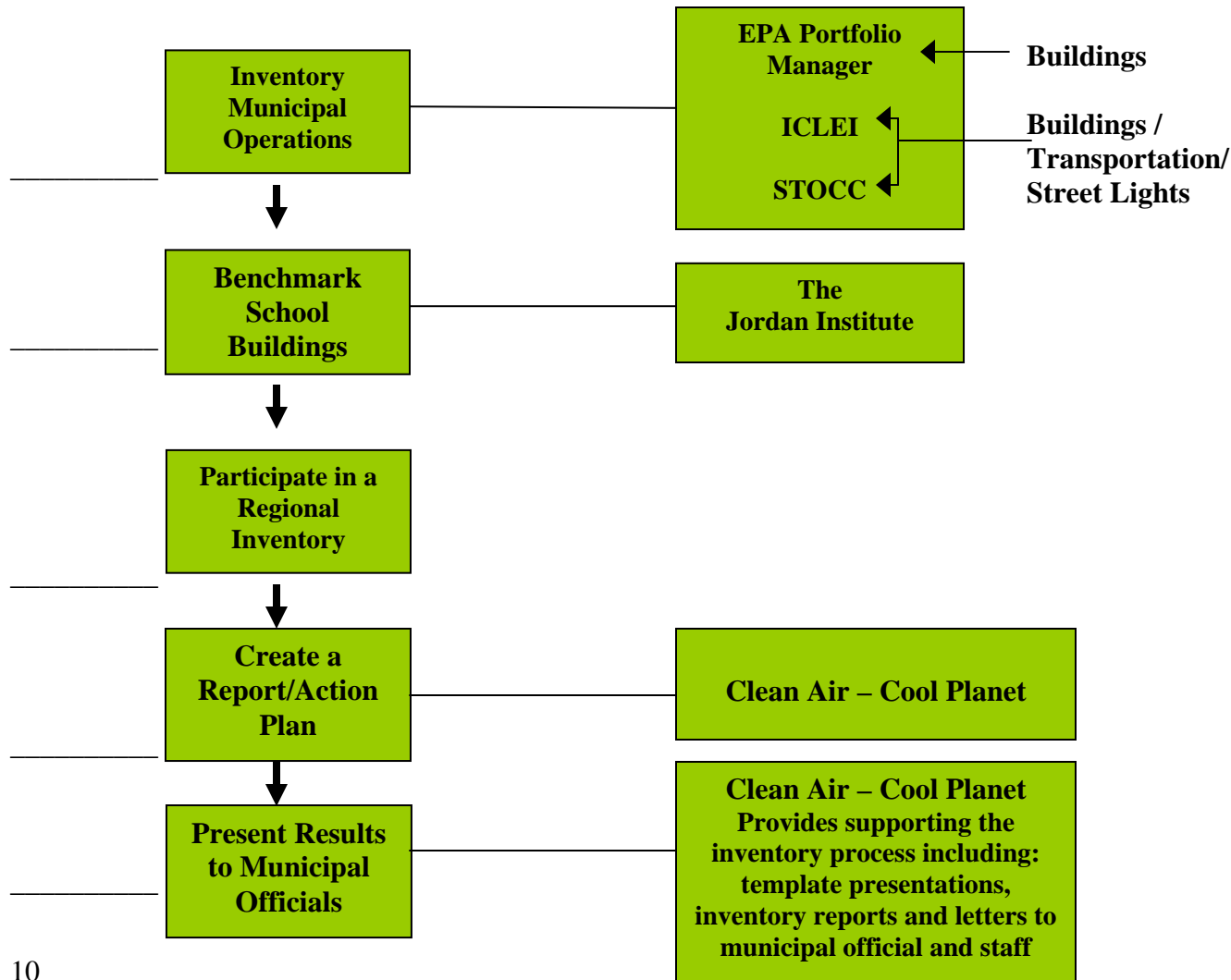
Resource Links:

- Clean Air – Cool Planet
www.cleanair-coolplanet.org
- NH Community Energy Project
www.nhenergy.org
*Link to Handbook Volume I
<http://www.nhenergy.org/images/a/a1/Handbook.pdf>
- Carbon Coalition
www.carboncoalition.org



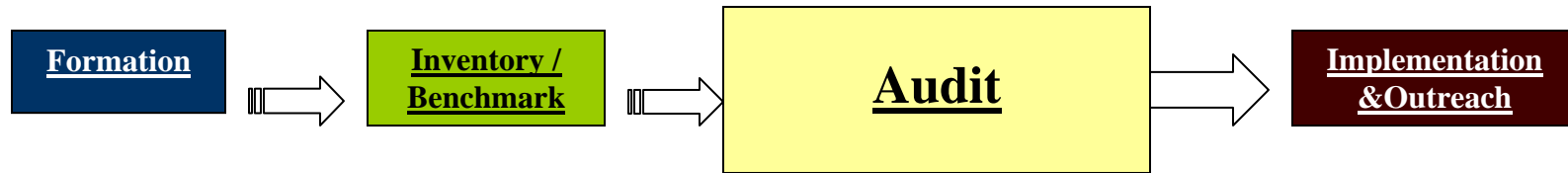
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Resources



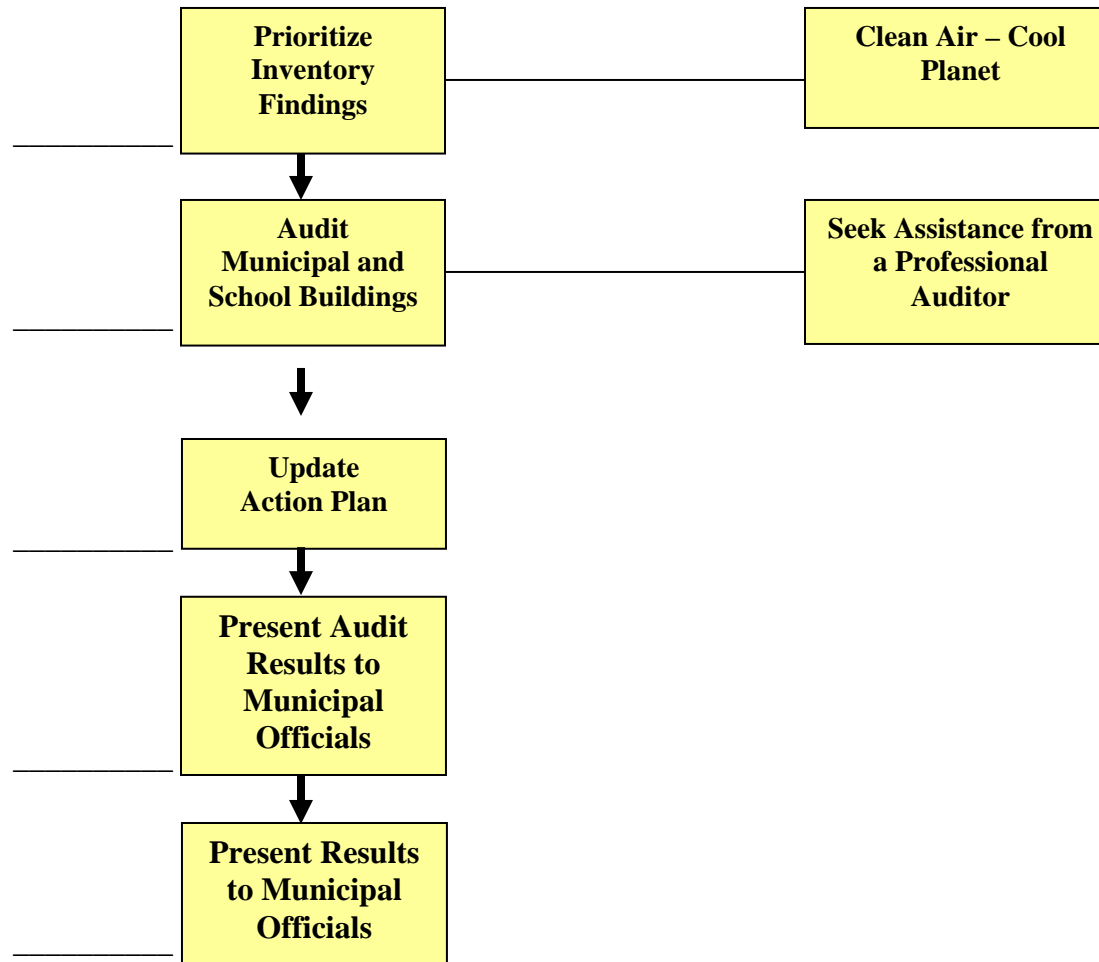
Resource Links:

- EPA Portfolio Manager
http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfolio_manager
- Small Town Carbon Calculator (STOCC) -
http://www.cleanair-coolplanet.org/for_communities/stocc.php
- ICLEI
http://www.icleiusa.org/about-iclei/iclei-by_region/northeast-regional-capacity-center
- The Jordan Institute
<http://www.jordaninstitute.org/>
- Clean Air - Cool Planet
www.cleanair-coolplanet.org



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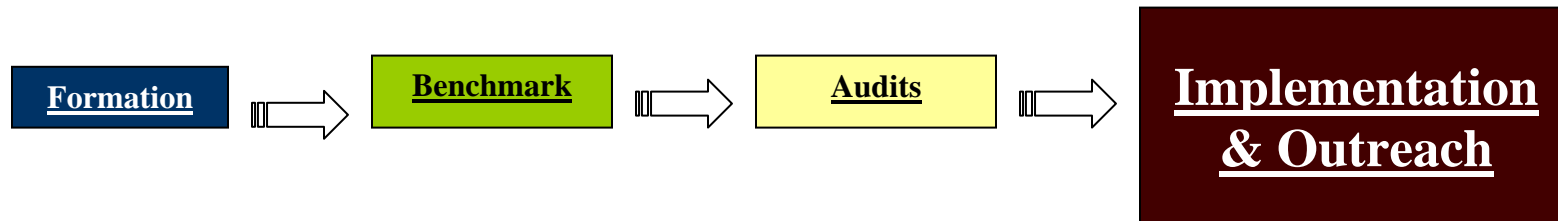
Resources



Resources Links:

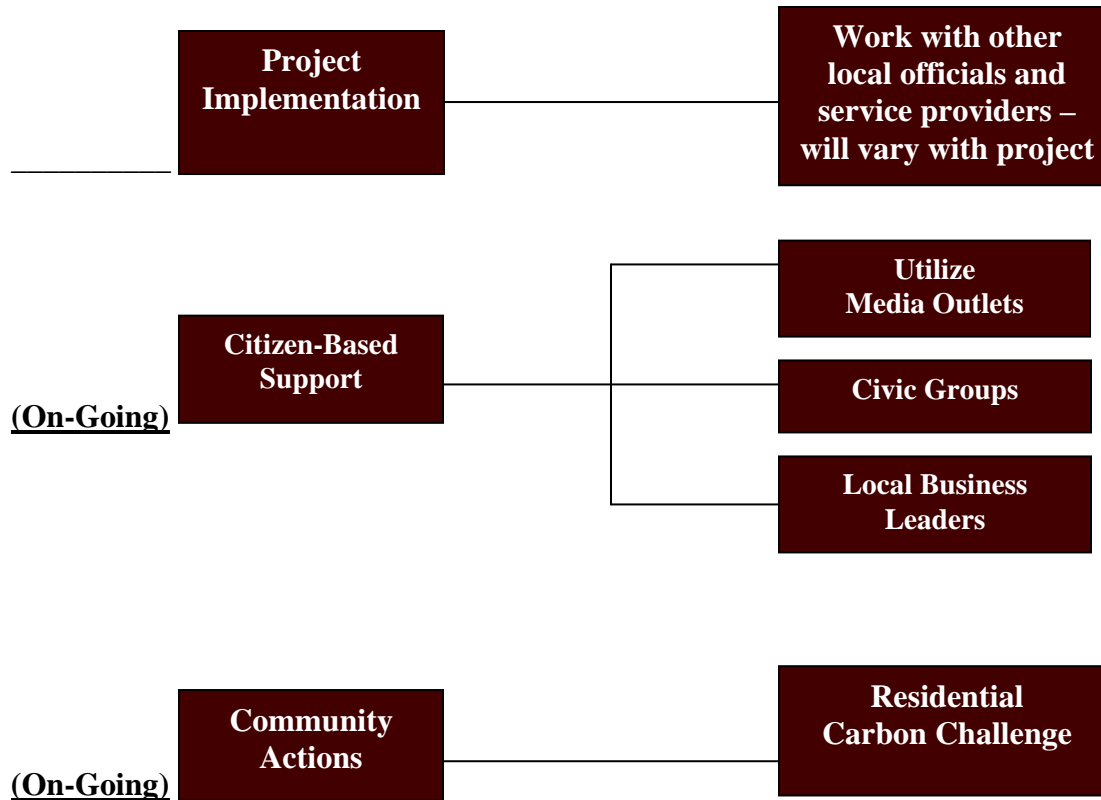
* The LEC Working Group is working to compile a list of qualified professional auditors.

- New Hampshire Sustainable Energy Association
<http://www.nhsea.org/>
- Local Service Providers (varies)



Complete

Resources



Resources Links:

- Media Resources in New Hampshire - <http://www.abyznewslinks.com/unitenh.htm>
- Database of State Incentives for Renewables & Efficiency (DSIRE) <http://www.dsireusa.org/>
- Carbon Challenge – www.nhcarbonchallenge.org

Chapter 2

A New Understanding of Energy Efficiency

2.1 How to Establish an Understanding of Your Municipality's Energy Use

This chapter briefly discusses how your committee can set specific goals, gain the type of information that will help you achieve those goals, and begin to check off steps found within the *Inventory Benchmark* and *Audit* phases of the Roadmap. This chapter will also include information regarding types of benchmarking tools available to your committee, how you can begin using these tools, and how to seek out a professional auditor to implement your work. In Chapter 3 we will discuss how the information gained through inventories, benchmarking and audits can lead to successful projects, what those projects could be, and some examples of successful projects other communities have completed.

While you are advocating for energy efficiency, you also want to push for efficiency in how you operate to reach determined goals. It is important to understand the audience you will be working with and explaining your information/findings to. If your committee currently focuses more on assistance and education to residents and community members, it is still important to first understand the audience you are trying to reach and what the greatest return for your efforts will be.

Your community's municipal/school operations may represent the largest energy consumption in your community. Energy bills begin to add up when you combine energy usage for municipal buildings (such as Town or City Halls, Police and Fire Departments, Public Works Building and K-12 School Buildings); transportation (school buses and municipal fleets); and street lighting. While it might seem daunting to try and tackle inefficiencies found within these building complexes, there are significant opportunities in these facilities to save your community money and reduce carbon dioxide (CO²) emissions through greater energy efficiency. Therefore, it is important to create a plan of attack and tackle one step at a time.

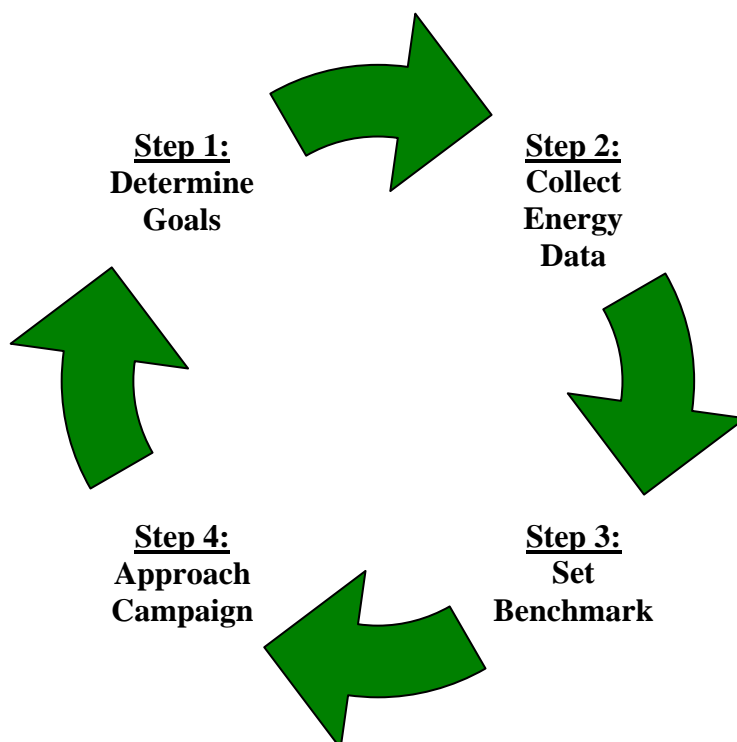
Common Acronyms & Terms

W	Watt = unit of energy
kW	Kilowatt - equals 1,000 watts
BTU	British Thermal Units 3412 BTUs equals a kilowatt
Inventory	Process of gathering useful information – including energy information, building characteristics, etc.
Benchmark	To determine how a building(s) is currently performing and to set the value that will be compared
Audit	Process of identifying the different areas of a building that can be improved to obtain greater efficiencies (several types of audits are available)

2.2 How to Determine Your Goals

A critical, yet often overlooked component for LECs is the determination of the committee's goals. You have likely gone through the process of crafting a workable mission statement during the formation process that will serve as a guiding philosophy, but it is goal-setting that brings your mission to life. Some committees might wish to set a goal to reduce energy consumption within municipal buildings by 30% over the next two to three years. Other committees might also wish to set a goal to provide a certain number of low income residents within free energy audits every year. Moreover, different members may feel particularly motivated toward one goal over another and attempt to push the committee toward that goal. Despite the individual feelings, setting goals requires your committee to weigh the pros and cons of each idea and then set your goals accordingly. Your committee will have certain strengths that you should build upon. You should gain a firm understanding of how the expertise found in your committee can best serve to achieve energy and CO² reductions. Additionally, identifying a champion in your community to support your committee's efforts is always a great idea.

At a minimum, however, your committee should carry out the process of working with your local officials to gather your municipality's energy information (which includes both heating fuel data and electricity data) concerning the various municipal-owned buildings. Information gathering allows you to then benchmark and compare these buildings to other similar types of building and determine projects to reduce energy consumption in those buildings. Projects that your committee might consider are discussed in Chapter 4 and should be viewed in context to your community's needs. The rest of this chapter will focus on obtaining information about your municipal buildings and how to best extrapolate what the data means to determining building benchmarks and potential improvements.



2.3 Assignments

Every committee is comprised of members with varying skill sets and expertise. Your committee should utilize these skill sets by allocating responsibilities to those members most aptly suited for the task(s). It is important, however, to share the work load evenly so as to include all members in the efforts, as well as avoid overloading certain members.

If your committee has reached the inventory/benchmarking stage (refer to the Roadmap in Chapter 1 for a reference point) then you have likely already assigned committee positions during the formation process (refer to Handbook I if you have not). To keep the process simple and projects moving forward, your committee should assign the following types of project responsibilities to your members:

- *Committee Liason* – This member will be the point of contact for other municipal officials during a specified project. Typically, the committee chair serves this role.
- *Outreach Coordinator* – This member should be responsible for actively generating interest

New Hampshire Utilities

- ◆ **Electric Distribution**
 - **Unitil Energy Systems**
www.unitil.com/
 - **New Hampshire Electric Cooperative**
www.nhec.com/
 - **Public Service of New Hampshire**
www.psnh.com
 - **Granite State (National Grid)**
<https://www.nationalgridus.com/granitestate/index.asp>
- ◆ **Natural Gas Distributors**
 - **Keyspan Energy Delivery**
<http://www2.nationalgridus.com/>
 - **Northern Utilities Natural Gas (Unitil)**
<http://www.northernutilities.com/>

among community members and the greater public about the committee and the project(s).

- *Secretary* – This member should be responsible for keeping minutes of the committee’s meeting and current tasks. If your committee has already created the Secretary position during the formation process, that individual can also serve as Secretary during specific project discussions.
- *Project Lead* – For every project, your committee should select a project leader who will be responsible for organizing tasks associated with that project.
- *Resource Coordinator* – Benchmarking and inventories typically require the use of a computer and computer software. Have a committee member take the lead with these software tools as this will help your committee navigate how to use the tools and determine which ones are more applicable to your project.

*See Appendix I for a Project Organization/Responsibility Form

2.4 Obtaining Energy Information - Conducting an Inventory

Your committee can obtain several forms of data by requesting copies of energy bills and walking around the building to look for glaring inefficiencies. This process of information gathering is commonly referred to as “conducting an inventory”. This inventory will serve as the baseline for subsequent decision-making with local officials. The information gained during the inventory will also help your committee establish an action plan to address the most inefficient buildings and help conserve the most amount of energy.

There are two main steps your committee should take during this inventory process. The first step involves gathering energy bills from selected buildings, as well as street lights and vehicles if using STOCC. The next step is to carry out a “building walk through” with a small team of people who will tour the building or facility and document all of the buildings observed characteristics. Carrying out these two steps will save time and money when conducting an audit, and provides you the necessary data to set building benchmarks. These steps may also immediately save money by discovering on-the-spot actions that had gone undiscovered prior to your investigation (i.e. close an opened window; replace incandescent light bulbs; etc.).

Both of these steps require your committee to collaborate and work closely with your municipal officials and staff. One of the first steps toward creating this collaboration is through an initial presentation to the elected officials on the logistics and benefits of conducting a municipal inventory. Two key outcomes of the presentation are: 1) gaining municipal support for collecting energy information and 2) establishing a timeline for delivering the final inventory report. These two factors are crucial in being able to complete an inventory in a timely fashion. There are many resources to help you with this presentation. Visit the Clean Air Cool Planet website for sample presentations and support on creating this presentation. The following are components of municipal inventory collection.

2.4.1 Energy Bills

Energy bills provide a significant amount of insight into the overall efficiency of a building. At least one year’s worth of bills allows you to view the total amount of energy required to

heat and power the facility(s) – although going back two to three years helps give a more accurate picture. Municipal buildings, just as with our homes and businesses, receive a monthly set of energy bills from their utility(s). These bills typically include a monthly electric bill, along with a monthly heating fuel bill (in the case of propane, oil, or another form of delivered fuel, the bill can be more sporadic and is received at the time of delivery). Since these bills are paid through the municipal budget process and receive tax payer money for the expense, these bills are open to the public and available to your committee. Energy bills are typically well kept by facility staff and may be available in spreadsheet format. Typical locations where you committee can locate these bills are:

- *School Complex* – Principal, Facilities Manager, Accounting/Finance Director
- *Town Hall* – Town Manager/Administrator, Facilities Manager, Accounting/Finance Director

Electric Bills

When evaluating your electric bills, there are several important points of information to look for. Electric bills can be somewhat confusing at first glance, but are simple to understand with a little practice. Your electric bills typically contain two over-arching areas of information – actual energy usage and the cost for that usage. First, let us focus on obtaining how much energy was used in a month. To determine this, simply look for the column that states “Actual Usage,” “Total Usage,” or some version thereof. By accounting for each month’s electric use for one to three years you can gain an understanding of how much total energy is being consumed and when the highest rate of use is. Understanding this allows you to manage your facility more efficiency and possibly reduce electric use during peak demand periods. This leads to the next area you want to evaluate – cost.

In the event the information has not already been compiled into a spreadsheet, your committee will need to obtain copies of the actual bills to evaluate. Compiling this information will also provide you the opportunity to assist facility managers in organizing energy data that can then be used to monitor your results at a later date.

The cost of electricity depends on more than just your usage charge. Your bill includes additional costs such as transmission and distribution costs, demand charges, and applicable taxes. To guarantee you are always factoring in the full costs, be sure to use the total cost figure. Below are several links that may help you better understand your utility bill.

NHPUC¹ - Overview of links.

<http://www.puc.state.nh.us/consumer/understandingbill.htm>

PSNH

http://www.psnh.com/youraccount/understanding_bill/default.asp

Unitil: Concord Electric Company

http://services.unitil.com/ceco/read_bill.asp

¹ New Hampshire Public Utilities Commission. <http://www.puc.state.nh.us/>

Unitil: Exeter and Hampton Electric

http://services.unitil.com/eh/read_bill.asp

Heating Fuel Bills

The type of fuel the building consumes will determine how the building receives a heating fuel bill. For example, if a building uses natural gas for a fuel there will likely be a monthly bill describing the amount of natural gas consumed (in therms) and the cost (per therm) of that fuel. If the building consumes a fuel that has to be dropped off then there will be an invoice for each occurrence that fuel is delivered (usually in \$/gal.). In either scenario, the bill will provide a total amount of fuel consumed/purchased (in therms or gallons) and the cost of that fuel (\$/therm or \$/gal.)

Each type of fuel has a certain CO₂ content in it that allows you to determine, based on the amount of fuel burned over a certain time frame, the CO₂ footprint of that building with regards to heating the building. When combined with the amount of electricity consumed (unless the building is electrically heated), which also has a CO₂ emissions rate per kWh, you are able to determine the full CO₂ emissions rate for that building.

<u>CO₂ Output Produced by Burning Various Fuels²</u>		
Heating Fuel Type	Pounds of CO₂ per Unit Volume/Mass	Pounds of CO₂ per Million BTU
Coal (varies by type)	2,791.60-5,685.00 per short ton	205.300-227.400
Wood	3,812 per short ton	195
Residual Fuel (No.5 & No. 6 Fuel oil)	26.033 per gallon	173.906
Distillated Fuel (No.1,		161.386

² Energy Information Administration. *Voluntary Reporting of Greenhouse Gases Program: Fuel and Energy Source Codes and Emission Coefficients*. <http://www.eia.doe.gov/oiaf/1605/coefficients.html>

No. 2, No. 4 & diesel)	22.384 per gallon	
Kerosene	21.537 per gallon	159.535
Propane	12.669 per gallon	139.178
Natural Gas (Pipeline)	120.593 per 1,000 ft ³	117.08
Nuclear	0	0
Gasoline	19.564 per gallon	156.425

Your inventory allows your committee and your local officials to understand the full scope of energy use and allows you to begin to understand the emissions impacts of the building, how your building's energy use compares to other similar type buildings, and what reduction rate to set.

Why do a Greenhouse Gas Inventory?*

A greenhouse gas emissions (GHG) inventory of energy usage and greenhouse gas emissions will help guide you in order to reduce your overall energy usage in order to save taxpayer money, reduce your dependency on imported fossil fuels, and reduce greenhouse gas emissions. The benefits of developing a GHG inventory are numerous and varied, and include:

- **Risk Management.** Voluntarily reporting GHG emissions may help local governments manage climate risk by documenting early actions to reduce GHG emissions. Such information may be accepted by future state, federal or international regulatory GHG programs.
- **Addressing Inefficiencies.** Accounting for emissions has helped many organizations gain better insights into the relationship between improving efficiency (reducing factor inputs and waste) and reducing emissions. As a result, organizations have redesigned business operations and processes, implemented technological innovations, improved products and services, and ultimately saved money and resources.
- **Readiness for a Carbon Constrained Future.** Identifying emissions sources to develop a GHG profile and management strategies may help local governments prepare for and respond to the potential impact of new regulations.
- **Recognition as an Environmental Leader.** Voluntarily reporting GHG emissions provides local governments with a pathway to recognize, publicize, and promote their environmental stewardship.
- **Stakeholder Education.** Assembling an annual GHG emissions inventory can help inform management, constituents, employees, and the public about a local government's GHG emissions profile.

Please view the ICLEI Local Government GHG Protocol at:
www.iclei.org/action-center/tools/lgo-protocol-1

*Information courtesy of ICLEI.

2.5 Benchmarking Your Buildings

Once you have gathered your energy data, the next step in the Roadmap is to benchmark your building(s). Benchmarking allows your committee to combine energy information and establish a baseline of your building's current performance. This allows your committee to set reduction targets and monitor the success of your efforts in the future, in turn allowing you to modify your efforts accordingly.

A terrific resource for benchmarking your municipal buildings, which compares your building's performance to other buildings of the same type/use is the Environmental Protection Agency's (EPA) *Portfolio Manager*.³ This free online resource provides you the opportunity to enter both energy, as well as water consumption data, into the software program and view your buildings current performance. This provides you with a starting point for your building. Portfolio Manager allows you to see which building's show the largest inefficiencies, compare them against one another, and then determine the best opportunity to achieve the largest energy and emissions reductions available.

Additionally, the EPA has initiated a program called "*Community Energy Challenge*" that provides an opportunity for "municipalities across New England to identify simple and cost-effective measures that increase energy efficiency and renewable energy use while reducing air pollution and saving money."⁴ The program challenges communities to sign up and pledge to reduce energy use by 10% for your municipal and school buildings over a timeframe of your choice. The program uses Portfolio Manager to establish the benchmark for your facilities and is an opportunity to gain recognition for your achievements. The program will require the involvement of municipal officials so it is again important that you have their support and collaboration before undertaking this pledge.

Why Establish an Emissions Reduction Target?

A target is essential. It fosters both political will and creates a framework that guides the planning and implementation of determined goals.

The most important things to consider in establishing reduction targets are that the target should be measurable and there should be accountability in the near term. Many governments establish both long and short term goals. Both goals are important because they provide a sense of urgency by creating benchmarks or interim targets along the way. For example a reduction target set for the year 2025 could include a percentage of the target to be achieved each year between now and then, or could have interim targets set at 5 year intervals.

Targets should be defined as a reduction from a base year by a given year; for example 20% below 2000 levels by 2020. Different targets can be set for municipal operations based on the municipal inventory and for the community as a whole. The community target would encompass the residential, commercial and industrial sectors. Whether you are establishing a municipal or a

³ EPA Portfolio Manager. www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager

⁴ EPA Community Energy Challenge. www.epa.gov/ne/eco/energy/energy-challenge.html

community target, it is encouraged that you set a target that is both achievable and ambitious. For a municipal target, the following bullets could be considered:

- The GHG reduction measures that have already been implemented locally;
- The range and expense of possible or proposed new GHG reduction measures;
- Goals established by other levels of government (most commonly state governments);
- Goals established by peer municipalities;
- The range and expense of possible or proposed new GHG reduction measures

The following bullets could be considered for a full community target:

- Expected changes over the target period such as population growth and changes in energy consumption per capita;
- Goals established by other levels of government (most commonly state governments);
- Goals established by peer communities;
- The GHG reduction measures that have already been implemented locally;
- The range and expense of possible or proposed new GHG reduction measures;
- The reductions that science tells us are necessary to prevent the most catastrophic effects of climate change.

Portfolio Manager Overview*

Portfolio Manager is an interactive energy management tool that allows you to track and assess energy and water consumption across your entire portfolio of buildings in a secure online environment. Whether you own, manage, or hold properties for investment, Portfolio Manager can help you set investment priorities, identify under-performing buildings, verify efficiency improvements, and receive EPA recognition for superior energy performance.

How can Portfolio Manager help me?

- [Manage Energy and Water Consumption for all Buildings](#)
- [Rate Building Energy Performance](#)
- [Set Investment Priorities](#)
- [Verify and Track Progress of Improvement Projects](#)
- [Gain EPA Recognition](#)
- [Related Tools](#)

Manage Energy and Water Consumption for All Buildings

Portfolio Manager helps you track and assess energy and water consumption within individual buildings as well as across your entire building portfolio. Enter energy consumption and cost data into your Portfolio Manager account to benchmark building energy performance, assess energy management goals over time, and identify strategic opportunities for savings and recognition opportunities.

Any building can efficiently track and manage resources through the use of Portfolio Manager. The tool allows you to streamline your portfolio's energy and water data, and track key consumption, performance, and cost information portfolio-wide. For example, you can:

- Track multiple energy and water meters for each facility
- Customize meter names and key information
- Benchmark your facilities relative to their past performance
- View percent improvement in weather-normalized [source energy](#)
- Monitor energy and water costs
- Share your building data with others inside or outside of your organization
- Enter operating characteristics, tailored to each space use category within your building.

* Information courtesy of the EPA. Further information can be found at http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager, or contact Linda Darveau, US EPA, Region 1, darveau.linda@epa.gov, (617) 918-1718

2.6 Your Reduction Targets

Your inventory and benchmarking results will provide the basis for your committee to establish reduction targets. Whether you are focusing on one building, or the entire municipality, your reduction target should be realistically based on your benchmarking and inventory data. Biting off more than you can chew might present some unanticipated challenges. Therefore, make sure your fellow committee members feel comfortable about the project and understand their role. Also, don't be afraid to request assistance from available resources.

Appendix II provides a model successfully implemented in the Monadnock region of New Hampshire for communities using the Portfolio Manager software. The “Cool Monadnock” initiative was established to help communities achieve significant greenhouse gas reductions by assisting LECs in that region with technical assistance, training and guidance toward implementing a regional climate action plan. In this effort, organizers created a template the Monadnock communities can use to enter and understand their energy and emissions rates. Appendix II is the report generated for the Town of Temple. The electronic template can be found at www.nhenergy.org.

2.7 Software for Buildings, Lighting and Transportation

Several forms of inventory/modeling software are available to your committee depending on what phase of evaluation you are in. Many of these software tools complement one another and provide valuable resources that are unique to that program. It is highly recommended that your committee utilize as many of these programs as possible. The following section provides a look and brief explanation of several software options.

Small Town Carbon Calculator (STOCC) (Free)

Developed by Clean Air - Cool Planet and the University of New Hampshire to serve the needs of small towns addressing the growing costs of municipal energy use and emissions of heat trapping gases, STOCC simplifies the process of creating a greenhouse gas and energy inventory. STOCC enables you to better understand and assess the sources of your energy expenses, as well as the majority of your greenhouse gas emissions. STOCC is intended for small towns with relatively few municipal buildings/facilities and vehicles.

STOCC is the first step toward reducing energy and greenhouse gas emissions at your most inefficient sources. This process will help your town to address the growing concern of climate change as well as the ever-present effort to reduce municipal energy costs. Note that STOCC does not provide suggestions for addressing energy efficiency. It simply identifies the source of your costs and emissions.

[ICLEI Inventory Tool](#)

If your energy committee represents a larger (>20,000) municipality consider using ICLEI's Clean Air Climate Protection software tool, which is designed for local governments with more diverse energy usage and emissions sources.⁵

The National Association of Clean Air Agencies (NACAA) have joined forces with ICLEI – Local Governments for Sustainability (ICLEI) to build a software product that helps local governments create greenhouse gas inventories, quantify the benefits of reduction measures and formulate local climate action plans. The software enables them to develop harmonized strategies to reduce both greenhouse gas and air pollution emissions. The result of this partnership is the Clean Air and Climate Protection (CACP) Software, which debuted in May 2003.

This one-stop emissions management tool tracks emissions and reductions of greenhouse gases (carbon dioxide, methane, nitrous oxide) and criteria air pollutants (NO_x, SO_x, carbon monoxide, volatile organic compounds, PM₁₀) associated with electricity and fuel use and waste disposal. This tool can help you:

- Create emissions inventories for the community as a whole or for the government's internal operations.
- Quantify the effect of existing and proposed emissions reduction measures.
- Predict future emissions levels.
- Set reduction targets and track progress towards meeting those goals.

The software and technical assistance will be provided to local governments participating in ICLEI's programs who wish to conduct an emissions inventory.⁶ Small towns may wish to begin the inventory process and project implementation using STOCC and then utilize ICLEI's more comprehensive greenhouse gas inventory tools.

[TREAT \(HERS software\)](#)

TREAT, or Targeted Residential Energy Analysis Tools, is a software program used by the energy services industry “designed to provide support for weatherization programs, building performance contractors and energy auditors. It is a comprehensive energy analysis tool that allows weatherization programs to provide new sources of value to their customers, with increased program efficiency.”⁷

TREAT is used principally for residential and multifamily building performance evaluations and is the chosen software program for the Home Energy Rating System, or HERS. This tool is included to demonstrate the variety of options available and to illustrate the use of a different tool depending on the project and type of building structure you are evaluating.

⁵ Carbon Coalition. *Resources for Local Energy Committees in NH*.

<http://www.carboncoalition.org/community/EnergyCommitteesResources.php>

⁶ ICLEI Clean Air and Climate Protection Software <http://www.icleiusa.org/action-center/tools/cacp-software>

⁷ TREAT Software Introduction. http://treatsoftware.psdconsulting.com/treat_intro.html

[RETScreen International](#) (Free)

RETScreen International provides a fairly advanced auditing software tool that was developed by Natural Resources Canada and is managed in partnership by the National Aeronautics and Space Administration (NASA), United Nations Environment Programme (UNEP), UNEP-Global Environment Facility (GEF) and the Renewable Energy & Energy Efficiency Partnership (REEEP). According to the RETScreen website:

"The RETScreen International Clean Energy Project Analysis Software is a unique decision support tool developed with the contribution of numerous experts from government, industry, and academia. The software, provided free-of-charge, can be used worldwide to evaluate the energy production and savings, life-cycle costs, emission reductions, financial viability and risk for various types of energy efficient and renewable energy technologies (RETs). The software also includes product, cost and climate databases, and a detailed online user manual. Other tools include: a case study based college/university-level training course; an engineering electronic textbook; and (the RETScreen) Website. All of these tools are available free-of-charge in English and French, with many of the tools available in other languages." ⁸

RETScreen provides a robust suite of assessment tools that allow the user to enter existing energy data, evaluate several different forms of energy generation technologies (including energy efficiency measure), incorporate a cost associated with the project, and generate a return on investment (ROI) for those measures. The results produced from this program can be used to satisfy an investment-grade audit. The use of RETScreen, however, should only occur after you have collected energy data, benchmarked your buildings, conducted a walkthrough audit, evaluated potential projects, received some installation costs and are ready to predict the potential savings.⁹

2.8 Types of Energy Audits

Understanding the different forms of building audits is critical when choosing both the type of audit necessary to achieve your committee's objectives and in comparing auditor proposals/quotes.

Decision Grade Audit (DGA) - Step 1 Building Walk Through

The decision grade audit is the first stage of the audit process. This stage is the simplest and quickest type of formal audit. It may involve minimal interviews with site operating personnel depending on the systems on site, is often commenced with a brief review of facility utility bills and other operating data, a walk-through of the facility to become familiar with the building operation, and identify, on site, the glaring areas of energy waste or inefficiency.

⁸ RETScreen International. <http://www.etscreen.net/ang/home.php>.

⁹ RETScreen does take some training and practice to master. Review by a professional auditor is highly recommended if you choose to use the RETScreen evaluation as a primary decision tool.

Typically, only major problem areas will be uncovered during this stage of the DG audit. The building walk through process is explained in greater detail in section 2.9.

Decision Grade Audit - Step 2 Evaluation

This evaluation stage of the DGA expands on the building walk through by collecting more detailed information about facility operation and performing a more detailed evaluation of energy conservation measures identified during the review of the site. Utility bills are collected for a 12 to 36 month period to allow the auditor to evaluate the facility's energy/demand rate structures, and energy usage profiles. In-depth interviews with facility operating personnel can be conducted to provide a better understanding of major energy consuming systems as well as insight into variations in daily and annual energy consumption and demand.

This type of audit is intended to identify most, if not all, energy conservation measures appropriate for the facility given its operating parameters and site owner's objectives. A fairly detailed financial analysis is performed for each measure based on estimated implementation costs, site-specific operating cost savings, and the customer's investment criteria. Sufficient detail is rarely provided to justify project implementation, but can occur if the problem and solution are straight-forward (an example of this would be the results of thermo-imaging — leaks would be found and sealing those leaks would be obvious).

For other measures, they are briefly described, and quick estimates of implementation cost, potential operating cost savings, and simple payback periods are provided. This level of detail, will not be sufficient for reaching a final decision on implementing these proposed measures. They are, however, adequate to prioritize energy efficiency projects and determine the need for a more detailed audit.

Investment-Grade Audit (IGA) – Take To the Bank

In most settings, upgrades to a facility's energy infrastructure must compete with decisions on non-energy related investments for capital funding. In order to compare these items, energy and non-energy investments are rated on a single set of financial criteria that generally stress the expected return on investment (ROI). The projected operating savings from the implementation of energy projects must be developed such that they provide a high level of confidence.

The IGA expands on the DGA described above by providing a dynamic model of energy use characteristics of both the existing facility and all energy conservation measures identified. The building model is calibrated against actual utility data to provide a realistic baseline against which to compute operating savings for proposed measures. Extensive attention is given to understanding not only the operating characteristics of all energy consuming systems, but also situations that cause load profile variations on both an annual and daily basis. Existing utility data is supplemented with metering of major energy consuming systems and monitoring of system operating characteristics.

2.9 Building Walk-Through Audit (A Type of Simple Decision-Grade Audit)

Once you have gathered all of the energy related records you can, the next step in your investigation is the “walk through audit.” This audit should be based on the results of your municipal inventory. Your inventory and benchmarking can give you insight into which building is the most significant energy user or performing poorly compared to other buildings. A walk through audit is a necessary step toward approaching an energy efficiency/alternative energy project. Conducting a walk through audit is a simple process that can achieve a significant amount of information about a building. It is important, however, that your walk-through audit should not be viewed as a thorough audit on which to make decisions or investments. Rather, it serves as an information gathering tool that will allow you to better determine the types of projects that will significantly increase building efficiency and performance. The goal of the walk-through is to create a report for the purpose identifying a structure with a large opportunity for savings, and to convince your select board to consider having an Investment Grade Audit (IGA) performed on the building.

Things you should have done before you arrive for the walk-through:

- Gather energy bills for at least 12 months, preferably 24 months.
- Enter all data into a spreadsheet and create some useful graphs.
- Check town schedules for a preferred walk-through date.
- Call town administrator, set date, ask her or him to contact the maintenance person for their availability on the day of the walk-through.
- Obtain a floor plan of the building.

Once you have collected and organized all energy data, it is time to determine a good day to tour the building. If your energy committee was responsible for producing the municipal inventory, your committee should have a productive working relationship with local officials and town staff by this time. Your Town Administrator/Manager or Select Board will be instrumental in setting up a building walk through and providing you with the type of access necessary for a beneficial walk through. One of the most important aspects of doing a walk-through audit is communicating with the staff of that building to understand how the building is

operating. The most important person to include is the person in charge of building maintenance. Talk to your Town Administrator/Manager or Select Board chair on identifying the facilities manager or any other staff/personnel who know a significant amount about the building you would like to include on your walk through. The information you gather from them will be vital to understanding and identifying building energy issues. These local officials and/or staff will be important members of your walk-through team.

Your team should plan on spending as much time as needed to effectively and thoroughly document the building’s current condition. The team should inspect the entire facility. Locked areas can occasionally contain significant findings. Spending several hours, taking notes and pictures, is not uncommon. If you don’t own a camera, borrow one! This will make the documentation process much faster and less expensive. Additionally, when interviewing staff and the facilities manager, it can be useful to have a tape recorder to guarantee you capture all of the information they provide (see Appendix III for a list of types of questions to ask).

Many town buildings have a basic floor plan of the structure that includes room layouts. You may want to bring a couple copies of the floor plan to write notes on. For example, you may take a photo of a window with an enormous gap, allowing for a large amount of air infiltration. Later, when you're going through your photos and using them in your "walk-through audit report", you may not recognize the photo, and can't remember the room from which it came. As you take pictures, write a small corresponding number on the floor plan. Don't be shy about taking photos!

A good rule to remember while conducting the walk-through audit is an abundance of information is a positive strategy. It is better to over analyze the building and document anything that you feel is or might be important, than to under analyze.

Think Like a British Thermal Unit (BTU)

When you arrive for the walk-through, get into the right frame of mind. When a carpenter is roofing a house, they need to think like a drop of water. That drop of water will enter the home wherever it can. So, the carpenter takes the utmost care in making sure that water can not enter. In that same vein, your team needs to think like a BTU (British Thermal Unit). A BTU is a unit of measurement commonly used to explain how much thermal energy is used/needed to heat a particular area. Because of the laws of thermodynamics, the BTU, as compared to the droplet of water, really wants to leave the building when it is cold out (or enter when it is hot outside) - and it will wherever it can. The installation of insulation attempts to slow that process. Wasted BTU's = wasted tax dollars = more carbon emissions.

What to Look for During a Walk-Through*

- **How old is the heating and distribution system?**
 - What year was the boiler installed?
 - What type of fuel does the system use?
 - These questions directly relate to the system's overall efficiency.
- **What is the total square footage of the building?**
 - How much of the space is conditioned (heated or cooled)?
- **How many electric meters are there and where are they located?**
- **What do the windows look like/how old are they? Are the seams sealed with caulk?**
- **What types of light fixtures are present throughout the building?**
- **Where are the thermostats and are they programmable?**
- **Are there air leaks in the doors, or areas of the building that should be better insulated (i.e. the attic, basement, or exterior walls)?**
- **Are heating pipes or ducts insulated? Check crawl spaces and dropped ceilings for pipe/duct runs.**
- **What type of electronic equipment (computers, soda machines, etc.) is there throughout the building? How many of each? Are power strips utilized to shut down computers/equipment at night?**

Items to Bring With You on a Walk Through

- ✓ **Pen / pencil**
- ✓ **Notebook to write findings**
- ✓ **Digital camera**
- ✓ **Tape recorder**
- ✓ **Flashlight**
- ✓ **Compass**



*** Appendix IV provides a simple walk through audit worksheet that your committee can use and expand upon when touring a facility**

Now that your team is established and includes 1-2 LEC volunteers, a town employee who is familiar with the history and use of town buildings, along with people who have access to the public buildings, your team should proceed through the building by fully examining one room at a time. Attempt to observe and include in your report the following items:

- **Exterior Doors** - From the inside, examine all the exterior doors. Look for gaps around the edges of the door, the doorframe and between double doors. If it is cold outside, you may be able to feel the draft with your hand. In some cases, you will be able to see light through these cracks as well. These cracks can add up.
- **Windows** - Examine all the windows in the building. Note if they are single or double pane. If they are double pane, and installed at least fairly well, replacing them may not be a large source of savings. Single pane windows, however, should certainly be recommended for replacement. While some single pane windows might be historic and appealing, they are extremely inefficient and costly. If the historic value of the windows means a lot, consider moving them inside and using them for interior design – or hang one on the wall in the lobby with a nice plaque.
- **Thermostats** - Keep track of every thermostat. You may discover rooms that have no thermostat. Chances are occupants of that room will have comfort issues. Building staff may be some of your best source intelligence in your energy sleuthing. They will likely explain that it is always too hot or too cold in their office. They will also likely have small electric space heaters by their desk – which are also very inefficient and tend to be energy hogs along with a potential fire hazard. This is a clear issue of improper zoning with the building's heating system, or, improperly located thermostats. More zones, or areas with independent thermostats, will mean greater control of how heating and/or cooling is distributed. The results of a properly zoned building are energy savings and greater occupancy comfort.

Many buildings are heating or cooling rooms that may not be occupied consistently. The temperature in these rooms should be turned down when “room temperature” is not necessary (i.e. no occupants).

Here is a likely scenario if you find two offices in an old building, with one office controlling the temperature of both: If room 1 has a thermostat that controls the flow of heat in both rooms 1 and 2,. Heat might leave room 2 faster than room 1. The thermostat in room one will read a temperature of 68°F, but the temperature in room 2 has fallen to 64°F. The thermostat does not know that, leaving the occupants of room 2 turning on their electric space heaters and driving up the electric bill. Conversely, maybe room 1 loses heat faster than room 2. In this case, the thermostat in room 1 is trying desperately to keep the room at 68°F, while the temperature in room 2 has risen to 76°F and the occupants of room 2 have now opened their windows to try and maintain a bearable work environment. The overall goal is an even, controlled distribution system.

Correct placement of thermostats is another issue to consider. A thermostat should never be placed on an exterior wall. Though it is rare to find this, don't be shocked. If you do find a thermostat on an exterior wall, understand that the thermostat is in the coldest place of that room, and is probably giving a false reading. The temperature in the room may be 72°F, but the thermostat thinks it's only 60°F. This will leave the occupants of that room feeling too warm or cold as they try to constantly adjust the temperature. Thermostats should also not be installed in an area that receives direct sunlight. This would also give a false reading. Finally,

digital/programmable thermostats are the best option for reducing energy usage. The ability to program the temperature to turn up and down at certain times of the day will greatly increase the overall efficiency of your heating/cooling system. (Not to mention prevent other people from playing with the settings.)

Turn Down Thermostats at Night!!!

A common question among LECs is whether you should turn down a building's thermostats at night. In fact, turning down the thermostats when the building does not have a large heat demand will save energy during those times. Programmable thermostats allow you to set certain times when the temperature can be automatically lowered or raised before occupants arrive. The best of both worlds!

- **Lighting** – The obvious task is to look for any incandescent light bulbs. Be aware, however, that just because a room has fluorescent ceiling lights, doesn't mean that they are the most efficient option. Even in newer buildings, a lighting audit will likely reveal room for improvement, incentives to do so, and a short payback period. Be sure to document where lights can be changed to compact fluorescent bulbs or LEDs. This is an immediate action that can begin saving money immediately.

Furthermore, notice whether occupancy sensors have been installed at certain locations. Bathrooms, hallways, council rooms and even some offices can benefit from the installation of occupancy sensors that will shut the lights off if no one is in the room.

- **Insulation** – If possible, try to estimate the R-Values of the building envelope.¹⁰ Today's International Building Code dictates that walls must be insulated to R-19, and ceilings to R-30. Many older buildings may not be insulated to such standards. When evaluating the R-Value, be sure to check not only how much insulation is in the attic, but also various crawl spaces, the walls (if possible) and the basement. In most cases, around 10% of a heating bill goes out the basement walls because they are un-insulated. Most of the time, in our climate, basements walls should be considered part of the thermal boundary.

¹⁰ The term "building envelope" is simply a term of art used to describe the buildings separation between the interior and exterior environments. We try and minimize the impact of the exterior environment through the installation of insulation. Appendix V provides a short list of cost-effective R-values for existing homes. Consult with a trained professional when determining the appropriate R-value and material for your building.

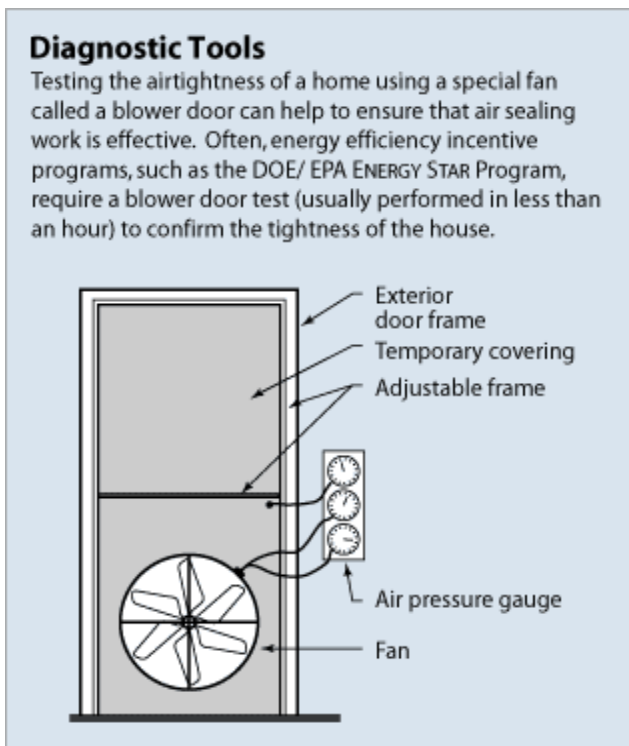
- **Pipe Insulation** – Take photos of all the un-insulated hot water pipes you find. Some may be associated with the heating distribution system, others for domestic use. Be sure to examine these pipes, when visible, throughout the building.
 - Most people only seem to be concerned that pipes are insulated in the boiler room. Just because a hot water pipe, heating or domestic hot water, is within the thermal boundary does not necessarily mean it should be un-insulated. A domestic hot water pipe should not be used to help heat a room if the radiators are properly sized. It only needs to efficiently transport hot water to the faucet. Furthermore, these pipes often travel along the perimeter of the building. Much of the heat from these pipes will radiate and conduct through the building shell to the exterior while on the way to its final destination.
- **Duct Air-seal/Insulation** – Where possible, try to examine the duct system. Unfortunately, most duct systems are inadequately air-sealed and insulated. And, just as a note, “duct tape” is not effective for sealing ducts.
 - The principal purpose for sealing ducts is the same for insulating pipes. You want to get the heat traveling through the ducts to where it needs to go without losing temperature. As with pipes, just because a run of ducts is within the thermal boundary of the building that does not mean that it should be unsealed and/or un-insulated. Greater comfort and energy savings are realized from properly sealed and insulated duct system. Document all the locations that should be sealed/insulated.
- **Ventilation** – When looking at a building’s ventilation system, you will likely find 1 of 2 scenarios.
 1. The building may have an inadequate or non-existent ventilation system. In this case, there is probably going to be an improper number of natural air exchanges per hour. Unfortunately, you will not be able determine if there is too much or too little ventilation from your walk through. That would have to be determined by a trained professional. You should, however, note the lack of a ventilation system.
 2. You may find a ventilation system as part of a forced hot air/cooling system. What you will likely find is that the system pulls air directly from the exterior of the building, which needed to be heated or cooled before it enters the conditioned areas of the building. This is very inefficient. A great opportunity for savings would be to install an Energy Recovery Ventilation System (ERV). The ERV exhausts stale air from the interior. The stale air charges the incoming air with its heat through an exchange system and reduce needed energy to condition that air.
- **Attic Spaces** – Take note if there is a mechanized ventilation system in the attic space. This would usually take the form of fans which blow hot air out of the attic space during warmer months. Mechanically venting these spaces is a great idea. It keeps the building cooler, allowing the cooling system to run more efficiently. These fans do use quite a bit of electricity, however, and could be replaced with inexpensive solar powered units.

- **Kitchen Equipment** – Is there is a staffroom, kitchenette, or full kitchen? Note the equipment being used. Is there an old electric range or refrigerator that could be replaced with a much more efficient model? Is the refrigerator running, empty, and not being used? Look for a yellow sticker displaying the energy efficiency of the unit
- **Computers** - Count computers and installed devices like printers. Note if they are on power-strips. Discuss the power-down management of systems with the staff. Reducing phantom load is another low-cost, easily implemented energy solution.

2.10 Hiring a Professional Auditor

After your team has conducted a walk-through audit and generated a baseline amount of information, you are now ready to identify a professional energy auditor to carry out a more precise energy evaluation. The auditor will utilize the information already obtained by your team and apply those findings to specific recommendations to improve the buildings performance and lower energy consumption. As previously discussed in section 2.8, there are two types of audits that are available to you at this stage – a “Decision-Grade Audit” (DGA) or an “Investment-Grade Audit” (IGA).

The energy auditor industry is an emerging industry, and as such, there will be several types of certification that an auditor may possess. The state of NH does not require energy auditors to be certified to conduct audits. The most common national audit certifications, however, are the [Home Energy Rater System](#) (HERS)¹¹ certification and the [Building Performance Institute](#) (BPI) certification. Some auditors may be new to the business as well. This is not necessarily a bad thing, but you want to make sure you are getting your money’s worth. Ask your auditor to provide an example audit that he or she has provided to another customer. At a bare minimum, certified auditors are required to carry out a certain amount of audits that are reviewed and approved by an entity established to train new auditors. Your auditor should at a minimum be able to provide you with one of these audit examples. This will allow you to see what you will get for your money. Typical procedures that a hired auditor will carry out are the following:



¹¹ Additional information regarding HERS can be found at http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_HERS

Blower Door Test:

A blower door test provides a professional auditor with the buildings airtightness.¹² The tightness of the building directly relates to how much air exchange occurs, therefore providing an understanding of how much heat and air conditioning escapes. The illustration and information on the next page was obtained through the Department of Energy's *Consumer Guide to Energy Efficiency and Renewable Energy*.¹³ While the example illustrates a home test, a professional auditor can still conduct a blower door test on many types of larger buildings. Be sure to ask the auditor if they have the equipment to test within a larger doorway.

¹² Depending on the building size, one blower door may not be sufficient to determine the tightness of the building.

¹³ You can find the full *Consumer Guide to Energy Efficiency and Renewable Energy* at <http://apps1.eere.energy.gov/consumer/>. This guide can provide a base understanding of components, technologies and simple projects your committee can carry out, or which you can carry out at your home. The diagram above was obtain from within the Consumer Guide and can be found at http://www.energysavers.gov/your_home/energy_audits/index.cfm/mytopic=11190.

Blower Door Tests*

Professional energy auditors use blower door tests to help determine a home's airtightness.

These are some reasons for establishing the proper building tightness:

- Reducing energy consumption due to air leakage
- Avoiding moisture condensation problems
- Avoiding uncomfortable drafts caused by cold air leaking in from the outdoors
- Making sure that the home's air quality is not too contaminated by indoor air pollution.

How They Work:

A blower door is a powerful fan that mounts into the frame of an exterior door. The fan pulls air out of the house, lowering the air pressure inside. The higher outside air pressure then flows in through all unsealed cracks and openings. The auditors may use a smoke pencil to detect air leaks. These tests determine the air infiltration rate of a building.

Blower doors consist of a frame and flexible panel that fit in a doorway, a variable-speed fan, a pressure gauge to measure the pressure differences inside and outside the home, and an airflow manometer and hoses for measuring airflow.

There are two types of blower doors: calibrated and uncalibrated. It is important that auditors use a calibrated door. This type of blower door has several gauges that measure the amount of air pulled out of the house by the fan. Uncalibrated blower doors can only locate leaks in homes. They provide no method for determining the overall tightness of a building. The calibrated blower door's data allow the auditor to quantify the amount of air leakage and the effectiveness of any air-sealing job.

Preparing for a Blower Door Test

Take the following steps to prepare your home for a blower door test:

- Close windows and open interior doors
- Turn down the thermostats on heaters and water heaters
- Cover ashes in wood stoves and fireplaces with damp newspapers
- Shut fireplace dampers, fireplace doors, and wood stove air intakes.

*Information courtesy of the US Department of Energy's *Energy Savers Booklet*.
http://www.energysavers.gov/your_home/energy_audits/index.cfm/mytopic=11190



Thermal Imaging:

Another diagnostic tool professional auditors typically use is a thermographic, or infrared camera. The camera is able to detect the surface temperature of different sections of a building, which light up different colors depending on how warm or cold those spots of the building are. This allows you to pin-point exactly where in the building heat is escaping. As with the blower door, below you will find information provided by the US Department of Energy's *Consumer Guide to Energy Efficiency and Renewable Energy* regarding the use of thermal imagery.¹⁴

Thermographic Inspections

Energy auditors may use thermography—or infrared scanning—to detect thermal defects and air leakage in building envelopes.

How They Work

Thermography measures surface temperatures by using infrared video and still cameras. These tools see light that is in the heat spectrum. Images on the video or film record the temperature variations of the building's skin, ranging from white for warm regions to black for cooler areas. The resulting images help the auditor determine whether insulation is needed. They also serve as a quality control tool, to ensure that insulation has been installed correctly.

A thermographic inspection is either an interior or exterior survey. The energy auditor decides which method would give the best results under certain weather conditions. Interior scans are more common, because warm air escaping from a building does not always move through the walls in a straight line. Heat loss detected in one area of the outside wall might originate at some other location on the inside of the wall. Also, it is harder to detect temperature differences on the outside surface of the building during windy weather. Because of this difficulty, interior surveys are generally more accurate because they benefit from reduced air movement.

Thermographic scans are also commonly used with a blower door test running. The blower door helps exaggerate air leaking through defects in the building shell. Such air leaks appear as black streaks in the infrared camera's viewfinder.

Thermography uses specially designed infrared video or still cameras to make images (called thermograms) that show surface heat variations. This technology has a number of applications. Thermograms of electrical systems can detect abnormally hot electrical connections or components. Thermograms of mechanical systems can detect the heat created by excessive friction. Energy auditors use thermography as a tool to help detect heat losses and air leakage in building envelopes.

Infrared scanning allows energy auditors to check the effectiveness of insulation in a building's construction. The resulting thermograms help auditors determine whether a building needs insulation and where in the building it should go. Because wet insulation conducts heat faster than dry insulation, thermographic scans of roofs can often detect roof leaks.

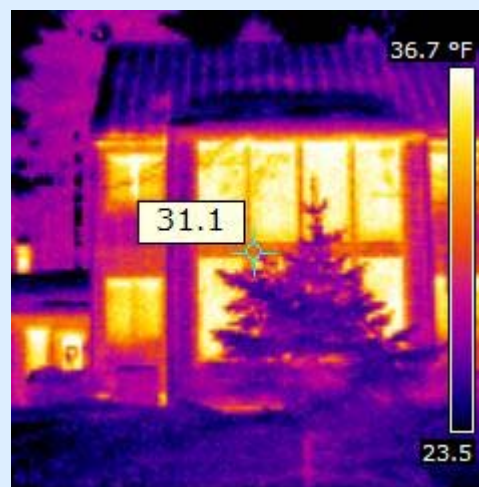
¹⁴ US Department of Energy. <http://www1.eere.energy.gov/consumer/tips/index.html>

Thermographic Inspections Continued...*

The energy auditor may use one of several types of infrared sensing devices in an on-site inspection. A spot radiometer (also called a point radiometer) is the simplest. It measures radiation one spot at a time, with a simple meter reading showing the temperature of a given spot. The auditor pans the area with the device and notes the differences in temperature. A thermal line scanner shows radiant temperature viewed along a line. The thermogram shows the line scan superimposed over a picture of the panned area. This process shows temperature variations along the line. The most accurate thermographic inspection device is a thermal imaging camera, which produces a 2-dimensional thermal picture of an area showing heat leakage. Spot radiometers and thermal line scanners do not provide the necessary detail for a complete home energy audit. Infrared film used in a conventional camera is not sensitive enough to detect heat loss.

Preparing for a Thermographic Inspection

To prepare for an interior thermal scan, the homeowner should take steps to ensure an accurate result. This may include moving furniture away from exterior walls and removing drapes. The most accurate thermographic images usually occur when there is a large temperature difference (at least 20°F [14°C]) between inside and outside air temperatures. In northern states, thermographic scans are generally done in the winter. In southern states, however, scans are usually conducted during warm weather with the air conditioner on.



*Information courtesy of the US Department of Energy's *Consumer Guide to Energy Efficiency and Renewable Energy* <http://apps1.eere.energy.gov/consumer/>.

2.11 How to Define Success

It is important for your committee to remember to monitor energy consumption after making improvements to determine the success of the project. Many projects will have a relatively long return on investment, but do not let this discourage you. *The inventory is not meant to be a onetime activity.* Rather, an inventory can be an annual exercise to incorporate annual data, involve and train new committee members, and collect new data to discern changes in energy consumption are projects are completed. This measurement and verification process is an important follow up step and should not be overlooked in the course of defining a projects full scope. It would be useful to begin discussion with municipal staff responsible for energy bills/data on what it would take for the data to be automatically entered into a chosen inventory tool for future billing cycles.

Remember, you will only realize significant energy efficiency gains if you are working with the building staff/users to use the building properly. An airtight envelope quickly loses its efficacy

when a staffer opens a window. Electricity bills will remain high when unnecessary refrigerators and equipment are left running 24/7.

Chapter 3

Technologies and Projects that Save Money and Reduce Emissions

After gathering all the necessary energy information, benchmarking your buildings, and then obtaining professional advice through conducting a professional audit, your committee has now arrived at attempting to implement the recommended efficiency improvement (again, be sure to refer to the Roadmap to verify you have not missed a step). Many projects are likely dancing through your head now, and in fact, many options may be available to you – based on your audit results. With all of the technologies and projects presented in this chapter, remember that every day that goes by is a lost opportunity to save money and make an investment in your community's energy future.

To help you sift through these options, we have included some information in this chapter that will help you understand some potential projects for your town.¹⁵

3.1 Potential Projects to Implement

3.1.1 Universal Projects

Weatherization

The process of weatherizing a building is typically the starting block to efficiency. Many buildings are similar to a leaky bucket – there are holes that need to be plugged before you try and fill it with water. A building is the same way. You want to fix the leaks (inefficiencies) in your building while at the same time try to incorporate new energy sources.

Weatherization typically includes:

- Sealing/repairing/replacing windows and exterior doors
- Improving insulation R-Values
- Insulating heating pipes and/or air ducts
- Cleaning air ducts and radiator units to allow for better heat transfer

Appendix VI provides information from the Environmental Protection Agency concerning types of weatherization projects your committee can carry out.

Lighting Projects

Significant cost and energy savings can be realized through lighting projects within your community. Municipal buildings, outdoor street lights and traffic lights are all potential

¹⁵ An important note to remember when evaluating the types of projects available to you is that each location and project is unique. You should consider all of the potential project categories listed in this chapter as simple examples that can be further evaluated by professionals who will consider the specific conditions of your site.

locations of greater efficiency. Replacing many lighting fixtures and bulbs with compact fluorescent (CFL) and LED bulbs can significantly reduce overall energy consumption. Many lighting specialists can assist your committee with identifying the greatest opportunity for savings. Consult with your electricity provider for specific utility lighting efficiency programs and rebates. See appendix for more information on utility programs.

Furthermore, to support keeping our sky dark at night (and therefore reducing energy), your committee might consider evaluating your community's outdoor lighting codes. The [International Dark-Sky Association](#) has developed a handbook called "[Outdoor Lighting Code Handbook](#)" that provides useful information concerning outdoor lighting.

3.1.2 Specific Projects and Technologies

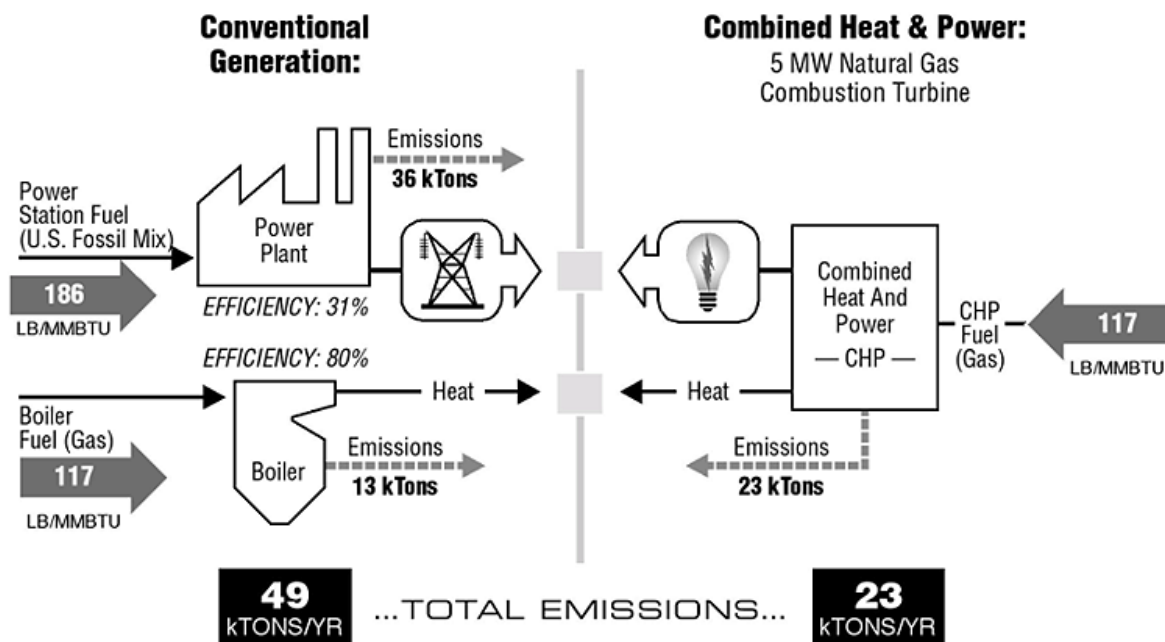
Combined Heat and Power (CHP)

Combined heat and power, also known as CHP or co-generation, is "an efficient, clean, and reliable approach to generating power and thermal energy from a single fuel source."¹⁶ A CHP system utilizes that single fuel, be it a fossil fuel based or renewable in nature, and ties into a buildings heat distribution system in the same way a traditional boiler does. The additional process is the connection of the system to the electrical panel to also provide electricity to the facility.

CHP is a form of distributive generation (meaning more, smaller, dispersed generating systems as compared to centralized power plants) that is now gaining significant traction in the United States. The image below provides an example of the increased efficiencies found with a large scale distributed CHP system.¹⁷ The avoided electrical losses seen when transporting electricity through outdated transmission systems provide for a more stabilized, less polluting power generation scenario.

¹⁶ EPA Combine Heat and Power Partnership. <http://www.epa.gov/chp/>

¹⁷ EPA Combined Heat and Power Partnership: Environmental Benefits. <http://www.epa.gov/chp/basic/environmental.html>. The illustration above was found on the EPA website and represents a larger, 5 megawatt CHP plant, but the efficiencies seen on a smaller scale are equal to or greater than that seen from a larger scale CHP plant.



Technological advances in the field of micro-CHP and micro-turbine technology have come a long way and now allow for individual building-sized applications. Typically seen in large scale industrial sites, university campuses, and district heating systems, CHP is now scaled for individual residential, commercial, and municipal uses. While the typical installation still uses a fossil fuel for its fuel source, CHP units possess the added benefit of increased efficiency through the production of two forms of energy. These efficiencies, coupled with proven technologies make CHP a wise option when evaluating a project that will require both heat and electricity.

In the fall of 2007, the [Town of Epping, NH](#), through the leadership of the Epping Planning Board and Planner, installed a 4.5 kw micro-CHP system in the Town's 125 year old Town Hall. The system runs on propane and provides the majority of the buildings heat for the entire year. To date, the Town has seen a 50% reduction in the building's electric bills and a 50-60% reduction in the heating bills. This technology was the first of its kind installed in New Hampshire and provides a replicable example of the use of micro-CHP within existing municipal buildings.¹⁸

Geothermal

Geothermal energy is the capture and use of the earth's relatively constant temperature for heating and cooling within a building. A geothermal heat pump (GHP) (also known as ground-source pumps) transfers thermal energy between the building and the ground through a series of pipes that are installed on the property. Pumps are then used to circulate the medium fluid through the ground loop that absorbs the heat during the

¹⁸ To find out more information about the Epping, NH, micro-CHP installation visit www.nhenergy.org.

summer to provide cooling, or provides BTU's for heating in the winter. The entire process simply moves heat back-and-forth from the ground into your building.

According to the US Department of Energy:

“The biggest benefit of GHPs is that they use 25%–50% less electricity than conventional heating or cooling systems. This translates into a GHP using one unit of electricity to move three units of heat from the earth. According to the EPA, geothermal heat pumps can reduce energy consumption—and corresponding emissions—up to 44% compared to air-source heat pumps and up to 72% compared to electric resistance heating with standard air-conditioning equipment.”¹⁹

For your municipality, typical applications can include coupling a geothermal heat pump with a radiant floor within the building to provide space heating, or for use in a garage bay at a municipal garage. These applications provide even, comfortable heat and are able to significantly lower the buildings heat loss (especially when compared to forced air systems).

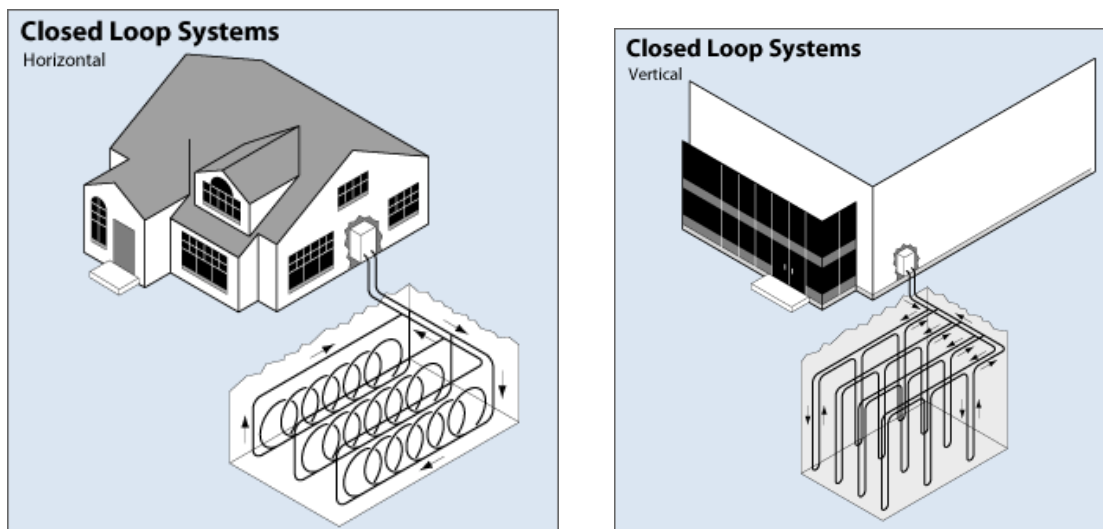
The New Hampshire Department of Environmental Services requires a registration process for the development of the wells associated with a geothermal installation, so be sure that the installer is aware of the necessary state requirements and codes before carrying out the installation.²⁰

The illustrations below depict two types of closed loop systems that could be installed at your building.²¹

¹⁹ US Department of Energy. Energy Efficiency and Renewable Energy: *Benefits of Geothermal Heat Pump Systems*. http://www.energysavers.gov/your_home/space_heating_cooling/index.cfm/mytopic=12660

²⁰ NH Department of Environmental Services: Requirements for Geothermal Systems in New Hampshire. <http://des.nh.gov/organization/commissioner/pip/factsheets/dwgb/documents/dwgb-22-23.pdf>

²¹ US Department of Energy. Energy Efficiency and Renewable Energy: *Types of Geothermal Heat Pump Systems*. http://www.energysavers.gov/your_home/space_heating_cooling/index.cfm/mytopic=12650



The Town of Strafford recently opened their new geothermal Town Hall. The system was integrated into the new construction project. This included a 3,600 square foot building that was built with state-of-the-art environmentally friendly materials including: cellulose insulation, raised heel trusses, insulated concrete floor slab, insulated slab edge, and a Geothermal heating, ventilating and air conditioning system. The use of these “green” materials will assist in saving the Town money in operating costs and do so in a way which ensures a healthy environment for years to come.

Solar Power

Solar power in New Hampshire has previously been regarded as a difficult investment because of the perception that there is an extended payback period due to upfront costs and lower solar radiance at this latitude. With reduced costs now seen with solar equipment, and a greater understanding of the actual output and benefits of solar power, these investments are proving more feasible and appropriate. Coupled with innovative financing options, further discussed in Chapter 4, solar power is now a completely viable option available to your municipality.

Two primary forms of solar energy are widely available – photovoltaic (PV) and solar thermal. Photovoltaic solar panels produce electrical power for use in a building, while solar thermal energy uses that same energy but transfers the energy into a fluid medium that is heated and used for either space heating or domestic hot water use within the building.²²

For a flat-plate collector, New Hampshire averages about 4-5 kw per square meter per day.²³

²² A terrific resource for all things solar is the Solar Energy Industries Association (SEIA). <http://www.seia.org/>

²³ US Department of Energy. Alternative Energy Resources in New Hampshire
<http://www.dsireusa.org/incentives/index.cfm?re=1&ee=1&spv=0&st=0&srp=1&state=NH>.

During the inventory and audit phase of your work, be aware of those locations that provide a large, flat, south-facing, non-shaded area where solar energy could be installed. Typical locations ideal for a larger array include school buildings, a large municipal complex, and fire and safety buildings. While large open locations are ideal, it should be noted that many buildings are still good candidates for solar power, just on a smaller scale.

Furthermore, solar energy can also be used to provide increased heat during the winter by utilizing passive heating, or preventing that passive solar gain during the summer to keep buildings cooler. Utilizing or preventing this passive solar gain can be as simple as opening or closing blinds.

The [Plymouth Area Renewable Energy Initiative](#) (PAREI) has put together a terrific program called “Energy Raisers” that brings local volunteer community members together to help install solar thermal and PV arrays on local resident’s homes.

Wind Power

Wind power is another clean form of energy generation that does not produce any emissions during electrical generation. The development of wind turbine technologies has also come a long way in their design and scale. The most critical component to wind power installations is first understanding what type of wind resource is available at a specific location. Just because it appears to always be windy in certain areas of your town does not necessarily mean those areas are appropriate for a wind turbine installation. Wind resources can be very site specific to a building/property. Not all locations have a steady/predictable amount of wind to harvest, as compared to solar which is relatively predictable over a year time frame. The most effective way to determine whether the installation of a wind turbine is appropriate at a facility is by erecting and operating (for a minimum of 6 months) a wind “anemometer”. An anemometer is a device that attaches to the top of a pole and collects valuable wind speed data over a given period of time. This allows you to evaluate whether there is a consistent amount of wind at that location to warrant the installation of a turbine, as well as what size turbine is appropriate.

Wind turbines also vary greatly in size and shape. Turbines now range anywhere from 400 watt systems all the way through multiple megawatt systems (1,000,000 watts equals 1 megawatt).

The objective for any wind turbine installation is to have the turbine in operation as much as possible. If the turbine installed requires too high of a cut in speed than is present on a consistent basis for the site (meaning the speed required for the system to initially begin operating), then the turbine will only operate during those times of high gusts and not produce the desired energy generation. Therefore, it is important for your committee to first evaluate potential sites your municipality could erect a turbine(s) and then work with a professional installer to determine the whether that site has enough of a wind resource to warrant a project.

The Town of Newfields erected an anemometer on top of their community's wastewater treatment plant during the fall of 2008. The picture to the right shows the installation of the anemometer device to the top of the pole. The device is then connected to a data collection device that will store the wind speeds seen at the site. The Town of Newfields is hoping to gain a better understanding of what type of wind resource is available in town.



To find out more information on wind energy, visit the following sites:

- American Wind Energy Association - <http://www.awea.org>
- US Department of Energy: Wind Powering America - http://www.windpoweringamerica.gov/astate_template.asp?stateab=nh
- New Hampshire Office of Energy and Planning – <http://www.nh.gov/oep/resourcelibrary/swes/index.htm>

Your committee can assist your local officials and staff in understanding the wind resources available in your community. Your committee can begin by visiting the resources above and presenting to your local officials what options might be available for further investigation in your town. Your committee can bring together the relevant experts, state and local decision makers, along with information from other municipalities that have used anemometers together for a discussion on what the next steps for your town are to investigate community wind power.

Cars & Trucks: Vehicle Fleet Evaluation and Replacement

Vehicle fleets typically include a wide variety of vehicles that can significantly vary in fuel efficiency. Some purpose-driven vehicles may not be suitable for replacement at the moment, but many other vehicle replacements may be possible (code enforcement vehicle, parking enforcement vehicles, etc.). The [City of Portsmouth](#), for example, through the use of ICLEI's Climate Protection Campaign, evaluated the City's municipal fleet and discovered that it accounts for roughly 12% of the City's CO₂ emissions.²⁴ In an effort to combat those emissions, the City of Portsmouth has purchased two electric vehicles that serve as security and maintenance vehicles in downtown Portsmouth and have removed two gasoline fuel vehicles from the City's fleet.²⁵

²⁴ Cities for Climate Protection Campaign. Portsmouth, NH: Summary Report. http://www.cityofportsmouth.com/sustainability/misc/final_report.pdf

²⁵ Portsmouth Committee on Sustainable Practices. <http://www.cityofportsmouth.com/sustainability/zerogastruck.htm>

Additionally, [STOCC](#) provides a municipal fleet evaluation tool that your committee can also use to determine the emission rate of your municipalities vehicle fleet.

3.1.3 Renewable Fuel: Production and Use

The use of renewable fuels provides your community the opportunity to utilize local resources for energy generation. In many instances, renewable fuels can be used with existing equipment – with a proper blend. A renewable fuel, as compared to a fossil fuel, is not finite. With proper management and the use of sustainable practices, renewable fuels can offset emission rates through replanting and harvesting of the biomass material in the fuel. Renewable fuels can range from biomass products (wood and organic materials), to biofuels (cellulosic ethanol), to the use of hydrogen in a fuel cell application. Below are a few examples of types of renewable fuels and their use.

Biodiesel

Currently all of Keene's 77 Public Works Department vehicles run on B20 biodiesel fuel. The Biodiesel project was initiated by Steve Russell of the Keene Public Works Department in 2002.

Cost & Savings:

There are no costs associated with the conversion of the engines to run on biodiesel fuel. The City of Keene has successfully changed over all their diesel fuel to B20 (biodiesel with 20% bio and 80% diesel). The estimated annual CO2 savings for the city of Keene is 417 tons.

Check out the [National Biodiesel Board](#) website for general information and tax incentives. As this price can vary on a day-to-day basis, check the National Biodiesel Board's website for the latest information as well as contacts for suppliers, retailers, and distributors. This is approximately 4 cents more per gallon than standard diesel fuel. The overall cost to the community would depend on how much fuel is required for their usage, and whether they were mixing the fuel themselves or purchasing it from a third party. The [Tax Incentives Assistance Project \(TIAP\)](#) offers up-to-date information on available credits and tax forms for use when applying for the credits, which are ultimately decided by the IRS.

The Keene biodiesel example demonstrates the relative ease of implementation so often seen with incorporating biodiesel - since no engine modifications were necessary and the biodiesel itself requires no special storage. Using biodiesel also helped Keene to lower the particulate emissions of their fleet vehicles. Workers inside the fleet maintenance facility have also benefited by the reduction in fumes, reporting better air quality and subsequently fewer headaches!

Wood Pellets²⁶

Wood pellets demonstrate another form of renewable heating fuel that can be gained from local biomass resources. According to the Pellet Fuels Institute, a non-profit industry association, wood pellets are a biomass product that is generally made from recycled wood waste. Fuel efficiencies in wood are typically determined by the moisture content found in that wood and can vary depending on the pellet's base material.



Wood pellets are becoming more widely available within the Northeast due to the continuing development of regional pellet fuel providers. This fuel is burned in specific wood pellet boilers that come in a variety of sizes. These boilers can replace existing out-dated boilers found in many municipal facilities throughout New Hampshire and can help support the use and development of a locally produced fuel source, as well as the development of a new type of industry within the State.

3.1.4 Additional Local Energy Projects

Safe Routes to School

The goal of the Safe Routes to School program is to encourage a greater number of children to either walk or ride their bikes to school. The program encourages children to walk or ride their bike through education and incentives that remind them how much fun it can be. Parents' safety concerns are also addressed by encouraging greater enforcement of traffic laws, exploring ways to create safer streets and educating the public about safe walking, biking and driving habits.

In the Fall of 2004, the [Nashua Regional Planning Commission](#) (NRPC) conducted the Safe Routes to School Pilot Study at Ledge Street Elementary School in Nashua. The purpose of the study was to identify current attitudes about biking and walking to school and issues and concerns that are deterring these modes of travel. The process involved gathering information from students and their parents regarding the trip to and from the school.



²⁶ The Massachusetts Division of Energy Resources released a guidebook titled *Wood Pellet Heating: A Reference on Wood Pellet Fuels and Technology for Small Commercial & Institutional Systems* in June 2007 that discusses wood pellets as a fuel source and a some common consideration when evaluating wood pellets for your application. You can download this guidebook at http://www.mass.gov/Eoca/docs/doer/pub_info/doer_pellet_guidebook.pdf.

A sample survey and map are available for download, as well as the complete study from the Nashua Regional Planning Office website.²⁷

Process:

To implement a Safe Routes to Schools Program in your community, the Marin County Bicycle Coalition (California), creators of Safe Routes to Schools, offers many resources on their [website](#), including links for training and technical assistance to aid in the development of your unique plan, model press releases and letters of support, and the [Safe Routes to Schools Toolkit](#). To find potential funding, look to the federal government's [SAFETEA program](#). Additional information can also be found at the [National Center for Safe Routes to Schools](#).

Implementing a safe routes to school initiative in your community can help with outreach into the school and residential communities. It has the multiple benefits of improving your town's air quality, addressing other health issues and reducing emissions and money spent on gasoline from citizens in your community.

Stay Warm NH Participation

The [Stay Warm NH](#)²⁸ program, run through the New Hampshire Office of Energy and Planning is a program to help vulnerable New Hampshire citizens reduce their winter energy costs by mobilizing volunteers to install winterization kits at several locations. Several committees have volunteered their time to assist with installing these Stay Warm Kits. The Colebrook Energy and Environment Committee assisted in installing a total of 24 kits last winter.²⁹

Idling Reduction Campaigns

The New Hampshire Idling Reduction Campaign³⁰, run through the New Hampshire Department of Environmental Services (DES), provides extensive information on how your committee can assist in reducing needless vehicle idling in your community. One specific area your committee can influence is school bus idling. According to DES' *School Bus Anti-Idling Initiative* :

“Air pollution from diesel vehicles has health implications for everyone, but children are more susceptible to this pollution because their respiratory systems are not fully developed. Diesel exhaust typically contains particulate matter (PM), hydrocarbons (HC), and carbon monoxide (CO). Exposure to fine particles in school bus exhaust can result in increased

²⁷ For additional information about the Nashua Safe Routes to Schools Program, visit: www.nashuarpc.org/saferoutes/index.htm

²⁸ New Hampshire Office of Energy and Planning. Stay Warm NH. <http://www.staywarmnh.org>

²⁹ Town of Colebrook Energy and Environment Committee. http://www.nhenergy.org/index.php?title=Town_of_Colebrook

³⁰ New Hampshire Department of Environmental Services. *Idling Reduction Campaign*. <http://des.nh.gov/organization/divisions/air/tsb/tps/mssp/irc/index.htm>

frequency of childhood diseases, such as asthma. At school yards, idling school buses release emissions directly into the breathing zone of children. As children line up to board an idling bus, they are exposed to the vehicle's emissions at the most concentrated levels. Limiting the amount of idling time not only reduces exposure of school students to the harmful pollutants in diesel exhaust, but it also improves air quality.”

“In 2002 DES teamed up with the New Hampshire School Transportation Association (NHSTA) to launch a voluntary initiative to protect school children and bus drivers from excessive exposure to exhaust emissions from school buses. As part of the initiative, fleet managers and school bus drivers throughout New Hampshire are encouraged to adopt policies and practices to reduce school bus engine idling time whenever possible. This initiative has been expanded to include the whole school community. School officials are encouraged to turn their school yards into “Clean Air Zones” by establishing no idling policies for all drivers who enter the school area - bus drivers, parents, teachers, student drivers and delivery vehicles.”³¹

The DES Idling Reduction Campaign website provides a host of material and information your committee can use to support an Idling Reduction Campaign in your community. Also available on the site is a sample idling policy document for municipalities that your committee can use as a template to establish your own municipal regulation.

Light Bulb Swap-Out

Several communities throughout New Hampshire have conducted “light bulb swap-out” projects that encourage community members to use and safely dispose of more efficient compact fluorescent lights (CFL). The [Town of Antrim Energy Committee](#), for example, “offered the compact fluorescent light bulbs (CFL) to Antrim residents at the Antrim Recycling and Transfer Station. A total of 155 bulbs, ranging in wattage from 15 to 25 watts were offered. The 15 and 20 watt bulbs were free after customers filled out a \$2 off coupon from PSNH.”³² As a result of the success of their efforts, the committee is considering carrying out more swap-out events in the future. Other committees that have also conducted this type of project include Colebrook and Barrington.

Film Series

Several communities have chosen to hold a film series every month that presents a film on a particular climate change topic intended to increase knowledge on the subject and/or awareness of actions that can be taken within the community. Film suggestions include:

- “An Inconvenient Truth”
- “The Great Warming”
- “The 11th Hour”

³¹ New Hampshire Department of Environmental Services. *Idling Reduction Campaign: Overview*. <http://des.nh.gov/organization/divisions/air/tsb/tps/msp/irc/categories/overview.htm>

³² Town of Antrim Energy Committee. http://www.nhenergy.org/index.php?title=Town_of_Antrim

- “End of Suburbia”
- “Affluenza”

3.2 Public, Private, Commercial, and Residential

Involving citizens and organizations outside of your committee and municipal structure will be an ongoing process. Many community members, from home owners to local businesses, are interested in saving energy and money by making improvements to their building or installing some form of sustainable energy generation. Your committee will likely receive calls from community members for assistance from your committee. Your committee’s level of participation will vary depending on whether you would have the capacity to support particular efforts.

Some things to consider when expanding your committee’s work to other areas of the community:

- Does this fit within our formation structure and mission statement?
- How much time will this require?
- Does the committee have sufficient resources to provide support to other entities?
- Can we effectively move forward with other committee work while being involved in this effort (i.e. continue inventorying and benchmarking municipal buildings)?
- Is this a beneficial outreach opportunity?

The New England [Carbon Challenge](#) provides “off-the-shelf” resources for individuals and communities to educate and motivate residential energy/greenhouse gas reductions. The Carbon Challenge™ is a joint initiative of the University of New Hampshire (UNH) and Clean Air - Cool Planet (CA-CP) committed to providing NH residents and communities with the information, tools and support necessary for households to reduce their residential carbon dioxide emissions by 10,000 pounds per year. A key objective of the Carbon Challenge is to develop a duplicable residential outreach model using research-based voluntary behavioral change tools that target the root causes of climate change inaction and utilize the networks and community organizations that can foster personal behavioral change.

LECs have been effectively building community partnerships around Community Carbon Challenges to both reduce residential emissions and to build community support for larger municipal initiatives and projects. The North Hampton Carbon Challenge is a prime example of utilizing New England Carbon Challenge tools in a three-way partnership between the LEC, school and public library. The New England Carbon Challenge provides customized web-based support, implementation guides, trainings and support for implementing community-designed residential outreach projects.³³

3.3 Leaving the 1970s behind

The 1970s forced many people to rethink our energy supply and habits within this country. Several international incidents forced Americans to realize the vulnerability of the nation’s

³³ Visit www.nhcarbonchallenge.org for more information.

energy infrastructure. As a result, Americans began to investigate alternative forms of energy that could be harnessed to reduce this volatility.

As we are aware, this initial thrust toward more sustainable, more renewable, local energy resources was largely marginalized once the price of oil receded and oil was plentiful once more.

Currently, awareness concerning climate change and the impacts to the global climate as a result of human activities has once again forced this country to reconsider how we use energy and what that energy is derived from.

While New Hampshire still obtains the majority of its power (both thermal and electric) from fossil fuel based resources, significant opportunities now exist for the installation of alternative/renewable forms of energy.

3.4 Information Accessibility

Not only have energy products and technologies changed, but our ability to educate and assist community members has changed significantly. The power and magnitude of the internet now enables your committee to showcase the accomplishments you have achieved, as well as to gain insight into the activities of other LECs across the State.

In response to repeated requests from LECs for a type of clearinghouse for information on what other LECs across New Hampshire are doing, along with information on energy technologies and current events, a Wikipedia-type website was created called the New Hampshire Community Energy Project - www.nhenergy.org. The website, fondly referred to as “The Wiki”, is meant to provide a gateway into energy, local activities, and best practices for local energy committees. The website is devoted to the objective distribution and sharing of information. The wiki provides your LEC with the ability to discover what other LECs are doing across the state. And you can create, update, and edit your very own community page within the wiki. Many LECs choose to also link to their own LEC webpage for further information on activities.

Furthermore, organizations and websites such as the New England Carbon Challenge now allow community members to log on to the website and take the Carbon Challenge, which provides an eye opening look at your carbon footprint and several common sense steps to reduce your impact.

While new technologies will further our ability to lower our impacts on the earth, our behavioral patterns and our ability to alter those patterns will ultimately decide what type of world we will create for our children.

Chapter 4

Financial Tools

Once a community has an understanding of its energy use and impact and has engaged in the preliminary analysis of project selection and alternatives, it is time to consider financing. Analyzing the wide range of options available for financing ensures that projects receive the support they deserve. The only option we do not cover here is the possibility of private donations. It is quite likely that such funds can be secured and should be considered, but the wide-range of possible outcomes is beyond the scope of this chapter.

Acquiring financial resources to conduct energy audits, educational programs, and energy efficiency and generation projects can be challenging. There are many organizations throughout the state that are working together to ramp up these resources and provide assistance to communities that are interested in exploring projects. This chapter is organized so that it follows financing structures for consideration. Different projects are discussed in the context of each structure along with the pros and cons of each implementation. Further research tips are provided, as well as next steps to ensure that your consideration is complete.

4.1 Introduction

This section boldly states concerns that are relevant to energy issues in our municipal building stock. It is important to persevere on project completion and combating the myths associated with energy projects due to the recent price fluctuations, dramatic economic downturn and stunning development of new incentives for action. New Hampshire municipalities must be encouraged to take advantage of this opportunity to invest in a domestic and sustainable energy future which results in a vibrant local economy and cost-stabilization for our citizens. The time is ripe for immediate action

In this context, it is important as we consider the economics of these efforts and confront the misperceptions and omissions in our dialogue about energy.

Life Cycle Costing

The National Institute of Standards and Technology (NIST) Handbook 135, 1995 edition, defines Life Cycle Cost as “the total discounted dollar cost of owning, operating, maintaining, and disposing of a building or a building system” over a period of time. Life Cycle Cost Analysis is an economic evaluation technique that determines the total cost of owning and operating a facility over period of time.

Since municipal buildings are funded in their initial year through bonds and/or capital outlays, they generally fall victim to an inordinate focus on the bottom line cost of construction instead of the lifetime cost to operate the building. This is a critical misstep in particular with energy concerns for municipal buildings because they are placed in service for a significant period and are subject to extended energy pricing. A more

efficient building could save the costs of initial investments several times over during its lifespan.

Energy Price Stability

The second most important concern about energy costs is the volatility. Municipalities budget on a yearly cycle and must predict energy costs over the year – sometimes over pricing the cost in the case of high lock-in prices or subjecting the municipality to risk where a cost (+ some percentage) contract is used for the year. When prices go up budgets go up, when they go down, budgets tend to go down. Changes result in wide variation in predictability and thus lead to fund shortages or balances, and general frustration on all sides of the discussion.

The concept of stability in the context of energy prices is achieved through on-site distributed generation with effective predictive modeling and most importantly, efficiency. The cheapest energy you buy is the kind you don't use. The less energy you have to buy, the less amount of appropriations are subject to the frequent energy price swings.

“Green” Building Cost Myths

A perception that all energy-efficient construction costs more than conventional construction persists. During the research on these handbooks, we were able to find no valid research that supports this conclusion, especially where choices made about efficiency are evaluated in a realistic context considering the life cycle cost to operate the facility. To the contrary, we found several sources, from government facility agencies, that show not only that in most cases costs are in fact lower but that any increased cost is almost immediately realized through lower operating expenses.

Net Metering

Net metering is a policy tool that enables utility customers with qualifying forms of onsite generation to interconnect with the grid and feed excess power to the grid for the full power rate. On the other side, the customer may draw power from the grid when on-site power consumption exceeds on-site power generation. When the customer feeds back into the grid, the electricity meter spins backwards, thereby crediting the onsite generation at the customer's retail price of electricity (which includes all taxes, transmission, distribution and generation costs associated with the credit kwh).

If a utility customer produces more power than it consumes, the amount of “net excess generation” is rolled forward and credited to the next month's bill. In New Hampshire, the credit is “annualized” to balance the use and generation across the entire year at that full retail rate. It is not clear from the law, where the excess power is “donated” to the utility or if the utility is then required to pay the generation rate for the power.

Tax Incentives

Normally, in the context of municipal investments in New Hampshire, the concept of tax incentives is never raised. However, recent developments in the market and the law have led to creative approaches in project financing that allows for governments to indirectly benefit from these incentives. Each of the financial vehicles that invoke these benefits on behalf of the municipality is discussed below.

The issue here is to realize that municipalities are no longer constrained by the budget approach – appropriation and expense. The changes are prolific in their benefits and limited in their costs, but require learning on the part of the government to insure that the right vehicle is selected for the right project.

Modeling

Energy projects that save money and reduce emissions are often researched and presented in terms of the cost, the projected savings, the projected emission reductions and with transparency with respect to assumptions. There are several simple software programs that allow users to model the effectiveness of most upgrades. These modeling software programs provide the most assistance in their ability to provide the base data necessary to fully explain and understand these projects.

As previously discussed, the fundamental data needed to understand the footprints of our buildings relates to the size and use of the structure, a year's worth of energy use (bills will do) and a general understanding of the current conditions of the facility (this lists items are the essential elements of a building's "benchmark"). This data can be plugged into most models to produce a variety of decision tools for consideration using available weather data, energy rates and emission profiles for the fuel. The benefit of trying to do it yourself is that multiple options can be explored without great expense and will generally lead to a more fully-formed understanding of the entire field.

Some funding mechanisms that may be new to the reader are also worth defining and describing. In some cases, these incentives have limiting factors that must be understood before assuming that they will be a viable option for your community. The following provides short summaries of some of lesser known options.

Forward Capacity Market

Our electric grid is managed by an entity known as the Independent System Operator New England (ISO-NE). ISO-NE is responsible for ensuring that the grid functions and supplies the energy we demand. As a means to facilitate our increased demand without relying solely on centralized power plants, the Forward Capacity Market (FCM) was created. Under this program, ISO-NE is responsible for performing forecasts of needed capacity three years in advance and for conducting an annual auction to purchase sufficient power to meet those needs. The program requires that generators be paid for any capacity purchased from them, but generators would not receive payment if the capacity is unavailable when called upon. Generators are designated by an application

process through ISO-NE. “Generation” under this program can be met through reduced demand (load shedding) and through aggregation of multiple sources. The smallest blocks of demand is 100kw, so the size is fairly large for most towns, but could easily be aggregated across facilities.

Several third-party providers can manage these applications for a fee. ISO-NE has extensive and highly-technical resources at their website. The fundamental issue is to be aware of the program and to not leave any funding stone unturned. Distributed generation and demand reduction can participate in the program in blocks of 100 kw. In most cases, multiple elements can be aggregated to reach these block levels. Payments are made monthly based on the capacity and is dependent on the reliability of performance. Failure to lower demand or generate when called upon will result in substantial penalties.

ISO-NE website: http://www.iso-ne.com/markets/othrmkts_data/fcm/index.html

Renewable Energy Credits and Their Benefit to Municipalities

Renewable energy credits (RECs) provide income by permitting the separation and sale of qualities of generated renewable electricity. These components are related to but separate from the generation of the electricity itself. Markets for RECs are found throughout the region and can be sold in other states in either voluntary or mandatory markets. Sales of RECs require verification and monitoring.

Municipal projects can draw income from RECs in either compliance or voluntary markets. In compliance markets RECS can be used for purposes such as fulfillment of renewable portfolio standard (RPS) requirements. In voluntary markets, organizations and individuals purchase RECs either bundled or unbundled with electricity to claim green power usage. Since these credits are auctioned, the options will be evaluated at the time of the credit’s production for the most favorable market. The funds from these auctions will be used to buffer the financial benefits of the project and secure the performance guarantees.

RECs are sold in blocks of megawatt/hours and can be coordinated by third-parties.

4.2 Balance Sheet Financing

In some cases, a town may be able to finance energy projects on its balance sheet (budget), using reserves or working capital as part of the budget. This may be easier when replacing failed equipment or for smaller projects. For upgrades and retrofits, there may be capital reserve accounts set aside for maintenance to town buildings or even Capital Improvement Programs that include schedules for such activities. Either way the cost these types of projects would be immediate and direct.

For efficiency projects, the facility will benefit from lowered utility costs. These lowered utility costs are subtracted from the up front costs to analyze the savings and benefits of the project.

Additional outcomes are equally beneficial but are generally non-economic, such as leadership, innovation and educational. For distributed generation projects, the site host benefits from avoided electricity costs and may be able to realize additional revenue from Renewable Energy Credits or similar financial incentives if they qualify.

Balance sheet financing raises issues associated with high up-front expenditures and a steep learning curve for a non-core government role. Additionally, such projects may leave the site host with technology and performance risk for some projects. Finally, a government is unable to benefit from the federal tax benefits generated by the project. As a result, other financing options are likely more advantageous.

Municipal budgeting is controlled by New Hampshire State Law and if this approach is to be considered, it should be carefully injected into the budget process early on to ensure its consideration and to provide time to deploy the necessary education and outreach.

4.2.1 Audits and Education Programs

Balance Sheet financing may be a viable option for audits and education programs because their up front costs are lower than other types of projects and their complexion is more service oriented. As such, they may appear to some to be more of a “service” of the government. There is no doubt that these efforts produce benefits; not the least of which is the foundation for all further programs. Sometimes, however, there is a delay or disconnect between the audit and the savings.

Audits provide the benchmark for energy performance and are a general check-up for buildings in the municipal portfolio. Decision grade audits can be affordable and partially performed by volunteers (some towns enjoy a high level of expertise on their committees and can complete them entirely on their own). Buildings where obvious concerns exist can be focused in their assessment, such as through blower door tests, heating system evaluation, etc. These projects can be paid through budget processes and/or reserve accounts that are set aside for building maintenance consistent with the theory that these projects equate to preventative measures for the building, allowing for prioritization of upgrades to the facilities

Another benefit to having the audits done separately ensures that the results are focused on community goals. A community should have an objective in mind when asking for an audit. That objective should be consistent with a set of goals that frame the desired outcome. If money is the only concern, that should be communicated to the auditor. If emissions are the primary goal, that should be communicated, otherwise, an "audit" could be endless and touch on issues that are not chief concerns of the community. Criticism can occur when auditing results are focused on specific outcomes that appear to favor the auditor rather than the client.

Educational and outreach programs are important to a municipality’s approach to energy-related impacts. The economic benefits are even more detached than audits. However, the results are no less important. Since this chapter is about financing however we must acknowledge that the most appropriate avenue for funding for education will likely to be more “programmatic” due to this factor.

4.2.2 Energy Efficiency

In this chapter the concept of energy efficiency is expanded upon as to how it relates to financing issues. Efficiency upgrades and efforts are not usually eligible to the municipality through tax incentives or other grants and programs if the project is funded directly from the balance sheet. This, of course, results because the government does not pay taxes.

In these cases, project evaluation requires a well-developed assessment of the costs and financial benefits so that the budgetary concerns can be adequately presented and understood. The other less-tangible results remain a part of the package results but are not directly considered economic.

Pursuing projects through the budgetary process has some attractive elements that are worth mentioning. With straight financing, the municipality owns the results and can utilize some of the other non-tax based incentives described below, such as RECs and FCM payments.

Energy efficiency “makes money” by generating savings. These savings can offset the costs and result in an immediate positive cash flow model. Equipment can be purchased through lease-purchase programs over a period of time allowing for an immediate savings and a cost line item that is budgetary and not debt-based. This flexibility is an important tool in the municipality’s options for financing.

4.2.3 Distributed Generation

How does Distributed Generation (DG) make money?

The fundamental impediment to the installation of renewable and clean energy systems is the perception of increased cost. The challenge is to change this perception and effectively communicate a new choice for facilities and utilities. The objective of many communities is to install and maintain energy systems that will meet the community’s environmental and economic objectives and provide an important educational and leadership opportunity for the community. If implemented effectively, the growth potential for distributed generation mirrors our projections for increased demand for energy. That said, the first order of business is the perceived impediment.

Myths associated with this impediment include the belief that:

- future systems will increase in efficiency or decrease in costs making a present investment untimely;
- energy prices fluctuate wildly making current investments risky;
- the complexity of these systems, their installation and their opposition from regulators and utilities will make their deployment too complicated;
- incentives are too infrequent, unstable, or difficult to benefit from and can only be utilized by private entities and home owners;

The reality is renewable and efficient energy systems:

- are reliable and affordable;
- are supplemented by stable incentive programs at the state and federal level;
- can be installed at virtually any facility (including schools and governments) in an arrangement that captures tax credits and incentives;
- stabilize energy costs over the long term with the support of the regulatory authorities and the utilities,;
- in most cases will yield a return on investment in less than 15 years for electric systems and 5 years for combined electric and thermal systems.

A final comment regarding distributed generation relates to the efforts to develop a “smart-grid”. The objective of smart grid technology is to create a connected information-based monitoring system. The communications and information in a smart-grid are projected to promote efficiency through real-time pricing, distribution, conservation and interaction with distributed resources.

4.3 State and Federal Incentives

Many opportunities to gain state and federal assistance in carrying out efficiency programs are available to LECs. It can be difficult, however, to navigate through the myriad of incentives to discover what program is right for you and your project.

Several existing and recently initiated New Hampshire-based programs are available for financial support of energy-related projects. A summary of these programs is provided in this section along with additional reference materials for further research in Appendix VII.

The federal government provides free access to up-to-date information regarding state and federal opportunities for building efficiency and energy generation. The *Database of State Incentives for Renewables & Efficiency* (DSIRE)³⁴ provides a terrific overview of New Hampshire’s existing incentives for renewable energy and energy efficiency measures. To better assist the reader in understanding the opportunities presented on the DSIRE website, we have included the summary language provided by DSIRE within Appendix VIII of this document. (Please note that the DSIRE website is continually updated and should be monitored for the most current revision/updates to these programs).

Resources and organizations available in New Hampshire:

[New Hampshire Office of Energy and Planning](#)

[The Jordan Institute](#)

[New England Grassroots Environment Fund](#)

The [American Recovery and Reinvestment Act of 2009](#) has provided new and expanded opportunities for your municipality to receive federal funding and resources. A dramatic round of

³⁴ You can view the DSIRE website at www.dsireusa.org. The service does not the following comment: “The information on the DSIRE web site provides an overview of incentives and other policies, but it should not be used as the only source of information when making purchasing decisions, investment decisions, tax decisions or other binding agreements. Please refer to the individual contact provided in each record to verify that a specific incentive or other policy is applicable to your specific project.”

funding and regulatory changes have been enacted under this law affecting a wide range of incentives and funding mechanisms. A summary of these changes is incorporated below to provide a jump-start to research into these opportunities. The state and the federal governments maintain websites devoted exclusively to the ARRA mechanisms.

4.3.1 Tax Incentives

Three-Year Extension of PTC: The section provides a three-year extension of the Production Tax Credit (PTC) for electricity derived from wind facilities placed in service by December 31, 2012, as well as for geothermal, biomass, hydropower, landfill gas, waste-to-energy and marine facilities placed in service by December 31, 2013.

- § 1101 ARRA, affecting § 45 IRC, allowing for longer period to get the credit for these facilities.

Investment Tax Credit (ITC) Accessible to All Renewable Energy: The section provides project developers of wind, geothermal, biomass and other technologies eligible for the PTC, the option of instead utilizing the 30% ITC that previously only applied to solar and other clean technology projects.

- § 1102 ARRA, affecting § 48 IRC in such a way as to elect out of § 45 IRC for these technologies, which allows for up front bonus versus life of the system “trickle in” bonus.

Repeals Subsidized Energy Financing Limitation on ITC: The section allows businesses and individuals to qualify for the full amount of the ITC, even if their property is financed with industrial development bonds or other subsidized energy financing.

- Section 1103 ARRA, affecting Section 48(a)(4) IRC, allowing the full cost of the project to be considered the basis of the property even if funded by bonds or other subsidies.

Grant Program in Lieu of Tax Credits: The bill allows project developers to apply for a grant from the Treasury Department in lieu of the ITC. The grant will be equal to 30% of the cost of eligible projects that start construction in 2009 or 2010. It will be issued within sixty days of the facility being placed in service or, if later, within sixty days of receiving a grant application.

- § 1603 ARRA creates the grant for the ITC amount and affects §§ 1-4 of 45 IRC (wind, biomass, solar and geothermal/electric) to 30% grant and adds new energy property with a 10% grant § 1104 ARRA coordinates the grant with Section 48 IRC to prevent double dipping.

30 % Grant:

- Wind
- Closed-Loop Biomass
(Plants planted for
purpose of electricity)
- Open-Loop Biomass
(Livestock waste and
waste plants)
- Geothermal
(Electricity)
- Solar
- Landfill
- Trash Combustion

- Hydro
- Hyrdokinetic (tidal)
- Fuel Cell
- Solar
- Small Wind

10% Grant:

- Geothermal
- Microturbines
- CHP
- Geothermal heat
pumps

Increases Credit for Alternative Fuel Pumps: This section increases the size of credits for installing alternative fuel pumps at gas stations from 30 to 50% (\$30,000 to \$50,000) for taxable years 2009-2010.

- § 1123 ARRA, amending § 30(C)(e) IRC.

Advanced Energy Manufacturing Credits: This section provides \$2 billion worth of energy related manufacturing investment credits at a 30% rate. These credits apply to projects creating or retooling manufacturing facilities to make components used to generate renewable energy, storage systems for use in electric or hybrid-electric cars, power grid components supporting addition of renewable sources, and equipment for carbon capture and storage (CCS).

- § 1302 ARRA affects many sections of the IRC and other statutes and requires a full read of the provision.

Plug-in Electric Drive Vehicle Credit: The bill increases the tax credit for qualified plug-in electric drive vehicles for the first 200,000 placed in service. The base amount of the credit is \$2500. Batteries with at least 5 kilowatt hours of capacity have a credit of \$2917. The credit is further increased by \$417 for every kilowatt hour in excess of 5 kilowatt hours, but cannot exceed \$5000. The credit is allowed to be taken against the alternative minimum tax (AMT).

- § 1141 ARRA sets the credit affecting § 30(D) of the IRC to create the new credit.
- § 1144 ARRA allows the credit to apply against the AMT.

Extends Bonus Depreciation: The bill extends, through 2009, the temporary increase of bonus depreciation to 50% that Congress enacted last year. These

write offs can be applied to capital expenditures ranging from \$250,000 to a newly increased threshold of \$800,000.

- § 1202 ARRA affects § 179 of IRC extending period of bonus depreciation for energy property.

4.3.2 Direct Spending Incentives:

Total Direct Spending for Renewable Energy and Energy Efficiency: The ARRA package provides \$16.8 billion in direct spending for renewable energy and energy efficiency programs over the next ten years.

- \$3,200,000,000 shall be available for Energy Efficiency and Conservation Block Grants for implementation of programs authorized under subtitle E of title V of the Energy Independence and Security Act of 2007 (42 U.S.C. 17151 et seq.), of which \$2,800,000,000 is available through the formula in subtitle E: The Secretary may use the most recent and accurate population data available to satisfy the requirements of section 543(b) of the Energy Independence and Security Act of 2007. Current projections are that the following guaranteed distributions will be made in New Hampshire (NH OEP):

New Hampshire, Municipal and State Allocations:

OEP	\$9,593,500
Concord	\$203,800
Derry	\$133,200
Dover	\$123,400
Hudson	\$104,500
Londonderry	\$106,200
Manchester	\$1,049,400
Merrimack	\$116,400
Nashua	\$834,900
Rochester	\$126,500
<u>Salem</u>	<u>\$131,100</u>
NH Total	\$12,522,900

- The remaining \$400,000,000 shall be awarded on a competitive basis.
- Provided further, that \$5,000,000,000 shall be for the Weatherization Assistance Program under part A of title IV of the Energy Conservation and Production Act (42 U.S.C. 6861 et seq.):

- \$3,100,000,000 shall be for the State Energy Program authorized under part D of title III of the Energy Policy and Conservation Act (42 U.S.C. 6321).

Smart Grid: increases federal matching grants for the Smart Grid Investment Program from 20% to 50%.

R&D, Demonstration Projects: provides \$2.5 billion for renewable energy and energy efficiency R&D, demonstration and deployment activities.

Advanced Battery Grants: provides \$2 billion for grants for the manufacturing of advanced batteries and components. This includes the manufacturing of advanced lithium ion batteries, hybrid electrical systems, component manufacturers, and soft-ware designers.

Defense Energy and Efficiency Programs: provides \$300 million to the Department of Defense (DOD) for the purpose of research, testing and evaluation of projects to energy generation, transmission and efficiency. The bill provides an additional \$100 million for Navy and Marine Corps facilities to fund energy efficiency and alternative energy projects.

Study of Electric Transmission Congestion: requires the Secretary of Energy to include a study of the transmission issues facing renewable energy in the pending study of electric transmission congestion that is due to be issued in August 2009.

Grid Development: provides \$11 billion to modernize the nation's electricity grid with smart grid technology. This includes \$4.5 billion for the DOE Office of Electricity Delivery and Energy Reliability for activities to modernize the nation's electrical grid, integrate demand response equipment and implement smart grid technologies.

4.3.3 Bond and Loan Programs:

Clean Energy Renewable Bonds (CREBs): The package provides \$1.6 billion of new clean energy renewable bonds to finance wind, closed-loop biomass, open-loop biomass, geothermal, small irrigation, hydropower, landfill gas, marine renewable, and trash combustion facilities. One third of the authorized funding will be available for qualifying projects of state/local/tribal governments, one-third for public power providers and one-third for electric cooperatives.

- § 1111 ARRA amends § 54 of the IRC to raise the amount of bonds eligible.

Renewable Energy Loan Guarantee Program: provides \$6 billion for a temporary loan guarantee program for renewable energy power generation and transmission projects that begin construction by September 30, 2011. Up to \$500 million of the

overall \$6 billion can be used for the development of leading edge biofuels that have been demonstrated and have commercial promise to substantially reduce greenhouse gas emissions.

4.4 Third-Party Ownership & Financing

The most important part to understanding the potential in third-party ownership is the ability to address up front capital costs and access tax benefits. Additional benefits are potential operations and maintenance savings where the implementation is owned by a third-party. In the three-party model, new businesses will be able to create an income stream and take over the insurance, performance assurance, and maintenance of the renewable energy system. New jobs and local investment will follow. The business will secure stable and long-term funding enabling expansion to other facilities for similar projects. This will form the foundation for a sustainable business model.

4.4.1 Benefits of Third-Party Ownership

There are several benefits that appear for the municipality that is considering a third-party financing strategy.

Ability to Monetize Federal Tax Incentives. Federal tax incentives for some projects can equal 30% of the installed capital cost. Under the current law, this 30% is payable in the form of a grant from the Department of Treasury (rules to be released in July 2009). In addition, businesses can accelerate the depreciation of the cost of some systems and installations using a five-year schedule. Together, these two incentives can have a tremendous impact on both the cost of and the financial returns on a project. Local governments, however, cannot directly benefit from these incentives. The third-party ownership model introduces a taxable entity into the structure that can benefit from the federal tax incentives, lowering the overall cost to the non-taxable entity.

Low/No Up-front Costs. **The need to reduce up front costs for a municipality is significant,** even with programs to provide support such as rebates and grants. Given the current economy and budget constraints, a large initial investment is difficult to achieve regardless of the return on the investment. A third-party structure places the responsibility of the increased initial cost on to the investor/developer of the project.

Predetermined Energy Pricing. In a project that involves efficiency or distributed generation, the portion of conservation or generation that is met by the project can be considered “fixed” at a particular price in the terms of the contract. This can be in the form of a fixed-priced power purchase agreement (with a predetermined escalation rate). This predictability offers stable pricing for the portion of the entity's load served by the project. In most cases, the price of electricity in power purchase agreement is usually set at or below the customer's current retail rate for the first year, and then escalates annually for term of the contract (in a solar power purchase agreement, these terms are usually 20 – 25 years). For solar projects, an annual price escalator of 3-3.5% is common.

Operations and Maintenance. Another attractive feature of the third-party ownership structure is the fact that new equipment can result in lower operation and maintenance expenses and in the case of some systems, the entire cost and responsibility can shift to the project developer.

Eventual Ownership. As a final issue, third-party structures can be pre-crafted to permit and even encourage local government buyout provisions. This allows the municipality to consider advanced purchase options if circumstances change in a way that makes this pathway more beneficial. For instance if a grant program becomes available, such funds can be used to accelerate the ownership path and provide for a more immediate “vesting” of full savings opportunities.

Otherwise, these arrangements usually provide for a number of options at the end of the term. The three likely scenarios for the host would be to: 1) extend the arrangement, 2) purchase the facility, or 3) ask that the improvements be removed.

4.4.2 Concerns with Third-Party Structures

Owning the Rights. In general, hosts for distributed generation systems must be careful how they advertise how the facility is *powered* by clean or green energy. If RECs are generated and disposed of on the REC markets, technically, only the owner of the REC can claim the environmental attributes of the solar power. In essence, the host has sold the clean attributes of the system in the form of REC.

We recommend for those that are concerned about this issue that the entity state that the facility “hosts” the system.

Ownership and the Host Facility. In some cases, ownership and facility access is important. Some facilities and staff may not be comfortable with a third party having access to and installing equipment on the property. Due to the fact ongoing site access is critical to the performance of the system the host town should involve all interested parties at the outset of the project.

4.4.3 Contract Issues and Municipality

New Hampshire towns approve funding of their operating obligations on an annual basis, so there will be issues associated the question about long-term leases and service contracts. From other state and local government experiences, these concerns are typically addressed through two mechanisms:

Non-appropriation clause requirement: Such a clause is required in municipal leases as well as energy performance contracts for state agencies. NH RSA 21-I:19-d. A non-appropriation clause permits the hosting customer to terminate the arrangement at the end of any appropriation period without further obligation or payment of any penalty, if and only if, the host was unable to obtain appropriation for funds to meet future scheduled payments and a formal resolution or ordinance is passed. The concerns associated with

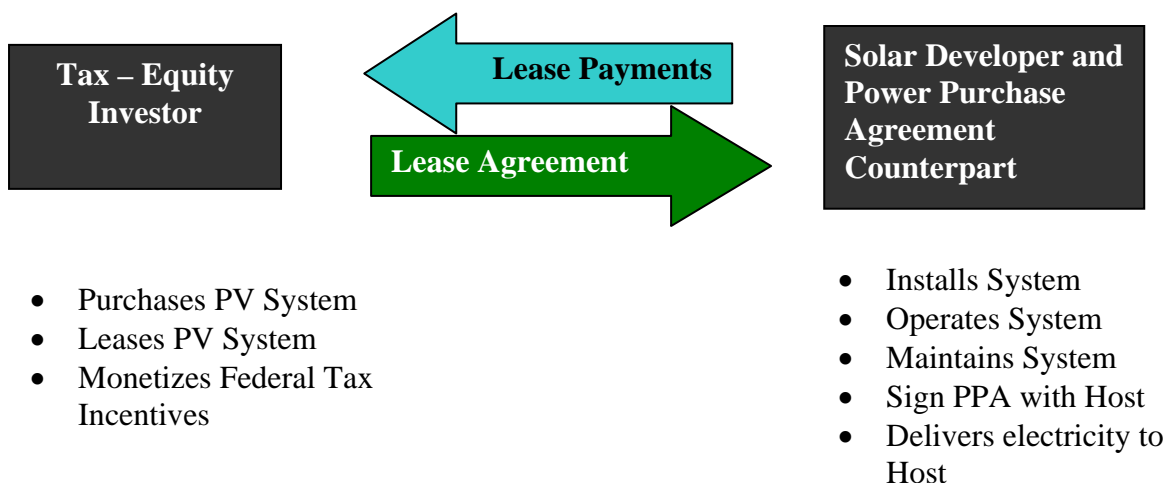
this issue are that financing entities may shy away from support for these projects where such an open ended way out is present.

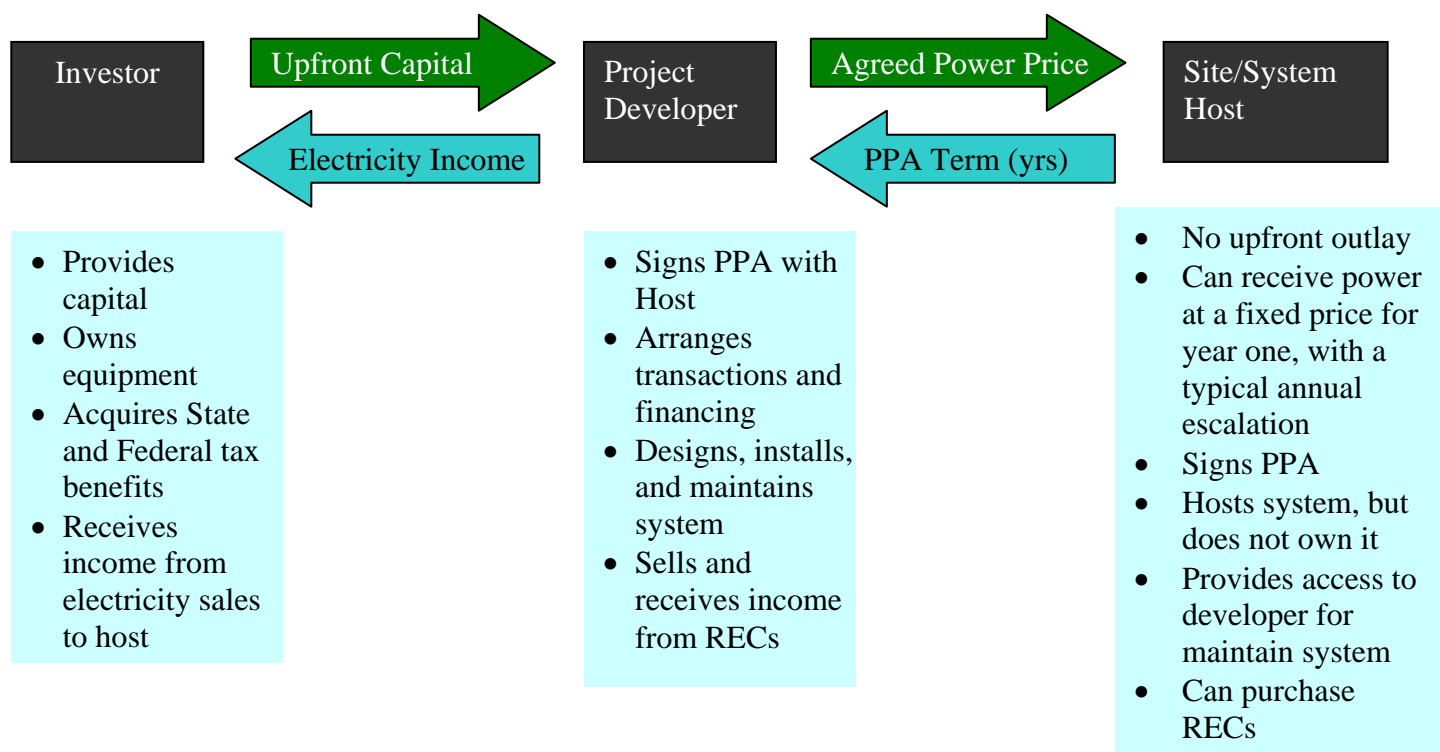
One way to alleviate these concerns is to include a "best efforts" requirement, i.e., the customer promises to use its best efforts to seek and obtain the necessary appropriation for payment. This provision is common in tax-exempt leases and is designed to enable the customer to account for the obligation as a current expense instead of debt. More support is provided for the ongoing funding of the project where the savings exceeds the costs – thus there is no actual “expense”.

Another attempt to address the non-allocation concern is the inclusion of a non-substitution clause. Non-substitution clauses are used to protect a project’s viability. If a contract is canceled due to non-appropriation, the clause prohibits the customer from replacing the hosted system supported by the agreement with equipment that performs the same or similar function. Given the host’s right to cancel through a non-appropriation clause, the non-substitution provision is intended to provide some comfort to the investor and the project developer. It is important to talk to the municipal attorney about either of these concerns and have them discuss the positives and negatives of these options with the local officials.

4.5 Third-Party Models

Towns are frequently exposed to the dynamics between project developers and tax-investors. The agreement between these parties will influence elements of the contract with the town. Ownership structures include the sale-leaseback model and the partnership-flip model. The model employed will usually affect the terms of the contract. These models are likely to only be seen in distributed generation systems rather than efficiency programs.





4.6 Performance Contracting

Performance contracting can be an agreement (contract) between a municipality and an energy service company (ESCO). The energy performance contract (EPC) can provide the resources to finance and acquire needed capital equipment in order to improve energy efficiency and comfort in public buildings. In a EPC with an ESCO, the ESCO identifies and evaluates energy saving opportunities and recommends improvements that will be paid for through the savings from energy reductions generated from the improvements. The ESCO will guarantee energy cost savings that will pay for all associated project costs over the life of the contract. These contracts typically average 7 to 10 years. New Hampshire has legislation that authorizes public facilities to use an EPC for implementing energy improvement projects.

4.7 Utility Programs

Utility programs are summarized in Appendix VII and should be researched directly with the providing utility. Different programs are available through the different utilities and should be included at the outset of any project.

4.7 Looking Forward

Two major developments in other jurisdictions are gaining support in New Hampshire. These programs involve the use of revolving loan funds for energy efficiency projects and the use of voluntary assessment districts where municipal financing can be accessed to install distributed generation systems.

APPENDICES

Appendix I: Project Organizational Form

Project Organizational Form

This form can be used to organize committee work and responsibility delegation on any particular project.

Project Title: _____ Date: _____

Brief Description: _____

Location: _____

Responsibilities:

Project Lead – _____

This member will be responsible for organizing tasks associated with the project and verifying tasks are being completed.

Committee Liason – _____

This member will be the point of contact for other municipal officials.

Outreach Coordinator – _____

This member should be responsible for actively generating interest about the project among community members and the greater public.

Resource Coordinator – _____

This member will be responsible for assisting in any benchmarking and inventories requirements and will be the lead on software tools for this project.

Appendix II: Case Study – Cool Monadnock



Municipal Greenhouse Gas and Energy Use Baseline Report for Chesterfield

This report is a summary of greenhouse gas emissions and energy use for the town of Chesterfield, NH for the year 2005. The focus of this report is the municipal operations of the town, with special emphasis on town-owned buildings. It does not encompass residential, commercial, or industrial energy use. It has been prepared by the Cool Monadnock Project,³⁵ a collaborative project of Clean Air-Cool Planet, Antioch New England Institute, and the Southwest Regional Planning Commission. Data was gathered through the volunteer efforts of the Cool Monadnock Town Representative and analyzed by the Cool Monadnock team, using EPA Portfolio Manager software and Clean Air and Climate Protection software provided by ICLEI.³⁶

Cool Monadnock Town Representative: John Kondos.
This report was prepared by Brendan Banerdt.

Municipal overview

Town population: 3,925³⁷.
Area of municipality: 47.6 sq. mi.
Population density: 82.5 people/sq. mi.
Cool Monadnock region total population: 102,926 (2006 estimate).
Municipal population as a percent of Cool Monadnock region population: 3.81%.
Number of municipal buildings: 14.
Total area of municipal building space: 39,955 sq. ft.
Average energy intensity of all municipal buildings: 53 kBtu/sq. ft.
Number of street lights: 114.
Number of vehicles in fleet: 20.
Total cost of municipal energy use in 2005: \$104,701.
Total municipal energy use in 2005: 5,771 MMBtu.
Total municipal CO₂ emissions in 2005: 511 tons.

³⁵ www.coolmonadnock.org.

³⁶ For more information on EPA Portfolio Manager Software, see www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager. Information on CACP software is at www.cacpsoftware.org.

³⁷ Population numbers are taken from the 2006 estimates from the Census Bureau at http://factfinder.census.gov/servlet/SAFFPopulation?_submenuId=population_0&_sse=on.

Municipal Sector Analysis

For each participating municipality, data was gathered on the operations of several sectors under the jurisdiction of the municipal government: the buildings, vehicle fleet, employee travel (how much municipal employees travel for municipal business), street lights, water and sewage, and waste. Different types of energy use were considered depending on the sectors, such as electricity use, heating fuel use, fuel for vehicles, and tons of waste. Where records were available, the costs of purchasing these energy sources were factored in to the analysis. The CACP software was used for the analysis of the aggregate data on all municipal sectors

Table 1. Energy use, equivalent carbon emissions³⁸, and costs, by municipal sector

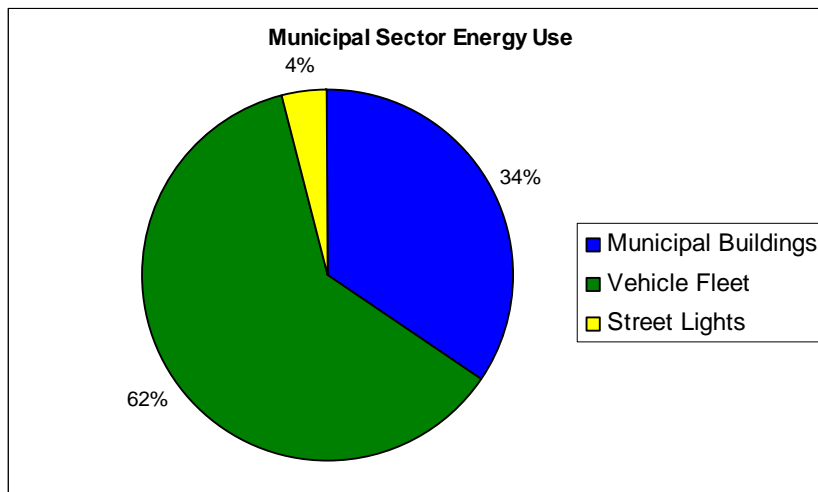
Municipal Sector	Energy Use (MMBtu) ³⁹	Energy Use (%)	Equiva-lent CO ₂ (tons)	Equiva-lent CO ₂ (%)	Energy Cost (US\$)	Energy Cost (%)
Municipal Buildings	1981	34	178	35	39697	38
Vehicle Fleet	3568	62	308	60	51425	49
Street Lights	222	4	25	5	13619	13
Total	5771		511		104741	

Source: 2005 Cool Monadnock inventory (compiled 2009)

Generated by CACP Software

Snapshot of 2005 Municipal Energy Use, Emissions, and Costs by Sector

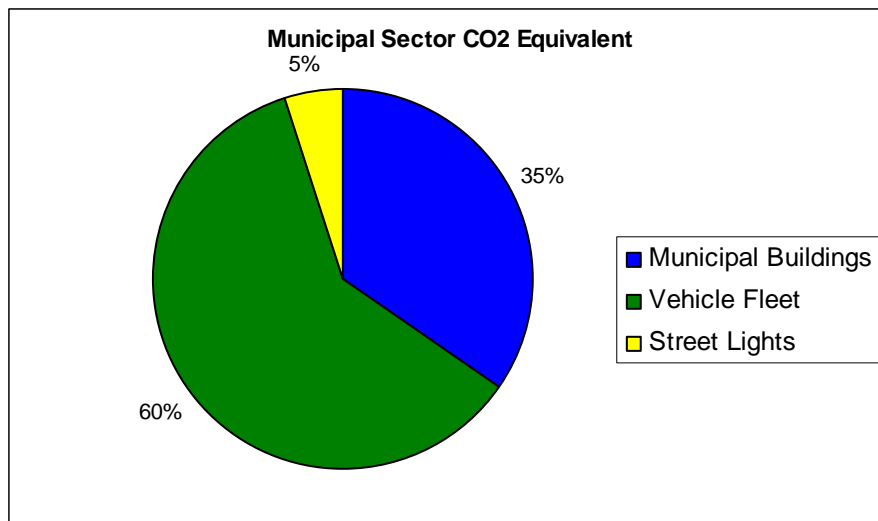
Graph 1a. Municipal Energy Use (MMBtu)



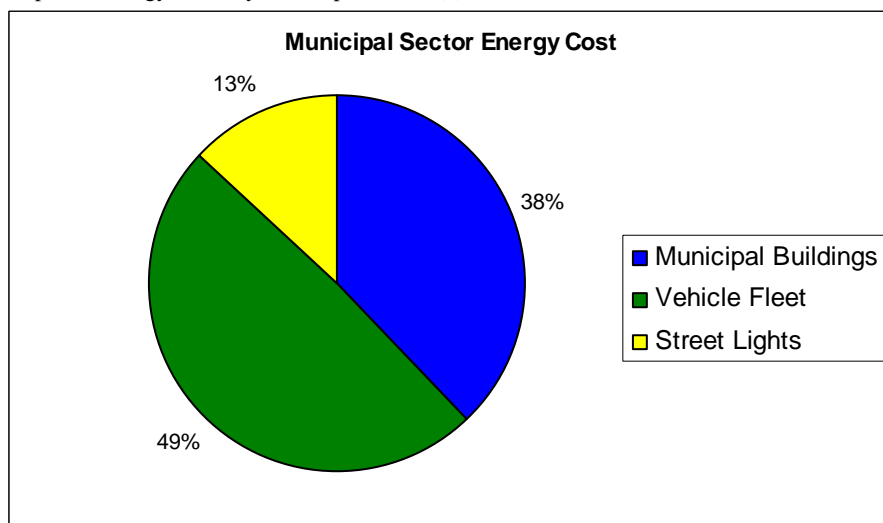
³⁸ According to the Clean Air and Climate Protection software, "Equivalent CO₂ (eCO₂) is a common unit that allows emissions of greenhouse gases of different strengths to be added together. For carbon dioxide itself, emissions in tons of CO₂ and tons of eCO₂ are the same thing, whereas for nitrous oxide, an example of a stronger greenhouse gas, one ton of emissions is equal to 310 tons eCO₂."

³⁹ The Clean Air and Climate Protection software presents energy use in MMBtus, which is one million British Thermal Units, a common measure of energy consumption (see [www.energyvortex.com/energydictionary/british_thermal_unit_\(btu\)_mbtu_mmbtu.html](http://www.energyvortex.com/energydictionary/british_thermal_unit_(btu)_mbtu_mmbtu.html)).

Graph 1b. Municipal Carbon Equivalent Emissions (tons)



Graph 1c. Energy Costs by Municipal Sector (\$)



We examine three sectors in this report: municipal buildings, the vehicle fleet, and street lights. This includes 14 buildings, 20 vehicles, and 114 street lights. The vehicle fleet is the most significant sector in all respects, accounting for 62% of energy use, 60% of carbon emissions, and 49% of energy costs. The other major sector, municipal buildings, account for 34% of energy use, 35% of carbon emissions, and 38% of energy costs. The next section contains a more detailed analysis of the municipal building sector. Recommendations for further investigation of the vehicle fleet can be found at the end of this report.

Building Performance: Energy Use, Emissions, Costs

Data was gathered for each individual building managed by the municipality. The following table combines data from EPA Portfolio Manager software (energy intensity, CO2 emissions) and CACP software (energy use). Data on costs were entered into the Portfolio Manager software. Graphs below illustrate the relative intensity of energy use and their costs among the buildings under the municipal jurisdiction.

Table 2. Energy Use, Carbon Emissions, and Energy Cost for Municipal Buildings

Name of Building	Energy Use (MMBtu)	Energy %	CO2 emissions (tons) ⁴⁰	CO2 %	Energy Cost (US\$)	Energy Cost %
Beach Property (Rec. Center)	1	0	0	0	1361	3
Beach Property (Residence)	3	0	0	0	194	0
Beach Property (Concession Stand)	6	0	1	1	351	1
Cemetery	5	0	1	1	278	1
Fire Department (Central)	213	11	4	3	3295	8
Fire Department (Spofford-Old)	254	13	22	15	4374	11
Fire Department (West Chesterfield)	121	6	9	6	1831	5
Highway Garage	343	18	34	22	7676	20
Historical Society	69	3	5	3	1261	3
Police Station	87	4	3	2	2926	7
Public Library	207	10	19	13	4856	12
Town Hall/Annex	393	21	30	19	5409	14
Old Town Offices	207	10	15	10	3260	8
Transfer Station	72	4	8	5	2625	7
Totals	1981		151		39697	

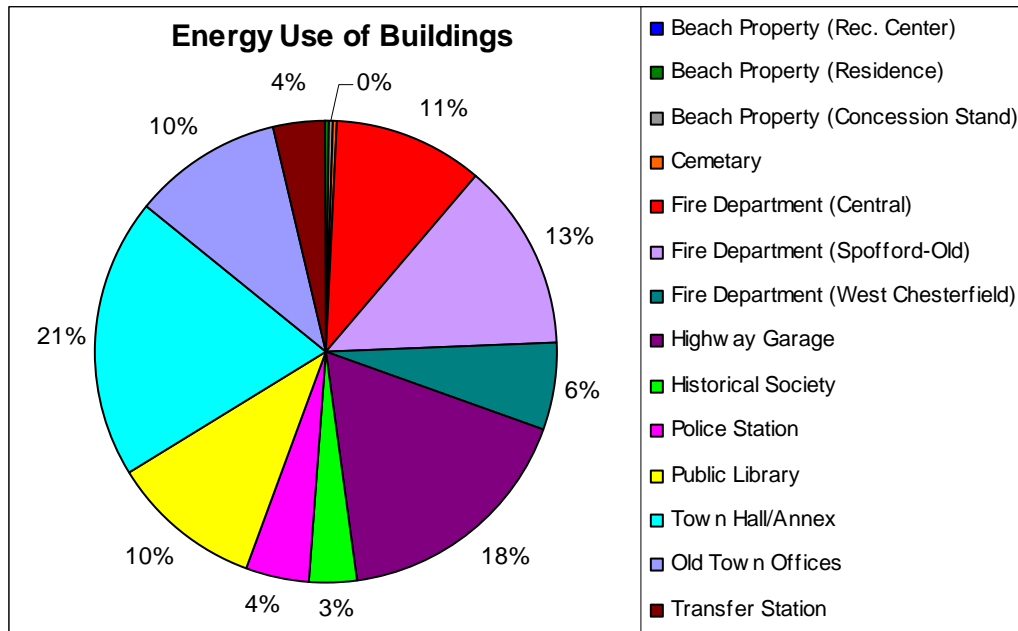
Source: 2005 Cool Monadnock inventory (compiled 2009)

Carbon data generated by EPA Portfolio Manager Program; energy use generated by CACP software

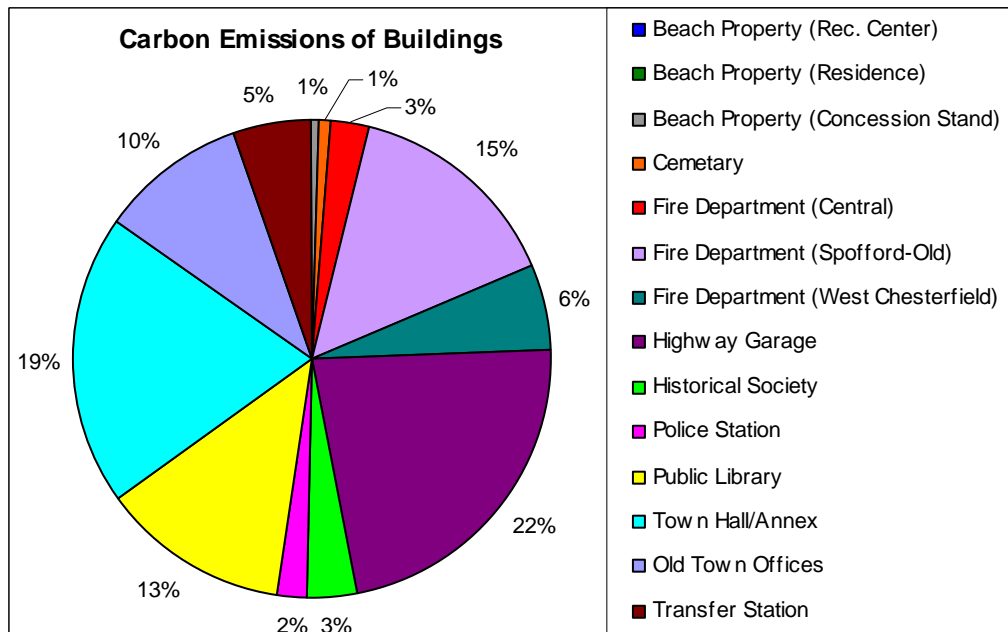
⁴⁰ Carbon emissions on the EPA Portfolio Manager software are measured as carbon dioxide emissions only and do not include equivalents for other types of greenhouse gas emissions.

Snapshot of 2005 Energy Use, Emissions, and Costs, by Building

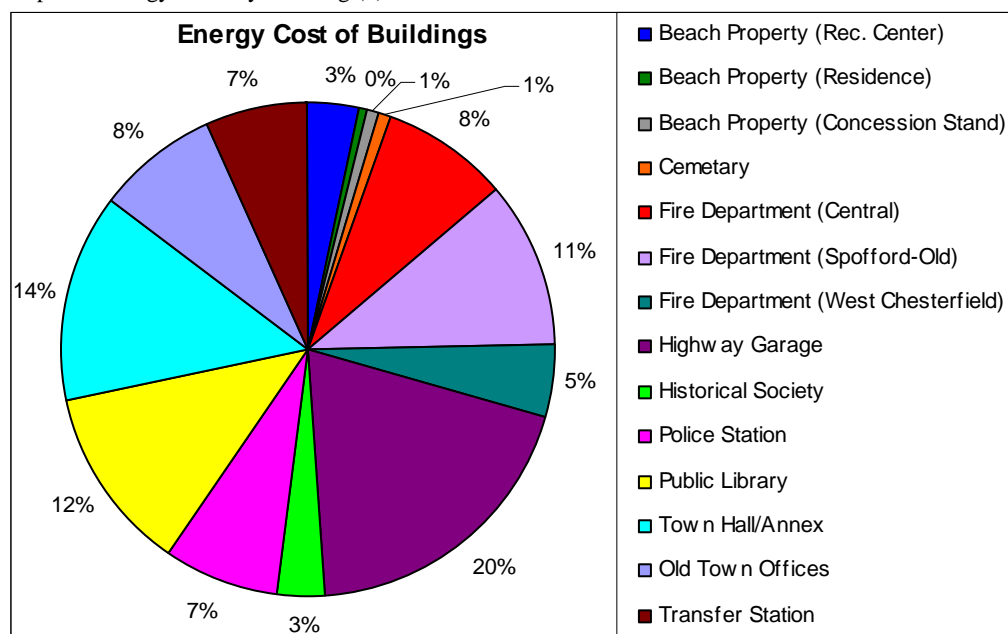
Graph 2a. Energy Use by Building (MMBtu)



Graph 2b. Carbon Dioxide Emissions by Building (tons)



Graph 2c. Energy Costs by Building (\$)



The two buildings that use the most energy are the Town Hall/Annex and the Highway Garage. (Note: The Highway Garage is heated by fuel from same tank vehicles refuel from. The energy usage of the garage is based on estimated values provided by the Highway Department.)

Other buildings that use high amounts of energy include the Public Library, Old Spofford Fire Department, Central Fire Department, and the Old Town Offices. Note that the Central Fire Department has much smaller carbon emissions than the other buildings in this group, probably due to less electricity use (a trait shared by the other fire departments, compared to library and offices) combined with less fuel for heating. It may be worthwhile to study this building for ideas to reduce emissions in other buildings.

Smaller but still significant consumers of energy include the Transfer Station, Police Station, Historical Society, and the West Chesterfield Fire Department.

Schools were not assessed because they are not included in the municipal budget. Local Energy Committees may approach school boards and encourage them to engage in an assessment process for school operations. The Jordan Institute can be approached as a resource to assist in this process.

Building Performance: Energy Intensity

Table 3. Energy Intensity, by municipal building

Name of Building	Type(s) heating fuel used	Area (Sq. Ft.)	Site energy intensity (kBtu/sq ft) ⁴¹	Average Site kBtu/sq ft for building type	Source energy intensity (kBtu/sq ft) ⁴²	Average source kBtu/sq. ft for building type
Beach Property (Rec. Center)		1141*	1	65	3	136
Beach Property (Residence)		1141*	2	87	8	194
Beach Property (Concession Stand)		1141*	5	104	17	213
Cemetary		1000**	5	104	16	213
Fire Department (Central)	Oil	5120	6	78	20	157
Fire Department (Spofford-Old)	Oil	3977	64	78	81	157
Fire Department (West Chesterfield)	Kerosene	1300	90	78	108	157
Highway Garage	Diesel***	7600	53	104	83	213
Historical Society	Oil	4558	15	104	19	213
Police Station	Oil	1329	62	77	186	182
Public Library	Oil	5400	38	104	67	246
Town Hall/Annex	Oil	3000	129	77	144	182
Old Town Offices	Oil	2960	70	77	103	182
Transfer Station	Propane	288	253	77	718	182

Source: 2005 Cool Monadnock inventory (compiled 2009)

Energy intensity data generated by EPA Portfolio Manager Program

* Square footage of Beach Properties estimated by dividing combined area between individual buildings.

** Square footage of Cemetary building is based on rough estimate provided by Chesterfield LEC member.

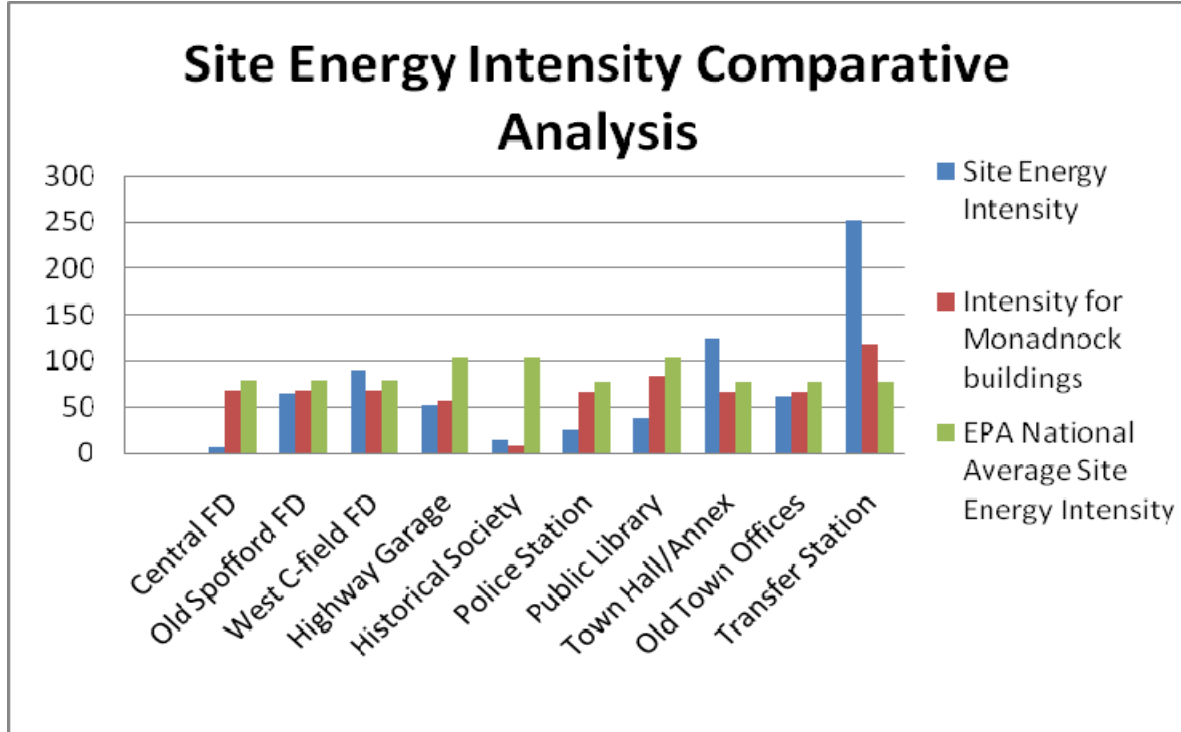
*** Highway Garage heated by fuel from same tank vehicles refuel from. Energy usage based on estimated values provided by the Highway Department.

⁴¹ Site energy intensity = amount of energy expended per square foot *on site* to heat, cool, and electrify the area. This measure relates to how much is being used on site and fluctuates directly with how much lighting is being used, how thermostats are kept, etc.

⁴² Source energy intensity = amount of energy expended per square foot based on the source of energy (hydropower, nuclear, coal, fuel oil, etc) and the efficiency of that fuel type.

Snapshot of 2005 Energy Intensity by Building

Graph 3. Site Energy Intensity (kBtu/sq. ft.) of significant Chesterfield buildings relative to buildings of similar usage in the Monadnock area and across the nation.



Energy intensity is the most powerful tool that the Cool Monadnock Project has available for measuring the relative energy efficiency of particular buildings. Site energy intensity can be addressed through behavioral and energy conservation measures whereas source energy intensity would require alterations in the type of energy being used to power, heat, or cool a space. The best opportunities for saving energy on site would involve behavioral changes (such as keeping lights and computers turned off; turning down thermostats) and energy conserving technologies (such as motion sensor lighting). Measures to save source energy would include switching the type of fuel being used to heat or cool a space and asking your electricity provider to use green sources of energy. The graph presents site energy intensity data only, as this is the area that can most easily be addressed through energy reduction efforts (source data is available in Table 3).

The EPA Portfolio Manager software allows for the comparison of buildings to a hypothetical “average building” of similar usage in the same geographic region. Most buildings in Chesterfield compare favorably to the average comparison building, with the exception of the Transfer Station, Town Hall/Annex, and the West Chesterfield Fire Department. Since the Transfer Station is a special case (explained below), the Town Hall/Annex is the building with the highest energy intensity, and probably offers the most opportunities for energy savings, followed by the West Chesterfield Fire Department.

(The Transfer Station does have an extremely high energy intensity, but it creates a misleading impression in this case. Energy intensity is based on the square footage of a building, and is more appropriate for measuring the energy efficiency of a heated space than a facility that runs heavy machinery.)

The Old Spofford Fire Department and Old Town Offices (both currently closed, new uses yet to be determined), and the Highway Garage have a slightly better than average energy intensity, while the Public Library and Historical Society are much better than average. These buildings are significantly better than the Town Hall/Annex, but will likely still have some room for improvement.

Including Chesterfield, we have completed 2005 municipal energy assessments in eight Monadnock area towns. Chesterfield buildings are compared to these averages in graph 3. Our sample included 13 fire departments, three of which are located in Chesterfield. The Central Fire Department had a significantly lower energy intensity than any other fire house in the region. The old Spofford Fire Department was close to the average in the area; and the West Chesterfield Fire Department was slightly higher than average. In the same way, the Highway Garage had a very average energy intensity compared to the 9 garages in our sample. The historical society is a very light energy intensity building, and so is the one other historical society in our sample. The Police Station, Town Hall, and Town Offices were included with the 13 office-type buildings in our sample. The police station and town offices were found to have lower energy intensities than the regional average, but the Town Hall/Annex had a relatively high energy intensity. The Public Library is a less energy intensive building compared to the nine local libraries. While the Transfer Stations is a very intensive energy user relative to the average, it is operating in a much smaller space in terms of square footage, which increases its relative intensity significantly.

Analysis: General Recommendations for Municipal Energy Savings

1. Evaluate ways to reduce fuel usage with vehicle fleet. This can be done by analyzing routes, usage, and a strict anti-idling policy.
2. Review existing Master Plan, Zoning Ordinances, and other town policies for inconsistencies with the goal to reduce energy usage.
3. Implement a behavioral change program based on the CA-CP guide. The guide is in revision process and will be provided as soon as possible.
4. Implement buying strategy of Energy Star equipment and Products and environmentally sensitive office products, and implement awareness campaigns to encourage “thoughtful” consumption of equipment and products.
5. Monitor performance of the new Spofford Fire Department’s geothermal heating system for applicability elsewhere.
6. Encourage recycling and composting to the extent possible, in order to divert the amount of municipal solid waste (organic matter) going to landfill.

Recommended Priorities for Chesterfield

1. Data collection in Chesterfield was particularly challenging as bills are paid by several separate departments and files are not collected in one office. Continued monitoring of energy use and energy costs is a very important practice that will be useful for applying for funds for energy retrofits. It will be extremely useful to have copies of data (fuel bills, electricity bills, etc) stored in one office.
2. It would be very desirable to reduce the emissions from the vehicle fleet sector. The first step to saving on vehicle fleet energy use would be to set up a system to track fuel use and costs more specifically (or otherwise study how vehicles are used in the town). The fuel currently goes to a common tank used to refuel vehicles and heat the Highway Garage. It would also be worthwhile to check in to options for buying lower-emission fuels.
3. Tour the town hall/annex, highway garage and fire houses and identify easy energy-saving opportunities such as changing lamps to CFLs, using task lighting where appropriate, changing temperature control regimes, turning off office machines when not in use, and implementing simple weatherizing and insulation measures.
4. The town hall/annex is the most significant energy user of town buildings, and has a higher than average energy intensity. This building, as it is an older facility, may also benefit from an insulation project. It is recommended that a building audit be done to determine specific areas of focus.
5. Complete collection of full year of data for new buildings. Continue to collect data for all buildings and compare changes in energy use caused by the replacement of certain buildings, as well as changes within buildings. A comparative energy assessment report can be prepared by Cool Monadnock as soon as new buildings have been in operation for a full year (preferably a January-December cycle to match the 2005 assessment).

Next Steps

As members of the Southwest Regional Planning Commission and the Cool Monadnock project, your municipality has access to support and guidance as you plan for the most effective and targeted energy saving measures. It is recommended that each town have a Local Energy Committee that will meet with the Cool Monadnock staff to review the findings of this report. The Carbon CO2alition's New Hampshire Handbook on Energy Efficiency and Climate Change can be a resource on energy committee formation and energy efficiency options.⁴³ Also see the Cool Monadnock Resource Guide at www.coolmonadnock.org for a compilation of background information and resources to put your municipal report in context and learn about options for saving energy. Through collaboration and consultation between the Local Energy Committee, the Board of Selectpersons or City Council, and Cool Monadnock, the town may identify the most effective and feasible projects that are likely to save energy and costs in the shorter and longer terms. With further collaborative research, the committee, with the assistance of the Cool

⁴³ http://www.antiochne.edu/anei/download/238_energy_handbook_carbon_version_final_draft.pdf.

Monadnock staff, can then identify any sources of financial support that will facilitate energy saving projects.

Methods

Greenhouse gas inventory approach

Data collection for this inventory involved collaborative efforts between the Cool Monadnock staff, which organized the data collection process over all, and the local town representative volunteers. With personal connections to their home towns, volunteers were better able to ascertain where to access certain data and to spend time at local offices sorting through bills and records. To collect the data in each town, data sheets were developed based on the software/program that was used for data processing. We used 2005 as a baseline year to collect the fuel and energy consumption information. Data sheets were sent to the town representative, who then collected and/or accessed the data. Follow-ups were done on a regular basis to make sure that the inventory progressed, the data collection process was effective, and the data needed was more or less accurately collected.

Data processing and data analysis

To process the data collected, we used two types of fuel and energy assessment software. The first was the Clean Air and Climate Protection (CACP) software used to quantify and estimate the amount of energy used and the greenhouse gases (GHG) generated from the energy usage. The CACP software allowed us to make community and government analysis of the GHG inventory. The second was the EPA Portfolio Manager Benchmarking Program, used to assess the energy consumption and GHG generated in specific buildings, based on square footage.

List of Acronyms

CACP	Clean Air and Climate Protection (software)
CA-CP	Clean Air-Cool Planet
EPA	Environmental Protection Agency
GHG	Greenhouse Gas
kBtu	Kilo British Thermal Units
MMBtu	Million British Thermal Units
SWRPC	Southwest Region Planning Commission

Appendix III: Question to Ask When Conducting a Walk Through Audit

As you perform your walk-through, casually talk to the employees. That is, if they are not busy.

Informational questions you should ask:

- **Comfort** - Ask them if they have comfort issues during the winter or summer months. If they do have problems staying comfortable, you may want to ask the following questions. It will help you understand if there are heating and cooling distribution problems.
 1. Are they using electric space heaters?
 2. Do they have to crack windows because they are too hot?
 3. Are they too cold during summer months (building occupants should not have to wear sweaters in August)?
- **Behavior** – Many municipal employees may not have the same understanding of energy and resource conservation as you do, so when you discuss the type of behavioral patterns seen within the building be aware of the questions you can ask the employees that will be the most insightful. Relate to the individual and give them little tips as you are speaking with them that can immediately save energy. Some examples of information you are looking for include:
 1. Are the computers shut down during nights and weekends?
 2. If computers are on power strips, are the power strips turned off during nights and weekend?
 3. Are lights usually turned off in unoccupied rooms?
 4. Do employees print documents on both sides of each sheet?
 5. Is there a utilized recycling program?
 6. Are the programmable thermostats set down a few degrees during nights and weekends?

Appendix IV: Walk through Audit Worksheet

Building Information

Walk through audit conducted by: _____

Building: _____ Building Address: _____

Facility Manager or Building Contact: _____

Type of Building (i.e. School, Office, etc.): _____

Building Square Footage (sq. ft): _____

Primary Objective: _____

Electrical Data:

Current Electric Rate: _____ (¢/kWh)

What voltage power is desired: _____ Phase: ____Single ____Three

What is facility's average demand (kWh): _____ Peak Demand: _____

Is there a backup power on site: ____ What size: _____ Type: _____

How many electrical meters serve the building? _____

Where is the electrical meter(s) located?: _____

Are there storage tanks (if hydronic system)?: _____ If so, what size (gal) _____

How much of the fuel is consumed for domestic hot water use?: _____%.

Any other information about operation or behavioral patterns that might be important, i.e. the building is shut down for portions of the year, etc.:

Has a heat loss calculation already been conducted on the building? _____

***** Obtain at least ONE YEARS worth of fuel consumption and price data *****

Structural Information

What type of windows does the building have and how many?

_____ Single Pane _____ Double Pane _____ Triple Pane

Notes about the windows: _____

How old are the windows? _____

Are the window seams sealed with caulking? _____

What types of light fixtures are present throughout the building?

_____ Incandescent _____ Compact Fluorescent (CFL) _____ LED

Appendix V: EPA R-Values for Existing Homes

Cost-effective Insulation R-Values for Existing Homes ^{a44}					
If you live in a climate that is...	and your heating system is... ^b	insulate to these levels in the...			
		ceiling	wood-frame wall	floor	basement/ crawl space walls ^d
Warm with cooling and minimal heating requirements (i.e., FL & HI; coastal CA; southeast TX; southern LA, AR, MS, AL & GA).	gas/oil or heat pump	R-22 to R-38	R-11 to R-13	R-11 to R-13	R-11 to R-19
	electric resistance	R-38 to R-49	R-13 to R-25	R-13 to R-19	R-11 to R-19
Mixed with moderate heating and cooling requirements (i.e., VA, WV, KY, MO, NE, OK, OR, WA & ID; southern IN, KS, NM & AZ; northern LA, AR, MS, AL & GA; inland CA & western NV).	gas/oil or heat pump	R-38	R-11 to R-22 ^c	R-13 TO R-25	R-11 to R-19
	electric resistance	R-49	R-11 to R-26 ^c	R-25	R-11 to R-19
Cold (i.e., PA, NY, New England, northern Midwest, Great Lakes area, mountainous area (e.g., CO, WV, UT, etc.)).	gas/oil	R-38 to R-49	R-11 to R-22 ^c	R-25	R-11 to R-19
	heat pump or electric resistance	R-49	R-11 to R-28 ^c	R-25	R-13 to R-19
<p>a. Adapted from the U.S. Department of Energy 1997 Insulation Fact Sheet.</p> <p>b. Insulation is also effective at reducing cooling bills. These levels assume your house has electric air-conditioning.</p> <p>c. R-values may be achieved through a combination of cavity insulation and rigid board insulation and are for insulation only (not whole wall).</p> <p>d. Do not insulate crawl space walls if crawl space is wet or ventilated with outdoor air.</p>					

⁴⁴ http://www.energystar.gov/index.cfm?c=home_sealing.hm_improvement_insulation_table

Appendix VI: EPA Weatherization Guide

This information can also be found at

http://www.energystar.gov/index.cfm?c=home_sealing.hm_improvement_sealing

Sealing Leaks

Air leakage is a very important factor in the performance of many buildings. Not only does it translate directly to the amount of air leaving the building as the pressure tries to balance, common fiberglass insulation has little resistance to air movement.

Many air leaks and drafts are easy to find because they are easy to feel — like those around poorly installed windows and doors, attic hatchways, unused chimneys, and broken or damaged portions of the home. But holes hidden in attics, basements, and crawlspaces are usually bigger problems. Sealing these leaks with caulk, spray foam, or weather stripping will have a great impact on improving your comfort and reducing utility bills.

Homeowners and Facility Managers are often concerned about sealing their building too tightly, but this is a falsehood. In actuality, the lower the amount of uncontrolled air entering and exiting the building the better. A certain amount of fresh air is needed for good indoor air quality and there are specifications that set the minimum amount of fresh air needed for a building. Introducing mechanical ventilation to control the amount of fresh air entering the building will lead to lower energy bills and greater comfort for the inhabitants. If you are concerned about how tight your building is, hire a contractor, such as a [Home Energy Rater](#), who can use [diagnostic tools](#) to measure your building's actual leakage. If your building is too tight, a fresh air [ventilation](#) system may be recommended.

After any building sealing project, have a heating and cooling technician check to make sure that your combustion appliances (gas- or oil-fired furnace, water heater, and dryer) are venting properly. For additional information on Indoor Air Quality (IAQ) issues related to buildings, such as combustion safety, visit [EPA's Indoor Air Quality Web site](#).

Here are some common leakage points in a home:



Adding Insulation

To Seal and Insulate with ENERGY STAR:

- Seal air leaks throughout the building to stop drafts,
- Add insulation to block heat loss in winter and heat gain in summer,
- Choose ENERGY STAR qualified windows when replacing windows.

If your attic is accessible you can Do-It-Yourself with help from our [Guide to ENERGY STAR Home Sealing](#). The Guide offers step-by-step instructions for sealing common air leaks and adding insulation to the attic.

Insulation helps your building maintain a constant temperature. There are several common types of insulation — fiberglass (in both batt and blown forms), cellulose, rigid foam board, and spray foam. [Reflective insulation \(or radiant barrier\)](#) is another insulating product which can help save energy in hot, sunny climates.

When correctly installed with air sealing, each type of insulation can deliver comfort and lower energy bills during the hottest and coldest times of the year.

Insulation performance is measured by R-value — its ability to resist heat flow. Higher R-values mean more insulating power. Different R-values are recommended for walls, attics, basements and crawlspaces, depending on your area of the country. Insulation works best when air is not moving through or around it.

So it is very important to seal air leaks before installing insulation to ensure that you get the best performance from the insulation.

- See [Recommended Levels of Insulation](#) to determine what is most cost-effective for your building. (See Appendix C)

To get the biggest savings, the easiest place to add insulation is usually in the attic. A quick way to see if you need more insulation is to look across your uncovered attic floor. If your insulation is level with or below the attic floor joists, you probably need to add more insulation. The recommended insulation level for most attics is R-38 (or about 12–15 inches, depending on the insulation type). In the coldest climates, insulating up to R-49 is recommended.

Why Insulate Your Building?

Heating and cooling account for about a quarter of a typical building..⁴⁵ Inadequate insulation and air leakage are leading causes of energy waste in most buildings. Insulation:

- saves money and our nation's limited energy resources
- makes your building more comfortable by helping to maintain a uniform temperature throughout the building, and
- makes walls, ceilings, and floors warmer in the winter and cooler in the summer.

The amount of energy you conserve will depend on several factors: your local climate; the size, shape, and construction of your building; the living habits of your family; the type and efficiency of the heating and cooling systems; and the fuel you use. Once the energy savings have paid for the installation cost, energy conserved is money saved - and saving energy will be even more important as utility rates go up.

This fact sheet will help you to understand how insulation works, what different types of insulation are available, and how much insulation makes sense for your climate. There are many other things you can do to conserve energy in your building as well. The Department of Energy offers many [web sites](#) to help you save energy by sealing air leaks, selecting more energy-efficient appliances, etc.

It is always more economical to install the recommended levels of insulation during initial construction rather than adding insulation later. Many insulation locations are enclosed during the construction process and it is very difficult to add insulation to these locations at a later time.

How Insulation Works

Heat flows naturally from a warmer to a cooler space. In winter, the heat moves directly from all heated living spaces to the outdoors and to adjacent unheated attics, garages, and basements - wherever there is a difference in temperature. During the summer, heat moves from outdoors to the building interior. To maintain comfort, the heat lost in winter must be replaced by your heating system and the heat gained in summer must be removed by your air conditioner. Insulating [ceilings, walls, and floors](#) decreases the heating or cooling needed by providing an effective resistance to the flow of heat.

Batts, blankets, loose fill, and low-density foams all work by limiting air movement. (These products may be more familiarly called fiberglass, cellulose, polycynene, and expanded polystyrene.) The still air is an

⁴⁵ <http://www.energystar.gov/index.cfm?c=business.EPA BUM CH9 HVAC>

effective insulator because it eliminates convection and has low conduction. Some foams, such as polyisocyanurate, polyurethane, and extruded polystyrene, are filled with special gases that provide additional resistance to heat flow.

Reflective insulation works by reducing the amount of energy that travels in the form of radiation. Some forms of reflective insulation also divide a space up into small regions to reduce air movement, or convection, but not to the same extent as batts, blankets, loose-fill, and foam.

Which Kind Of Insulation Is Best?

answer

is that the 'best' type of insulation depends on:

- how much insulation is needed,
- the accessibility of the insulation location,
- the space available for the insulation,
- local availability and price of insulation, and
- other considerations unique to each purchaser.

Whenever you compare insulation products, it is critical that you base your comparison on equal R-values.

What Is an R-Value?

Insulation is rated in terms of thermal resistance, called R-value, which indicates the resistance to heat flow. The higher the R-value, the greater the insulating effectiveness. The R-value of thermal insulation depends on the type of material, its thickness, and its density. In calculating the R-value of a multi-layered installation, the R-values of the individual layers are added.

The effectiveness of an insulated ceiling, wall or floor depends on how and where the insulation is installed.

- Insulation which is compressed will not give you its full rated R-value. This can happen if you add denser insulation on top of lighter insulation in an attic. It also happens if you place batts rated for one thickness into a thinner cavity, such as placing R-19 insulation rated for 6 1/4 inches into a 5 1/2 inch wall cavity.
- Insulation placed between joists, rafters, and studs does not retard heat flow through those joists or studs. This heat flow is called thermal bridging. So, the overall R-value of a wall or ceiling will be somewhat different from the R-value of the insulation itself. That is why it is important that attic insulation cover the tops of the joists and that is also why we often recommend the use of insulative sheathing on walls. The short-circuiting through metal framing is much greater than that through wood-framed walls; sometimes the insulated metal wall's overall R-value can be as low as half the insulation's R-value.

Reading the Label

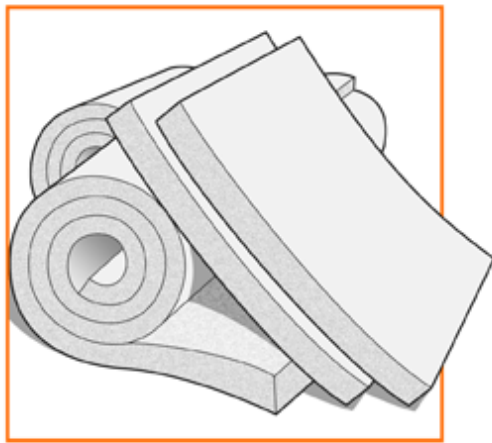
No matter what kind of insulation you buy, check the information on the product label to make sure that the product is suitable for the intended application. To protect consumers, the Federal Trade Commission has very clear rules about the R-value label that must be placed on all residential insulation products, whether they are installed by professionals, or whether they are purchased at a local supply store. These labels include a clearly stated R-value and information about health, safety, and fire-hazard issues. Take time to read the label BEFORE installing the insulation. Insist that any contractor installing insulation

provide the product labels from EACH package (which will also tell you how many packages were used). Many special products have been developed to give higher R-values with less thickness. On the other hand, some materials require a greater initial thickness to offset eventual settling or to ensure that you get the rated R-value under a range of temperature conditions.

Insulation Product Types

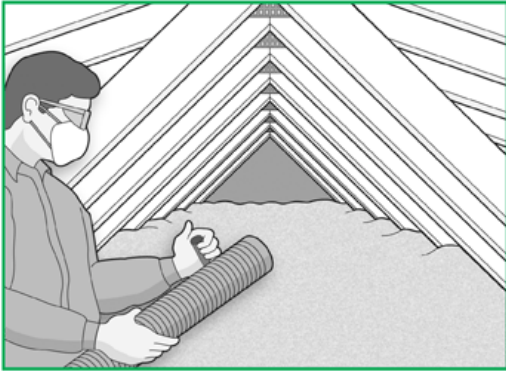
Some types of insulation require professional installation, and others you can install yourself. You should consider the several forms of insulation available, their R-values, and the thickness needed. The type of insulation you use will be determined by the nature of the spaces in the building that you plan to insulate. For example, since you cannot conveniently "pour" insulation into an overhead space, blankets, spray-foam, board products, or reflective systems are used between the joists of an unfinished basement ceiling. The most economical way to fill closed cavities in finished walls is with blown-in insulation applied with pneumatic equipment or with sprayed-in-place foam insulation.

The different forms of insulation can be used together. For example, you can add batt or roll insulation over loose-fill insulation, or vice-versa. Usually, material of higher density (weight per unit volume) should not be placed on top of lower density insulation that is easily compressed. Doing so will reduce the thickness of the material underneath and thereby lower its R-value. There is one exception to this general rule: When attic temperatures drop below 0°F, some low-density, fiberglass, loose-fill insulation installations may allow air to circulate between the top of your ceiling and the attic, decreasing the effectiveness of the insulation. You can eliminate this air circulation by covering the low-density, loose-fill insulation with a blanket insulation product or with a higher density loose-fill insulation.



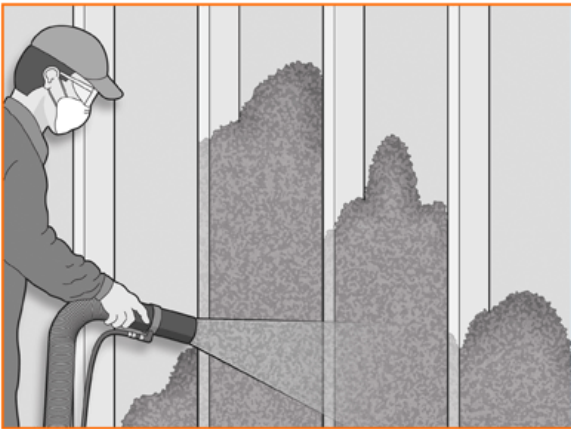
ORNL 07-G01658/abn

Blankets, in the form of batts or rolls, are flexible products made from mineral fibers, including fiberglass or rock wool. They are available in widths suited to standard spacings of wall studs and attic or floor joists. They must be hand-cut and trimmed to fit wherever the joist spacing is non-standard (such as near windows, doors, or corners), or where there are obstructions in the walls (such as wires, electrical outlet boxes, or pipes). Batts can be installed by you or a professional. They are available with or without vapor-retarder facings. Batts with a special flame-resistant facing are available in various widths for basement walls where the insulation will be left exposed.



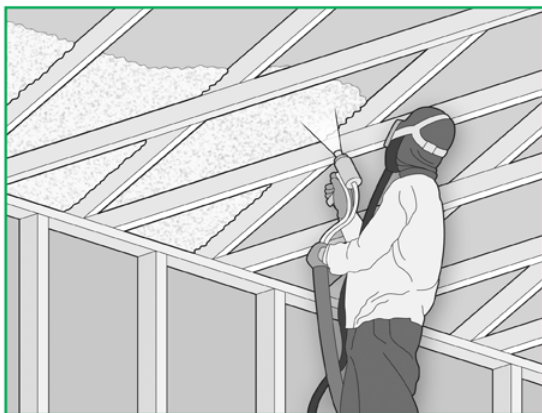
OPNL 07-001657/06th

Blown-in loose-fill insulation includes cellulose, fiberglass, or rock wool in the form of loose fibers or fiber pellets that are blown using pneumatic equipment, usually by professional installers. This form of insulation can be used in wall cavities. It is also appropriate for unfinished attic floors, for irregularly shaped areas, and for filling in around obstructions.



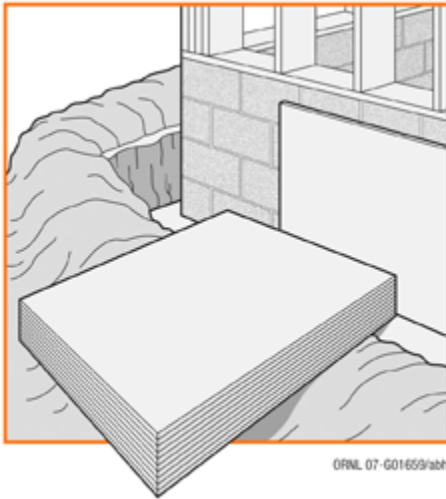
OPNL 07-001663/06th

In the open wall cavities of a new building, cellulose and fiberglass fibers can also be sprayed after mixing the fibers with an adhesive or foam to make them resistant to settling.

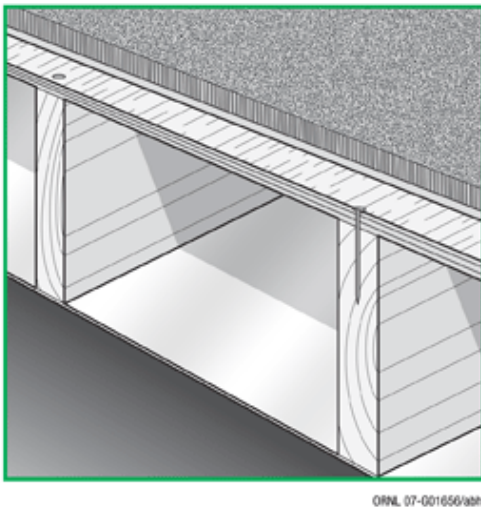


OPNL 07-021061/06th

Foam insulation can be applied by a professional using special equipment to meter, mix, and spray the foam into place. Polyisocyanurate is an open-celled foam. Polyisocyanurate and polyurethane are closed-cell foams. In general, open-celled foam allows water vapor to move through the material more easily than closed-cell foam. However, open-celled foams usually have a lower R-value for a given thickness compared to closed-cell foams. So, some of the closed-cell foams are able to provide a greater R-value where space is limited.



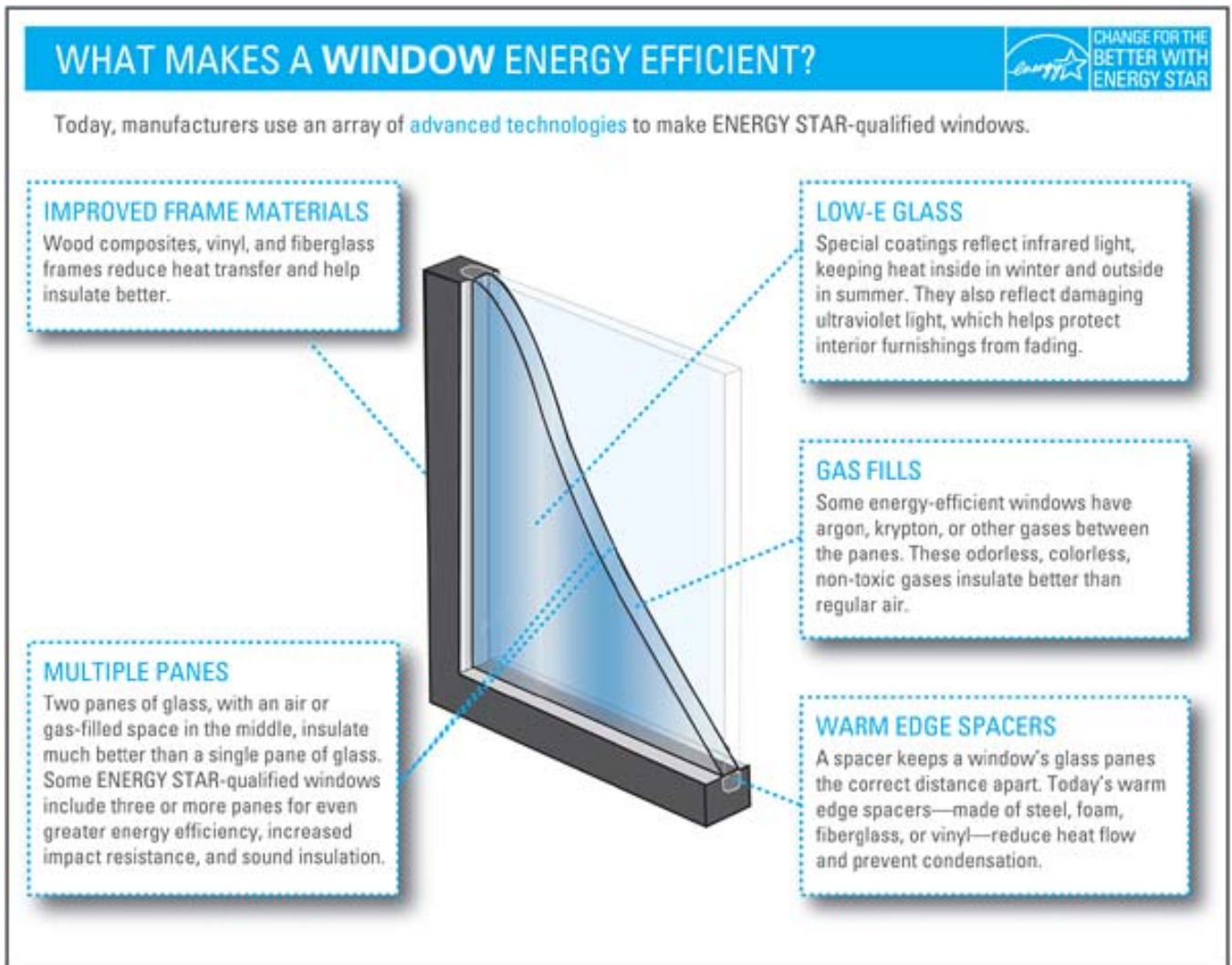
Rigid insulation is made from fibrous materials or plastic foams and is produced in board-like forms and molded pipe coverings. These provide full coverage with few heat loss paths and are often able to provide a greater R-value where space is limited. Such boards may be faced with a reflective foil that reduces heat flow when next to an air space. Rigid insulation is often used for foundations and as an insulative wall sheathing.



Reflective insulation systems are fabricated from aluminum foils with a variety of backings such as kraft paper, plastic film, polyethylene bubbles, or cardboard. The resistance to heat flow depends on the heat flow direction, and this type of insulation is most effective in reducing downward heat flow. Reflective systems are typically located between roof rafters, floor joists, or wall studs. If a single reflective surface is used alone and faces an open space, such as an attic, it is called a [radiant barrier](#).

Radiant barriers are installed in buildings to reduce summer heat gain and winter heat loss. In new buildings, you can select foil-faced wood products for your roof sheathing (installed with the foil facing down into the attic) or other locations to provide the radiant barrier as an integral part of the structure. For existing buildings, the radiant barrier is typically fastened across the bottom of joists, as shown in this drawing. All radiant barriers must have a low emittance (0.1 or less) and high reflectance (0.9 or more).

Anatomy of an Energy Efficient Window⁴⁶



⁴⁶ http://www.energystar.gov/index.cfm?c=windows_doors.pr_anat_window

WHAT MAKES A DOOR ENERGY EFFICIENT?



MULTIPLE GLASS PANES

Double or triple-paned insulating glass is used to reduce heat flow.

IMPROVED CORE MATERIALS

Fiberglass, wood cladding, and steel with polyurethane foam core are among the most energy-efficient door materials available today.



TIGHTER FIT AND IMPROVED WEATHER STRIPPING

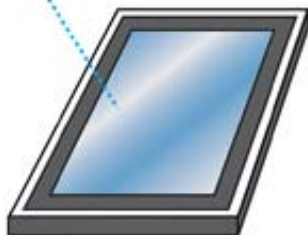
New frames may include a magnetic strip to create a tighter seal that reduces air leakage around the edges.

WHAT MAKES A SKYLIGHT ENERGY EFFICIENT?



TRADITIONAL SKYLIGHTS

Skylights use the same technologies as windows. But these technologies are even more valuable for skylights, which receive direct sun in summer and greater outside/inside temperature differentials in winter.



TUBULAR DAYLIGHTING DEVICES INCREASED DAYLIGHT

Tubular daylighting devices (TDD) gather sunlight at the roof and transmit it down to a diffusing lens mounted in an interior surface, usually a ceiling. The natural light from a TDD can illuminate closets, bathrooms, hallways, or other spaces that typically would not have access to sunlight, decreasing the need for electric lighting.



3. Mechanical Systems

Sealing Ducts

In building with forced-air heating and cooling systems, ducts are used to distribute conditioned air throughout the building. In a typical building, however, about 20 percent of the air that moves

through the duct system is lost due to leaks and poorly sealed connections. The result is higher utility bills and difficulty keeping comfortable, no matter how the thermostat is set.

Because some ducts are concealed in walls and between floors, repairing them can be difficult. However, exposed ducts in attics, basements, crawlspaces, and garages can be repaired by sealing the leaks with duct sealant (also called duct mastic). In addition, insulating ducts that run through spaces that get hot in summer or cold in winter (like attics, garages, or crawlspaces) can save significant energy.

In radiant, steam and domestic hot water systems, insulating the piping with at least R-6 pipe insulation will reduce losses in delivery. This is especially important if the piping is outside the insulated area of the building.

Appendix VII: New Hampshire Financial Incentives for Renewable Energy and Energy Efficiency⁴⁷

List of Incentives:

Property Tax Exemption

Local Option Property Tax Exemption for Renewable Energy

State Loan Program

Renewable Energy and Energy Efficiency Business Loan

State Rebate Program

Renewable Energy Rebate Program

Utility Grant Program

New Hampshire Electric Co-Op - Low-Income Energy Assistance Grant Program

PSNH - Energy Rewards RFP Program

Utility Loan Program

New Hampshire Electric Co-Op - SmartSTART Energy Efficiency Loan Program

PSNH - Municipal Smart Start Program

Utility Rebate Program

National Grid:

Commercial (Electric) Energy Efficiency Incentive Programs

Commercial (Gas) Energy Efficiency Programs

Residential (Electric) Energy Efficiency Incentive Programs

Residential (Gas) Energy Efficiency Program

Small/Mid-Sized Business Energy Efficiency Program

Solar Thermal Rebate Program

New Hampshire Electric Co-Op:

⁴⁷ All financial incentives and programs listed, and the summaries describing those incentives and programs, were obtained through the Interstate Renewable Energy Council's (IREC) Database of State Incentives for Renewables & Efficiency (DSIRE) at www.dsireusa.org. DSIRE routinely updates its website to provide any revisions witnessed to the incentives and programs mentioned. While extremely comprehensive, it should be noted that there may also be incentives and programs not included on this website. It is recommended that you also contact your utility and State officials and request information into any additional incentives and programs. (This list was last updated on April 20, 2009.)

Large Business Energy Solutions
New Equipment and Construction Program
Residential Energy Efficiency Rebate Programs
Small Business Energy Solutions
Solar and Wind Energy Rebate Program

Northern Utilities:

Commercial Energy Efficiency Programs
Residential Energy Efficiency Programs

PSNH:

Large Commercial and Industrial Energy Efficiency Rebate Program
Residential Energy Efficiency Rebate Program
Small Business Retrofit Program

Unitil:

Commercial and Industrial Energy Efficiency Programs
Residential Energy Efficiency Programs

Property Tax Exemption

Local Option Property Tax Exemption for Renewable Energy⁴⁸

Last DSIRE Review: 10/24/2008

Incentive Type: Property Tax Exemption
Eligible Renewable/Other Technologies: Passive Solar Space Heat, Solar Water Heat, Solar Space Heat, Photovoltaics, Wind, Wood-Fired Central Heating Systems
Applicable Sectors: Residential
Amount: Varies (local option)
Authority 1: New Hampshire Statutes, Chapter 72:61 et seq.
Date Enacted: 1975 (solar option)
Effective Date: 1/1/1976
Website: <http://nh.gov/oep/programs/energy/RenewableEnergyIncentives.htm>

Summary:

New Hampshire allows cities and towns to offer an exemption from residential property taxes in the amount of the assessed value of a renewable-energy system used on the property. Eligible technologies include solar-energy systems (photovoltaic systems, solar space-heating systems, solar water-heating systems, passive solar-energy systems); wind-energy systems, and wood-fired central heating systems. Cities and towns must adopt an exemption provision separately for each energy source. As of October 2008, 77 cities and towns in New Hampshire have adopted a property tax exemption for one or more of these energy sources.

Visit the web site above for a list of New Hampshire municipalities that offer property tax exemptions for renewables. Contact your local tax collector or assessor for further details.

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http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NH01F&state=NH&CurrentPageID=1&RE=1&EE=1

State Loan Program

Renewable Energy and Energy Efficiency Business Loan⁴⁹

Last DSIRE Review: 08/06/2008

Incentive Type: State Loan Program

Eligible Efficiency Technologies: Lighting, Chillers, Heat pumps, Air conditioners, Compressed air, Motors, Motor-ASDs/VSDs, Custom/Others pending approval, Dry-Type Transformers

Eligible Renewable/Other Technologies: Solar Water Heat, Solar Thermal Process Heat, Photovoltaics, Wind, Biomass, Other Distributed Generation Technologies

Applicable Sectors: Commercial

Amount: \$10,000 minimum

Terms: Maximum term of seven years. Interest rate is prime rate minus 1% (floating)

Website: <http://www.nheconomy.com/pdf/BusinessLoanBrochure.pdf>

Summary:

The New Hampshire Business Resource Center and Ocean National Bank have partnered to offer the Renewable Energy and Energy Efficiency Business Loan Program, which provides low-interest loans to small businesses to purchase structural and equipment improvements that reduce energy consumption. A variety of energy efficiency measures and renewable energy systems are eligible for financing. This program targets loan amounts of \$10,000 or more, with a maximum term of seven years. The interest rate is the prime rate minus 1%. Participants use energy cost savings to repay the loan.

Eligible projects include energy-efficient lighting, variable frequency drives, premium efficient motors, energy-efficient HVAC systems and chillers, air compressors, energy-efficient dry-type transformers, custom energy-efficiency measures, and renewable-energy systems.

Contact:

Public Information Officer
New Hampshire Business Resource Center
P.O. Box 1856
172 Pembroke Road
Concord, NH 03302-1856
Phone: (603) 271-2591
Fax: (603) 271-6784
E-Mail: info@nheconomy.com
Web site: <http://www.nheconomy.com/>

State Rebate Program

Renewable Energy Rebate Program⁵⁰
Last DSIRE Review: 12/29/2008

Incentive Type: State Rebate Program
Eligible Renewable/Other Technologies: Solar Water Heat, Photovoltaics, Wind
Applicable Sectors: Residential
Incentive Amount: \$3/W
Maximum Incentive: \$6,000 or 50% of system costs, whichever is less
Eligible System Size: Less than 5 kW
Equipment Requirements: Must meet applicable safety standards
Funding Source: Renewable Portfolio Standard (RPS) alternative compliance payments
Expiration Date: Not specified (PUC may modify program after 12/31/2010)
Website: <http://www.nh.gov/oep/programs/energy/hb1628.htm>
Authority 1: New Hampshire Statutes, Chapter 362-F:10
Date Enacted: 7/11/2008
Effective Date: 7/11/2008

Summary:

New Hampshire enacted legislation (H.B. 1628) in July 2008 requiring the state's Public Utilities Commission (PUC) to establish and administer a rebate program for certain renewable-energy systems. Although the rebate program applies to systems that begin operation on or after July 1, 2008, rebates will not be available until July 1, 2009, and the PUC has not yet adopted program guidelines. (The PUC's guidelines will provide additional program details and clarification.)

By statute, the rebate is equal to \$3 per watt of nominal generation capacity per residential owner of an eligible facility, up to \$6,000 or 50% of system costs, whichever is less. Systems must have a peak generation capacity of less than five kilowatts (kW) and must be located at the owner's residence. Small renewable energy systems, such as photovoltaic (PV) and small wind-energy systems, are eligible.* Equipment must meet applicable safety standards, and facilities must meet local zoning regulations.

The program is funded by alternative compliance payments from the state's renewable portfolio standard (RPS). Rebates will be awarded to the extent that funding is available.

* The PUC's program guidelines, when issued, will provide more guidance regarding eligible technologies and system requirements.

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http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NH32F&state=NH&CurrentPageID=1&RE=1&EE=1

Contact:

Jack K. Ruderman

Public Information - NH PUC

New Hampshire Public Utilities Commission

8 Old Suncook Road

Concord, NH 03301

Phone: (603) 271-2431

Fax: (603) 271-3868

Utility Grant Program

*New Hampshire Electric Co-Op - Low-Income Energy Assistance Grant Program*⁵¹

Last DSIRE Review: 11/10/2008

Incentive Type: Utility Grant Program

Eligible Efficiency Technologies: Clothes Washers/Dryers, Dishwasher, Refrigerators/Freezers, Lighting, Programmable Thermostats, Caulking/Weather-stripping, Duct/Air sealing, Building Insulation, Windows, Doors

Applicable Sectors: Low-Income Residential

Max. Limit: Up to \$3,600

Terms: To qualify, the customer must be a co-op member and meet the income guidelines provided on the website

Website: http://www.nhec.com/residential_energyassistance_home.php

Summary:

The Energy Assistance Program is designed to help NHEC's income-qualified members manage their energy use with the goal of lowering their energy costs. Qualified members living in an apartment or house, either rented or owned, can receive up to \$3,600 in products and services, including a free customized audit report which will help members better understand their home and the factors affecting their energy use. Based on the Home Energy Analysis, NHEC will make recommendations for improving energy efficiency in the customer's home that may help reduce the heating portion of their electric bill. Measures identified in the audit are then installed by Community Action Program (CAP) agencies, contractors managed by the Co-op, or Co-op energy specialists. Eligible improvements include:

- Sealing air leaks with caulking and installing weatherstripping
- Upgrading insulation in attics, walls and basement ceilings
- Improving windows with energy-saving storm windows
- Installing thermal covers on windows, sliding glass doors and whole house fans
- Replacing old thermostats on heating systems
- Upgrades to Energy Star appliances
- Upgrades to Energy Star lighting

Contact:

Member Solutions
New Hampshire Electric Co-Op
579 Tenney Mountain Highway
Plymouth, NH 03264-3154
Phone: (800) 698-2007

⁵¹

http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NH21F&state=NH&CurrentPageID=1&RE=1&EE=1

Fax: (603) 536-8687

Web site: <http://www.nhec.com/>

*PSNH - Energy Rewards RFP Program*⁵²

Last DSIRE Review: 08/06/2008

Incentive Type: Utility Grant Program

Eligible Efficiency Technologies: Lighting, Lighting Controls/Sensors, Air conditioners, Motor-ASDs/VSDs, Custom/Others pending approval

Applicable Sectors: Commercial, Industrial

Amount: Varies

Terms: Customer must have minimum demand of 350 kW. Minimum project energy savings is 100,000 kWh per year (may be aggregated across multiple sites). Minimum total project cost is \$200,000.

Website: <http://www.psnh.com/Business/Efficiency/Rewards.asp>

Summary:

Public Service of New Hampshire (PSNH), the state's largest electric utility, offers incentives on a competitive basis to commercial and industrial customers that achieve measurable energy savings through the installation of energy efficiency measures. Under the Energy Rewards Request for Proposal Program, PSNH accepts proposals for electrical energy efficiency projects to be implemented at the facilities of eligible customers with a minimum demand of 350 kilowatts (kW). PSNH commercial and industrial customers, energy service companies, and other third party service providers representing commercial and industrial customers are eligible to participate. The minimum project energy savings for this program is 100,000 kWh per year (may be aggregated across multiple sites), and the minimum total project cost is \$200,000.

Each proposal must identify the incentive amount required from PSNH to go through with the project. Proposals are evaluated based upon a comparison of energy savings and other price and non-price variables. (Non-price variables include factors such as whether the project includes items other than lighting, and whether the environmental impacts reduce on-site emissions or waste stream.) Eligible measures include replacing standard fluorescent lighting with high-efficiency fluorescent lighting, installing variable-speed drives on motors, installing lighting controls to reduce lighting operating hours, and replacing low-efficiency air conditioning equipment with high-efficiency equipment. Measures that are not eligible include new construction projects, any power-producing project such as combined heat and power (CHP), fuel switching (from electric energy), and repairs or maintenance projects.

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http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NH28F&state=NH&CurrentPageID=1&RE=1&EE=1

Proposals are accepted in two tracks. The "Project Track" seeks proposals that can be developed in a short period of time and yet still have sufficient detail to estimate energy savings, project costs and other parameters accurately. The "Study Track" seeks proposals for projects that appear to have sufficient energy savings, but need additional study due to complexity, engineering study costs or other reasons.

Contact:

Gary LaCasse
Public Service of New Hampshire
Box 330
Manchester, NH 03105
Phone: (603) 634-3216
Fax: (603) 634-2449
E-Mail: lacasga@psnh.com
Web site: <http://www.psnh.com>

Utility Loan Program

*New Hampshire Electric Co-Op - SmartSTART Energy Efficiency Loan Program*⁵³
Last DSIRE Review: 11/10/2008

Incentive Type: Utility Loan Program

Eligible Efficiency Technologies: Lighting, Duct/Air sealing, Building Insulation,
Custom/Others pending approval

Applicable Sectors: Commercial, Residential

Terms: Loan payments equal to two-thirds of the monthly savings realized through the energy efficiency measure will be applied to the customer's utility bill.

Website: http://www.nhec.com/business_energysolutions_smartstart.php

Summary:

New Hampshire Electric Co-Op's SmartSTART (Savings Through Affordable Retrofit Technologies) Program is a no money down option to have energy efficient products installed in a home or business. The cost of the improvements is repaid over time, using the savings generated by the products themselves. For instance, if a customer installs energy efficient products worth \$500 and those products save the customer \$50 per month, the customer will pay for the product in monthly payments on their electric bill equal to two-thirds of the savings, or \$34 per month. Customers still realize overall savings on their electric bills while paying for energy efficient improvements that will save money for years to come. If the customer moves and the installed products stay, their obligation to pay for them ends. The next occupant will "pay as they save."

Contact:

Member Solutions
New Hampshire Electric Co-Op
579 Tenney Mountain Highway
Plymouth, NH 03264-3154
Phone: (800) 698-2007
Fax: (603) 536-8687
Web site: <http://www.nhec.com/>

PSNH - Municipal Smart Start Program⁵⁴

Last DSIRE Review: 09/22/2008

Incentive Type: Utility Loan Program

Eligible Efficiency Technologies: Custom/Others pending approval

Applicable Sectors: Local Government

Terms: Payment for services and products made through savings from lower energy costs

Website: http://www.psnh.com/Energy/Business_Efficiency/PaySave.asp

Summary:

Municipal customers of Public Service of New Hampshire (PSNH), an electric utility, may reduce energy consumption (and bills) by allowing the utility to install energy-saving measures at municipal facilities. Payment for services and products will be made over time with the savings obtained from lower energy costs. Under the Smart Start Program, PSNH pays all of the costs associated with the purchase and installation of approved measures. A monthly charge, calculated to be less than the monthly savings, is added to the municipal facility's monthly electric bill until all costs are repaid.

For more information about this program, see the program web site.

Contact:

Customer Service - PSNH
Public Service of New Hampshire
Box 330
Manchester, NH 03105
Phone: (800) 662-7764
Web site: <http://www.psnh.com>

Utility Rebate Program

National Grid:

*Commercial (Electric) Energy Efficiency Incentive Programs*⁵⁵

Last DSIRE Review: 07/22/2008

Incentive Type: Utility Rebate Program

Eligible Efficiency Technologies: Lighting, Lighting Controls/Sensors, Furnaces, Boilers, Heat pumps, Air conditioners, Compressed air, Motors, Motor-ASDs/VSDs, Custom/Others pending approval, Dry Type Transformers, Time Clocks, Occupancy Sensors, Walk-in Coolers

Applicable Sectors: Commercial, Industrial, Schools, Local Government

Incentive Amount: Schools and New buildings (custom): 75% of additional cost for efficiency upgrades

Existing buildings (custom): 45% of the project cost

Small business: 80% of equipment installation cost

Other rebates: Varies by technology and efficiency

Website: <http://www.thinksmarthinkgreen.com>

Summary:

National Grid offers electric energy efficiency programs for its' large commercial and industrial customers.

Design 2000plus: National Grid's new construction program offers energy strategies, technical assistance and financial incentives to customers who are building new facilities, adding capacity for manufacturing, replacing failed equipment or undergoing major renovations. In addition to providing support -- both technical and financial -- in the energy-efficient design of new buildings, financial incentives pay up to 75% of the incremental costs for the high efficiency materials and systems.

Energy Initiative: National Grid's program for existing buildings, provides technical assistance and incentives to upgrade the performance of existing equipment and systems. Incentives are designed to pay, on average, approximately 40%-50% of the total project cost. Incentives for custom projects provide up to 45% of the total project costs.

National Grid offers a range of related services that complement the above two energy efficiency programs and assist their large commercial customers with identifying and installing energy efficient technologies.

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http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NH12F&state=NH&CurrentPageID=1&RE=1&EE=1

- Technical Assistance—Engineering and support services available to help identify, evaluate, and implement energy efficient opportunities for a facility.
- Turnkey Services—Authorized, qualified vendors to identify and install energy efficient equipment.
- Commissioning—A quality control process to ensure that the heating, cooling, and other mechanical systems work efficiently together to save energy and reduce operating costs.
- Lamp and Ballast Recycling—Recycling for lighting lamps and ballasts containing PCBs.
- Buyers Alliance—Lighting equipment discounts on lighting energy efficient products.
- Financing—Designed to help assist with funding for qualifying energy efficiency projects.

Small/Mid-Sized business customers can participate in Design2000plus, Energy Initiative or may be eligible to participate in National Grid's Small/Mid-Sized Business Program.

Contact:

National Grid Energy Efficiency

Phone: (800) 292-2032

Web site: <http://www.thinksmarthinkgreen.com>

National Grid:

*Commercial (Gas) Energy Efficiency Programs*⁵⁶

Last DSIRE Review: 07/22/2008

Incentive Type: Utility Rebate Program

Eligible Efficiency Technologies: Equipment Insulation, Water Heaters, Furnaces, Boilers, Air conditioners, Heat recovery, Programmable Thermostats, Energy Mgmt. Systems/Building Controls, Building Insulation, Windows, Custom/Others pending approval, Boiler Reset Controls, Steam Trap Replacements

Applicable Sectors: Commercial

Incentive Amount: Custom Projects: 50% of project cost, based on energy savings

Heating rebates: \$100-\$6,000

Maximum Incentive: Custom Projects: \$100,000

Website: <http://www.thinksmarthinkgreen.com>

⁵⁶

http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NH15F&state=NH&CurrentPageID=1&RE=1&EE=1

Summary:

National Grid's Commercial Energy Efficiency Program provides support services and incentives to commercial customers who install energy efficient natural gas related features. All firm commercial and firm transportation rate customers are eligible. Prescriptive rebates are available for common energy efficiency measures installed after the completion of an energy audit, including: programmable thermostats, boiler reset controls, steam trap replacements, pipe/duct insulation, building shell insulation and windows.

Custom Rebates are available for projects that demonstrate the use of natural gas more efficiently than industry practices, and/or more efficiently than the minimum building code requirements. Incentives are available covering up to a maximum of 50% of project costs, capped at \$100,000 per site and/or per project. Custom Incentives are classified as either Level One or Level Two depending on size and complexity of the project. Customers should refer to website provided above to see what kinds of projects qualify for each level.

The Commercial High Efficiency Heating Program offers rebates ranging from \$100 to \$6,000 for various types of energy efficient space and water heating equipment. Rebates depend on equipment type and efficiency. All equipment must meet certain energy efficiency standards provided on their website.

Contact:

National Grid Energy Efficiency

Phone: (800) 292-2032

Web site: <http://www.thinksmarthinkgreen.com>

National Grid:

Residential (Electric) Energy Efficiency Incentive Programs⁵⁷

Last DSIRE Review: 07/23/2008

Incentive Type: Utility Rebate Program

Eligible Efficiency Technologies: Refrigerators/Freezers, Lighting, Duct/Air sealing, Building Insulation, Comprehensive Measures/Whole Building

Applicable Sectors: Residential

Incentive Amount: Lighting rebates: \$1-\$10/fixture

Room AC: \$20

Maximum Incentive: Home Energy Solutions Program: \$4,000

Website: <http://www.thinksmarthinkgreen.com>

⁵⁷

http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NH10F&state=NH&CurrentPageID=1&RE=1&EE=1

Summary:

The National Grid's New Construction program offers incentives and technical support to help their customers who are building an Energy Star certified home. In addition, the Energy Star Rebate program offers rebates to National Grid's residential customers for the purchase and installation of certain Energy Star certified equipment. Eligible equipment includes lights, washers, and room air conditioners. Rebates range from \$1 to \$50. Some rebates are given at the time of purchase while others require a mail-in application. See website listed above to find out about specific requirements for the different rebates available.

The Home Energy Solutions Program offers National Grid's New Hampshire residential customers up to \$4,000 in services for qualified electric efficiency improvements. This program is available to customers with average electric use of 30 kWh per day or more. A free home energy survey is provided. Incentives are available to replace inefficient lighting and refrigerators and to add insulation in electrically heated homes.

Contact:

National Grid Energy Efficiency

Phone: (800) 292-2032

Web site: <http://www.thinksmarthinkgreen.com>

National Grid:

*Residential (Gas) Energy Efficiency Program*⁵⁸

Last DSIRE Review: 07/22/2008

Incentive Type: Utility Rebate Program

Eligible Efficiency Technologies: Equipment Insulation, Water Heaters, Furnaces, Boilers, Programmable Thermostats, Caulking/Weather-stripping, Duct/Air sealing, Building Insulation, Windows

Applicable Sectors: Residential

Incentive Amount: Heating rebates: \$100 - \$1,000

Website: <http://www.thinksmarthinkgreen.com>

Summary:

⁵⁸

http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NH13F&state=NH&CurrentPageID=1&RE=1&EE=1

National Grid offers a number of programs to encourage energy efficiency amongst its residential customers.

National Grid's High Efficiency Heating Rebates are offered to any residential heating customers in Massachusetts, New Hampshire, Rhode Island and Metro New York. Eligible technologies include boilers and furnaces. Rebates of up to \$1,000 are available, depending on equipment type. All equipment must meet certain energy standards provided on the website. Applications are to be completed and sent in after equipment installation. The application form is available on the program's website.

National Grid also offers \$10 rebates to residential heating customers for every ENERGY STAR® replacement window with a U-factor of .35 or less installed in their home, and \$50 rebates are available for the purchase and installation of programmable thermostats. In addition, National Grid offers a rebate of up to \$300 for energy efficient on-demand tankless water heaters and high efficiency in-direct water heaters. Applications for all of these rebates can be found off the program website above or at the individual program websites.

National Grid Residential Weatherization Program is for heating customers in New England. The program provides a rebate covering 20% of the cost, up to \$750, for various weatherization measures, including: attic, wall, basement, crawl space, rim joist, and heating system duct insulation; attic ventilation; and air infiltration and ductwork leakage testing and sealing. Work must be completed by a National Grid approved contractor.

Contact:

National Grid Energy Efficiency
Phone: (800) 292-2032
Web site: <http://www.thinksmarthinkgreen.com>

National Grid:

*Small/Mid-Sized Business Energy Efficiency Program*⁵⁹
Last DSIRE Review: 07/22/2008

Incentive Type: Utility Rebate Program
Eligible Efficiency Technologies: Lighting, Lighting Controls/Sensors,
Programmable Thermostats, Time Clocks, Occupancy Sensors, Walk-in
Coolers

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http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NH11F&state=NH&CurrentPageID=1&RE=1&EE=1

Applicable Sectors: Commercial, Industrial

Incentive Amount: 70% of project costs can be paid through a rebate. The remaining 30% can be financed by National Grid with a 0% interest loan, with a payback time of up to 24 months

Website: <http://www.nationalgridus.com/smallbusiness>

Summary:

National Grid's Small/Mid-Sized Business Program is for business customers with an average demand of 200 kilowatts or less (or 40,300 kilowatt-hours or less) per month. The program aids qualifying business customers in installing energy efficient equipment. National Grid provides a free energy audit and report of recommended energy efficiency improvements. If the business customer chooses to make the recommended improvements using National Grid's vendor and equipment, National Grid will pay 70% of the cost of the installation of energy efficient equipment. The remaining 30% can be paid through the customer's electric bill, at 0% interest over a maximum period of 24 months. Customers paying their 30% share in a single lump sum are provided a 15% discount. Eligible energy efficient equipment includes: lighting upgrades, energy efficient time clocks, occupancy sensors, programmable thermostats, and walk-in and reach-in cooler measures. Customers can register online at the website listed above for a free energy audit.

Commercial and industrial customers who are interested in energy efficiency but who do not qualify for the Small/Mid-Sized Business program, may still qualify for other rebate programs offered by National Grid.

Contact:

National Grid Energy Efficiency

Phone: (800) 292-2032

Web site: <http://www.thinksmarthinkgreen.com>

National Grid:

*Solar Thermal Rebate Program*⁶⁰

Last DSIRE Review: 11/24/2008

Incentive Type: Utility Rebate Program

Eligible Renewable/Other Technologies: Solar Water Heat, Solar Space Heat, Solar Thermal Process Heat

Applicable Sectors: Commercial, Industrial, Residential, Multi-Family Residential, (National Grid Customers Only)

⁶⁰

http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NH05F&state=NH&CurrentPageID=1&RE=1&EE=1

Incentive Amount: Residential: 15% of project cost;
Commercial/Multi-family: \$3/therm based on estimated first-year savings
Maximum Incentive: Residential: \$1,500;
Commercial/Multi-family: \$100,000 per project, up to 50% of project costs
Website: <http://www.thinksmarthinkgreen.com>

Summary:

National Grid provides funding support to residential, commercial, industrial, and multifamily customers who install solar thermal technologies. Recommended solar thermal applications include solar hot water heating, and in some cases solar space heating or high temperature process applications. Eligibility requirements are in place to ensure quality installation of solar thermal systems.

Residential customers: National Grid customers with eligible SHW systems can apply for a rebate of 15% off project costs up to a maximum of rebate of \$1,500 for solar water heating systems. This rebate requires that participating customers share their water heating usage data for a period of 12 months in order to receive funding. National Grid works directly with residential solar installers, who submit rebate applications on behalf of the customer.

Commercial & Industrial, and Multi-family customers: National Grid requires a free energy audit to interested participants to identify appropriate solar thermal technologies as well as estimated natural gas savings. Commercial, industrial, and multifamily customers receive a one-time rebate of \$3 per therm of estimated first-year savings, up to 50% of the project costs or \$100,000 per project.

Funding is limited. For further information please visit the program website or contact National Grid using the information below.

Contact:

National Grid (Gas)
Phone: (800) 292-2032
E-Mail: solar@us.ngrid.com
Web site: <http://www.thinksmarthinkgreen.com>

New Hampshire Electric Co-Op:

*Large Business Energy Solutions*⁶¹

Last DSIRE Review: 11/10/2008

Incentive Type: Utility Rebate Program

Eligible Efficiency Technologies: Lighting, Lighting Controls/Sensors, Furnaces, Heat pumps, Air conditioners, Compressed air, Energy Mgmt. Systems/Building Controls, Motors, Motor-ASDs/VSDs, Custom/Others pending approval, LED Traffic Lights

Applicable Sectors: Commercial, Industrial

Incentive Amount: Up to 35% of the installed cost or a buy-down to a one-year payback, whichever is less.

Website: http://www.nhec.com/business_energysolutions_largebusiness.php

Summary:

New Hampshire Electric Co-Op offers incentives for its large business customers (using 100 kW or more) to increase the energy efficiency of their facilities through their Large Business Energy Solutions Program. This program offers prescriptive and custom rebates designed to pay up to 35% of the installed cost or a buy-down to a one-year payback, whichever is less. To qualify for rebates, the business must be a non-residential property, an NHEC member, and the proposed measures will save electricity and pass a benefits/cost test. Eligible projects include: lighting conversions and controls, energy-efficient motors, variable frequency drives (VFDs), HVAC and compressed air equipment and controls, LED traffic lights, and approved custom projects.

Contact:

Member Solutions
New Hampshire Electric Co-Op
579 Tenney Mountain Highway
Plymouth, NH 03264-3154
Phone: (800) 698-2007
Fax: (603) 536-8687
Web site: <http://www.nhec.com/>

⁶¹

http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NH24F&state=NH&CurrentPageID=1&RE=1&EE=1

New Hampshire Electric Co-Op:

*New Equipment and Construction Program*⁶²

Last DSIRE Review: 11/10/2008

Incentive Type: Utility Rebate Program

Eligible Efficiency Technologies: Lighting, Lighting Controls/Sensors, Chillers, Furnaces, Boilers, Heat pumps, Air conditioners, Motors, Motor-ASDs/VSDs, Custom/Others pending approval, Energy Efficient Transformers

Applicable Sectors: Commercial, Industrial

Incentive Amount: The lesser of 12-month payback or 75% of incremental costs up to the member's incentive cap.

Website: http://www.nhec.com/business_energysolutions_newbusiness.php

Summary:

New Hampshire Electric Co-Op offers incentives to its commercial and industrial customers to encourage energy efficiency. The program targets any commercial/industrial member building a new facility, undergoing a major renovation, or replacing failed (end-of-life) equipment. The program offers prescriptive and custom rebates designed to cover the lesser of a one year payback or 75% of incremental costs up to the member's incentive cap. Rebates are available for: energy-efficient lighting and controls; energy-efficient motors, variable frequency drives (VFDs), HVAC equipment and controls, energy-efficient transformers, chillers, and approved custom projects.

Contact:

Member Solutions

New Hampshire Electric Co-Op

579 Tenney Mountain Highway

Plymouth, NH 03264-3154

Phone: (800) 698-2007

Fax: (603) 536-8687

Web site: <http://www.nhec.com/>

New Hampshire Electric Co-Op:

Residential Energy Efficiency Rebate Programs⁶³

Last DSIRE Review: 11/10/2008

Incentive Type: Utility Rebate Program

Eligible Efficiency Technologies: Clothes Washers/Dryers, Refrigerators/Freezers, Equipment Insulation, Lighting, Heat pumps, Air conditioners, Programmable Thermostats, Duct/Air sealing, Building Insulation, Comprehensive Measures/Whole Building, Room Air Conditioners

Eligible Renewable/Other Technologies: Geothermal Heat Pumps

Applicable Sectors: Residential

Incentive Amount: Insulation, air sealing, refrigerators, equipment thermostats and lighting upgrades: 50% - 100% of project cost

Energy Star Room A/C: \$20

Energy Star Clothes Washer: \$50

Energy Star Lighting: \$2-\$15 per fixture

Energy Star Home: Up to \$2,500

Air Source Heat Pump: \$1,000-\$2,000

Geothermal Heat Pump: \$800 per ton, up to 5 tons; plus \$500 for all ductwork

Maximum Incentive: Insulation, air sealing, refrigerators, thermostats, and lighting upgrades: \$4,000 max

Geothermal Heat Pump: \$4,500 max

Website: http://www.nhec.com/residential_homeenergysolutions.php

Summary:

New Hampshire Electric Co-Op provides incentives for its residential members to increase the efficiency of their homes through several rebate programs. First, members can receive a free Home Energy Analysis through their Home Energy Solutions Program. The analysis will examine the home's air sealing, insulation, equipment thermostats and insulation, as well as the energy consumption of the home's refrigerator. The NHEC representative will recommend certain improvements during the evaluation and offer 50% - 100% off the cost of the improvements up to a total of \$4,000.

NHEC also offers rebates on Energy Star rated Homes, lighting, room air conditioners and washing machines. To qualify for the Energy Star Home rebate, the home must be a new or completely renovated existing single-family or multi-family home, located in the Co-op's service territory, which meets certain design specifications. Some restrictions apply to individual rebate offers.

NHEC also provides rebates to customers who install new or upgraded air source or geothermal heat pumps. The rebate is worth \$1,000-\$2,000 for a new energy efficient

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http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NH19F&state=NH&CurrentPageID=1&RE=1&EE=1

air source heat pump and \$800 per ton, up to a maximum of \$4,500, for geothermal heat pumps. In order to receive the maximum rebate, the house in which the heat pump is installed must achieve a HERS (Home Energy Rating System) of 86 or higher. A \$350 fee may be deducted from the rebate for plan evaluations and site inspections for new construction. The completed application and plans must be submitted prior to construction. The website contains a list of qualified HVAC vendors and installers, as well as further program details.

Contact:

Member Solutions
New Hampshire Electric Co-Op
579 Tenney Mountain Highway
Plymouth, NH 03264-3154
Phone: (800) 698-2007
Fax: (603) 536-8687
Web site: <http://www.nhec.com/>

New Hampshire Electric Co-Op:

*Small Business Energy Solutions*⁶⁴
Last DSIRE Review: 11/10/2008

Incentive Type: Utility Rebate Program

Eligible Efficiency Technologies: Refrigerators/Freezers, Equipment Insulation, Lighting, Lighting Controls/Sensors, Heat pumps, Air conditioners, Custom/Others pending approval

Applicable Sectors: Commercial

Incentive Amount: Up to 50% of the cost

Website: http://www.nhec.com/business_energysolutions_smallbusiness.php

Summary:

New Hampshire Electric Co-Op offers incentives for its small commercial customers (those using less than 100 kW) through their Small Business Energy Solutions Program. The Co-op will conduct a free assessment of a company's energy consumption, recommend efficiency improvements to reduce consumption, and provide rebates of up to 50% toward the cost of implementing the recommendations. Eligible improvements include: lighting technologies, occupancy sensors, hot water tank insulation wraps, refrigeration, and HVAC systems.

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http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NH23F&state=NH&CurrentPageID=1&RE=1&EE=1

Contact:

Member Solutions
New Hampshire Electric Co-Op
579 Tenney Mountain Highway
Plymouth, NH 03264-3154
Phone: (800) 698-2007
Fax: (603) 536-8687
Web site: <http://www.nhec.com/>

New Hampshire Electric Co-Op:

*Solar and Wind Energy Rebate Program*⁶⁵

Last DSIRE Review: 01/15/2009

Incentive Type: Utility Rebate Program

Eligible Renewable/Other Technologies: Solar Water Heat, Photovoltaics, Wind

Applicable Sectors: Commercial, Residential, Nonprofit, Schools, Agricultural, Institutional

Incentive Amount: PV: \$3.00 per installed watt (DC);

Solar Hot Water: 25% of installed project cost;

Wind: 25% of installed project cost

Maximum Incentive: PV: \$3,500; Solar Hot Water: \$1,500; Wind: \$5,000

Installation Requirements: System must be installed by a qualified installer

Ownership of Renewable Energy Credits: Remains with system owner

Expiration Date: 2009: TBD

Project Review/Certification: A monitoring and evaluation follow-up visit may be conducted by a NHEC engineer. System owner must also submit a project completion form.

Website: http://www.smallsteps.coop/coop_programs

Summary:

New Hampshire Electric Co-Op (NHEC) will offer the following rebates again in 2009, although program guidelines and applications are not yet posted on their website. NHEC encourages those who plan to request a rebate in 2009, to call Co-op Member Solutions at 1-800-698-2007 to hold your place in the queue. Rebates will be awarded on a first-come first-served basis to members who install qualified systems and submit required paperwork. Check their website for updates.

New Hampshire Electric Co-Op (NHEC) offers rebates to customers who install qualified renewable energy systems in its service territory. Members that install a

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http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NH29F&state=NH&CurrentPageID=1&RE=1&EE=1

solar hot water systems may receive a rebate of 25% of the installed system cost, up to \$1,500. Members that install a photovoltaic (PV) system may qualify for a rebate of up to \$3,500. NHEC is also providing incentives for the qualified installation of small and medium-sized wind generators of up to \$5,000.

All projects must be installed by qualified installers, and systems must be installed in NHEC's service territory. See the program web site listed above for more information, applications and FAQs.

Contacts:

Thomas Palma (for PV and Wind)
Project Development Executive
New Hampshire Electric Co-op
579 Tenney Mountain Highway
Plymouth, NH 03264
Phone: (603) 536-8650
Web site: www.nhec.coop

Mike Reynolds (for Solar Hot Water)
New Hampshire Electric Co-op
579 Tenney Mountain Highway
Plymouth, NH 03264
Phone: (800) 698-2007
Web site: www.nhec.coop

Northern Utilities:

*Commercial Energy Efficiency Programs*⁶⁶

Last DSIRE Review: 01/01/2009

Incentive Type: Utility Rebate Program

Eligible Efficiency Technologies: Water Heaters, Chillers, Furnaces, Boilers, Heat recovery, Programmable Thermostats, Building Insulation, Custom/Others pending approval, Low-Intensity Infrared Heating, Fryers

Applicable Sectors: Commercial, Industrial, Schools, Local Government, Multi-Family Residential, Institutional

Incentive Amount: Base Rebate: 50% of installation cost

Scoping study rebate: 50% of cost

Additional equipment rebates: \$25-\$1,000

Maximum Incentive:Base Rebate: \$50,000

Scoping study: \$7,500

Additional equipment rebates: \$500

Website: <http://www.northernutilities.com/business/eneraudit.htm>

Summary:

Northern Utilities offers rebates for multifamily customers, small/medium businesses and large businesses. Eligible multifamily buildings have more than four units, a master-metered account, and use gas heat and/or gas hot water. Customers who have a commercial or industrial building that has an annual gas usage of 40,000 therms or less qualify for the small/medium business customers program. All gas customers whose annual use exceeds 40,000 therms, plus all municipal buildings, hospitals, and universities, qualify for the large business program.

Eligible energy efficient upgrades are similar for all three programs with slight variations; customers should check the website for which measures qualify in which programs. Upgrades include: attic, roof, wall, ceiling, floor, basement, heating pipe, duct and hot water pipe insulation, temperature turn down, boiler reset control, automatic temperature controls, water heater tank rap, low-flow showerheads, faucet aerators, heat recovery potential, chillers, etc. Each program also offers a custom program that includes all of the above as well as heating system electronic/pilotless ignition, burner replacement, and other measures determined on a site-specific basis.

Northern Utilities will also perform an energy audit for commercial and industrial customers, make recommendations, and pay 50% of the qualified installation cost of suggested upgrades, up to a maximum of \$50,000. In addition, Northern Utilities will pay large business customers 50% (up to \$7,500) of the cost of a scoping study.

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http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NH07F&state=NH&CurrentPageID=1&RE=1&EE=1

Customer must sign a Partners in Energy Installation Agreement prior to the commencement of any energy-related work.

Northern Utilities, as a member of GasNetworks, also offers high efficiency space and water heating equipment rebates. Rebates range from \$25 to \$1,000, depending on equipment type. All equipment must meet certain energy efficiency standards listed on the program web site.

Contact:

Northern Utilities
Partners in Energy Intake Center
300 Friberg Parkway
Westborough, MA 01581
Phone: (800) 232-0120
Web site: <http://www.northernutilities.com>

Northern Utilities:

*Residential Energy Efficiency Programs*⁶⁷

Last DSIRE Review: 01/01/2009

Incentive Type: Utility Rebate Program

Eligible Efficiency Technologies: Water Heaters, Furnaces, Boilers, Programmable Thermostats, Caulking/Weather-stripping, Duct/Air sealing, Building Insulation, Windows, Doors, Comprehensive Measures/Whole Building, Faucet Aerators, Low-Flow Showerheads, Clock Thermostats

Applicable Sectors: Residential

Incentive Amount: Space and Water Heating Equipment: \$10-\$1,000, depending on equipment type

Self-Installation Weatherization Program: \$25 per account

Home Energy Assessment Rebate: \$150 per account

Weatherization Program (home owners and landlords): 50% project cost

Weatherization Program (tenants): 75% project cost

Maximum Incentive: Space and Water Heating Equipment: \$1,350

Home Energy Assessment rebate: \$150

Weatherization Program: Up to \$1,500

Equipment Requirements: Space and Water Heating Equipment: equipment must meet program energy efficiency requirements

Installation Requirements: Space and Water Heating Equipment: must be installed by a licensed contractor

Website: <http://www.northernutilities.com/forhome/eneraudit.htm>

Summary:

Northern Utilities offers two weatherization programs. Through the Partners in Energy Weatherization Program, customers can receive rebates of 50% to 75% of the costs associated with purchasing and installing weatherization improvements, such as attic/wall insulation and air sealing. Homeowners are eligible for 50%, up to \$1,500, and tenants can receive 75% of the cost, up to \$1,500. Low-income customers are eligible to receive weatherization improvements at no cost. For smaller, “do-it-yourself” weatherization projects such as installing door sweeps, pipe insulation, and caulking, Northern Utilities offers a \$25 "Self Install" rebate. Customers should see the program web site for rebate forms and program details.

Customers can learn how to improve the energy efficiency of their home and save money on energy bills with a Home Energy Assessment. Northern Utilities' Partners in Energy Program offers up to \$150 toward an in-home energy assessment. This program allows customers to pick their own contractor. Rebate forms and information on how to select a contractor can be found on the program web site.

Northern Utilities, as a member of GasNetworks, also offers rebates for high efficient space and water heating equipment. This program offers residential customers up to \$1,350 in rebates towards the installation of qualified high-efficiency gas-fired space and water heating equipment. Eligible equipment includes furnaces, boilers, water heaters, thermostats, and windows. All equipment must meet certain energy efficiency standards listed on the website. Customers fill out the application after the installation is complete.

In addition, Northern Utilities is a sponsor of the state-wide Energy Star Homes Program, which provides various rebates and technical support for customers interested in building an Energy Star home.

Contact:

Northern Utilities
Partners in Energy Intake Center
300 Friberg Parkway
Westborough, MA 01581
Phone: (800) 232-0120
Web site: <http://www.northernutilities.com>

PSNH:

*Large Commercial and Industrial Energy Efficiency Rebate Program*⁶⁸

Last DSIRE Review: 03/31/2009

Incentive Type: Utility Rebate Program

Eligible Efficiency Technologies: Lighting, Lighting Controls/Sensors, Chillers, Heat pumps, Air conditioners, Compressed air, Motors, Motor-ASDs/VSDs, Custom/Others pending approval

Applicable Sectors: Commercial, Industrial

Incentive Amount: Rebate amounts vary widely for the different technologies depending on the type and size of equipment and whether it is being installed in a new building, or retrofitting an existing facility.

Project Review/Certification: All projects require a post-installation inspection and itemized invoices for the equipment purchased. Additionally, all retrofits require a pre-installation inspection, and new construction may require a pre-installation inspection.

Website: <http://www.psnh.com/Business/Efficiency/default.asp>

Summary:

Public Service of New Hampshire, in collaboration with nhsaves, encourages its large commercial and industrial customers to conserve energy through their New Equipment and Construction Program and their Large Business Retrofit Program. Both programs offer prescriptive rebates for a variety of equipment including lighting systems and controls, motors, variable frequency drives, air compressors, and chillers. The New Equipment and Construction program also offers rebates for new HVAC equipment. These prescriptive rebates vary widely depending on the equipment type and the size. Each equipment type has stated efficiency levels which must be met in order to qualify. Interested customers should visit the program websites for a full listing of rebate amounts and program requirements. Pre-approval of rebates by PSNH is required prior to the purchase and installation of the energy efficient equipment.

Both programs also provide custom rebates, which allow for facility-specific efficiency improvements. Eligible new construction projects may qualify for a rebate equal to the lesser of 75% of the incremental cost or buy down to one-year pay-back. Eligible retrofit projects may qualify for a rebate equal to the lesser of 35% of the total cost or buy down to one-year pay-back.

Contact:

Energy Efficiency Services
Public Service of New Hampshire

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http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NH26F&state=NH&CurrentPageID=1&RE=1&EE=1

780 North Commercial Street
PO Box 330
Manchester , NH 03105
Phone: (800) 662-7764
E-Mail: psnhreq@psnh.com
Web site: <http://www.psnh.com/>

PSNH:

*Residential Energy Efficiency Rebate Program*⁶⁹
Last DSIRE Review: 11/10/2008

Incentive Type: Utility Rebate Program
Eligible Efficiency Technologies: Clothes Washers/Dryers, Equipment Insulation, Water Heaters, Lighting, Heat pumps, Duct/Air sealing, Building Insulation, Comprehensive Measures/Whole Building, Room Air Conditioner
Eligible Renewable/Other Technologies: Geothermal Heat Pumps
Applicable Sectors: Residential
Incentive Amount: Energy Star CFL Bulbs: \$2 per bulb
Energy Star Light Fixtures: \$10 per fixture
Room Air Conditioner: \$20
Clothes Washer: \$50
Maximum Incentive: \$2,500 for the Home Energy Savings Program "traditional track" (with an air source heat pump) \$7,500 for the Home Energy Savings Program "geothermal track" (with a geothermal heat pump)
Website: <http://www.psnh.com/Residential/Efficiency/default.asp>

Summary:

Public Service of New Hampshire, in collaboration with nhsaves, provides incentives for its residential customers to increase the energy efficiency of their homes. Prescriptive rebates are available for the purchase of Energy Star rated clothes washers, room air conditioners, and lighting. Customers who wish to improve the efficiency of their homes as a whole can also participate in the Home Energy Solutions Program. Through this program, PSNH will send an energy auditor to the customer's house to perform a variety of diagnostic tests to discover the largest areas for improvement to the home's energy efficiency. The customer may then receive rebates up to \$2,500 if installing an air source heat pump and rebates of up to \$7,500 if installing a geothermal heat pump, to carry out the recommended improvements including increased insulation levels, air sealing, duct sealing, improved HVAC filters, and other improvements identified by the auditor.

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http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NH27F&state=NH&CurrentPageID=1&RE=1&EE=1

Contact:

Energy Efficiency Services
Public Service of New Hampshire
780 North Commercial Street
PO Box 330
Manchester , NH 03105
Phone: (800) 662-7764
E-Mail: psnhreq@psnh.com
Web site: <http://www.psnh.com/>

PSNH:

*Small Business Retrofit Program*⁷⁰
Last DSIRE Review: 03/31/2009

Incentive Type: Utility Rebate Program

Eligible Efficiency Technologies: Equipment Insulation, Lighting, Lighting Controls/Sensors, Programmable Thermostats, Energy Mgmt. Systems/Building Controls, Custom/Others pending approval

Applicable Sectors: Commercial

Incentive Amount: Varies by project

Maximum Incentive: 50% of labor and material costs for approved upgrades

Equipment Requirements: Average monthly customer demand may not exceed 100 kW

Website: <http://www.psnh.com/Business/Efficiency/SmallBusinessRetrofit.asp>

Summary:

Public Service of New Hampshire (PSNH), an electric utility, offers financial incentives and technical advice to small business customers seeking to improve energy efficiency through retrofits. PSNH's Small Business Retrofit Program, which is available to business customers with an average monthly demand less than 100 kilowatts (kW), tailors incentives for a variety of energy-efficiency measures. The program will cover up to 50% of labor and material costs for the following approved upgrades:

- Energy-efficient fluorescent ballasts, lamps and fixtures
- Hard-wired & screw-in compact fluorescent systems
- High-intensity discharge lighting systems
- Occupancy sensors
- Programmable thermostats

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http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NH31F&state=NH&CurrentPageID=1&RE=1&EE=1

- Electric hot water
- Tank wraps
- Cooler door heater controls
- Walk-in cooler economizers

PSNH will provide eligible customers with a comprehensive energy analysis at no cost. This analysis will identify opportunities for enhancing the energy efficiency of your business. The utility will also assign interested small businesses an energy contractor who will provide a written proposal outlining recommended improvements. This proposal will include a detailed explanation of each improvement, a review of projected energy and cost savings, and the estimated return on investment. The contractor will also explain the retrofitting process.

Contact:

Customer Service - PSNH
Public Service of New Hampshire
Box 330
Manchester, NH 03105
Phone: (800) 662-7764
Web site: <http://www.psnh.com>

Unitil:

Commercial and Industrial Energy Efficiency Programs⁷¹

Last DSIRE Review: 05/30/2008

Incentive Type: Utility Rebate Program

Eligible Efficiency Technologies: Water Heaters, Lighting, Lighting Controls/Sensors, Chillers, Air conditioners, Compressed air, Programmable Thermostats, Motors, Motor-ASDs/VSDs, Custom/Others pending approval, Controls for walk-in Coolers

Applicable Sectors: Commercial, Industrial, Institutional

Incentive Amount: Small Business Energy Efficiency: Up to 50% of installed cost of prescribed equipment

Large Commercial & Industrial Retrofit: lesser of a one-year payback or 35% of installed equipment cost

Large Commercial & Industrial New Construction: lesser of a one-year payback or 75% of installed equipment cost

Website: http://services.unitil.com/ceco/bus_energy_efficiency_programs.asp

Summary:

Unitil offers three different programs for its commercial, industrial, and institutional customers in New Hampshire: the Small Business Energy Efficiency Program, the Large Commercial and Industrial (C&I) Retrofit Program, and the Large C&I New Construction Program.

The Small Business Energy Efficiency Program is designed for commercial and industrial customers that use less than 100 kilowatts (kW). A Unitil energy contractor completes a free technical assessment of the customer's facility, recommends energy efficiency opportunities and offers a rebate of up to 50% of installed cost on prescribed equipment. Eligible technologies include:

- lighting
- occupancy sensors
- electric hot water measures
- controls for walk-in coolers
- air-conditioning
- programmable thermostats.

Custom projects may also qualify. Unitil's contractor will install the equipment, an installation inspection will be performed, and all work is warranted for one year. Unitil also disposes of all removed materials in an environmentally responsible manner.

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http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NH09F&state=NH&CurrentPageID=1&RE=1&EE=1

Unitil's Large C&I Retrofit Program provides financial and technical services to facilitate the replacement of old, inefficient equipment with new energy efficient equipment in existing facilities. Prescriptive and custom incentives are available to cover the lesser of a one-year payback or 35% of the installed cost of the equipment. Eligible technologies include:

- lighting and controls
- variable frequency drives
- motors
- LED traffic lights
- compressed air systems
- other custom projects

Application forms are available on the website listed above.

Unitil's Large C&I New Construction Program offers financial and technical services to commercial, industrial and institutional customers building a new facility, undergoing a major renovation, or replacing failed (end-of-life) equipment. Prescriptive and custom incentives are available to cover the lesser of a one-year payback or 75% of the incremental cost of the efficient over standard equipment. Eligible technologies include:

- lighting and controls
- variable frequency drives (VFD's)
- chillers
- HVAC equipment
- compressed air systems
- motors
- other approved custom projects.

Application forms are available on the program web site listed above.

Contact:

Unitil Energy Systems
Customer Service
One McGuire Street
Concord, NH 03301
Phone: (800) 852-3339
Web site: <http://www.unitil.com/>

Ed Mailloux
Unitil Energy Systems
Sr. Program Coordinator - Large Business Energy Efficiency Programs
One McGuire Street
Concord, NH 03301

Phone: (603) 773-6541
Web site: <http://www.unitil.com/>

Unitil:

*Residential Energy Efficiency Programs*⁷²
Last DSIRE Review: 05/30/2008

Incentive Type: Utility Rebate Program

Eligible Efficiency Technologies: Clothes Washers/Dryers, Refrigerators/Freezers, Lighting, Programmable Thermostats, Caulking/Weather-stripping, Duct/Air sealing, Building Insulation, Comprehensive Measures/Whole Building, Low-flow Shower Heads, Aerators

Applicable Sectors: Residential, Installer/Contractor, Multi-Family Residential, Low-Income Residential

Incentive Amount: ENERGY STAR® Homes: \$3000
Home Energy Solutions:
Weatherization: 75% rebate
Air-sealing and weather stripping: 100% rebate
Programmable thermostats: 100% rebate
ENERGY STAR® Appliance Program:
ENERGY STAR® Clothes washer: \$50
ENERGY STAR® fixtures: \$10 customer cost per fixture
ENERGY STAR® refrigerator: Up to \$450
ENERGY STAR® CFL Bulbs: 100% rebate
ENERGY STAR® room air conditioner: \$20
Home Energy Assistance (Low-income residents): Up to \$4,000

Maximum Incentive: Home Energy Solutions: Up to \$4,000
Home Energy Assistance (Low-income residents): Up to \$4,000
ENERGY STAR® Homes: \$3,000

Equipment Requirements: Equipment must be ENERGY STAR® labeled.

Installation Requirements: Unitil's Energy Auditor will arrange for a qualified contractor to install the approved measures and equipment.

Expiration Date: Rebates for room air conditioning units are only available during the months of May through August.

Project Review/Certification: Customers are required to schedule a free home energy audit prior to any installation of equipment. Once installation is complete, a final inspection is required.

Website: http://services.unitil.com/ceco/energy_efficiency.asp

⁷²

http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NH08F&state=NH&CurrentPageID=1&RE=1&EE=1

Summary:

Unitil offers its New Hampshire residential customers a number of programs to encourage more energy efficient homes. The Home Energy Solutions Program can help to improve the energy efficiency of qualified homes. Customers with electrically heated homes qualify for a complete home energy audit and receive recommendations for improving the energy efficiency of their home. The program provides rebates up to \$4,000 and includes incentives for installing energy savings improvements including:

- attic and building insulation
- Programmable thermostats
- Air sealing and weather stripping materials

An online sign up form can be found on the website listed above.

In addition, through the ENERGY STAR® Appliance Program rebates are available for ENERGY STAR® labeled lighting, refrigerators, clothes washers, and air conditioning units. Rebates from \$1 - \$10 are offered on various Energy Star lighting fixtures. Rebate coupons can be downloaded online and are also available at participating New Hampshire retailers. A list of eligible technologies as well as an online rebate form is available on the website provided above.

The Home Energy Assistance Program aids low-income customers in improving their home's energy efficiency. Products and services are provided at no cost to customers meeting program income guidelines, regardless of heating fuel type. Products and services of up to \$4,000 are available to eligible customers.

Through the ENERGY STAR® Homes Program Unitil provides technical assistance, marketing support and rebates of up to \$3,000 per home to encourage builders to construct homes that meet federal Energy Star standards.

Appendix VIII: State and Federal resources for municipalities seeking energy efficiency conservation, and alternative energy generation measures

State:

NH PUC

New Hampshire Public Utilities Commission
8 Old Suncook Road
Concord, NH 03301
Phone: (603) 271-2431
Fax: (603) 271-3868
<http://www.puc.state.nh.us/>

NH DES

New Hampshire Department of Environmental Services
Mailing Address:
PO Box 95
Concord, NH 03302-0095
Street Address:
29 Hazen Drive
Concord, NH 03301
Phone: (603) 271-3503
<http://des.nh.gov/>

NH OEP

New Hampshire Office of Energy and Planning
4 Chenell Drive
Concord, NH 03301-8501
Phone: (603) 271-2155
Fax: 603-271-2615
<http://www.nh.gov/oep/>

Federal:

US DOE

US Department of Energy
<http://www.energy.gov/>

EERE

Energy Efficiency and Renewable Energy
<http://www.eere.energy.gov/>

EIA

Energy Information Administration

<http://www.eia.doe.gov/>

US EPA

US Environment Protection Agency

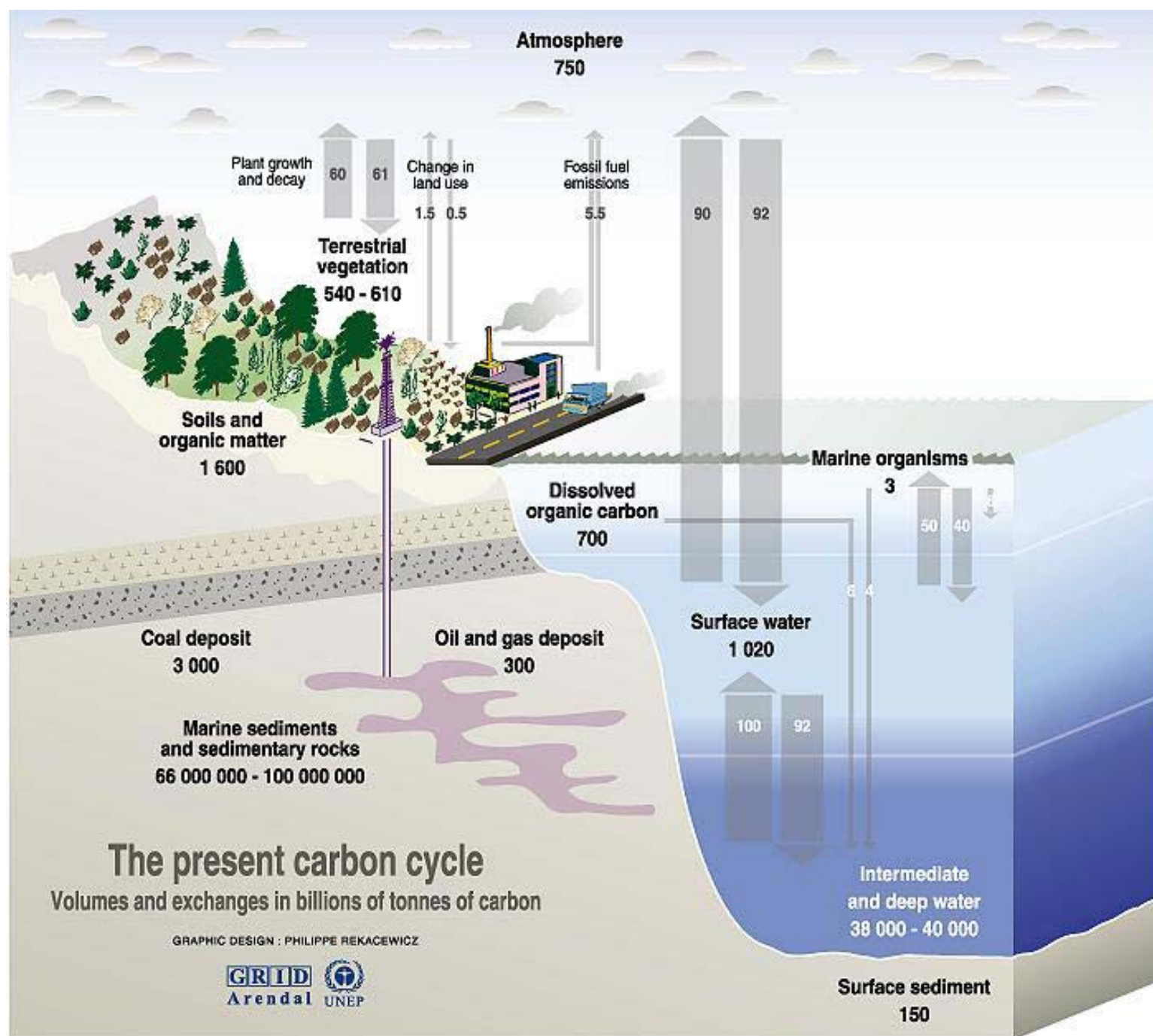
<http://www.epa.gov/>

NREL

National Renewable Energy Laboratory

<http://www.nrel.gov/>

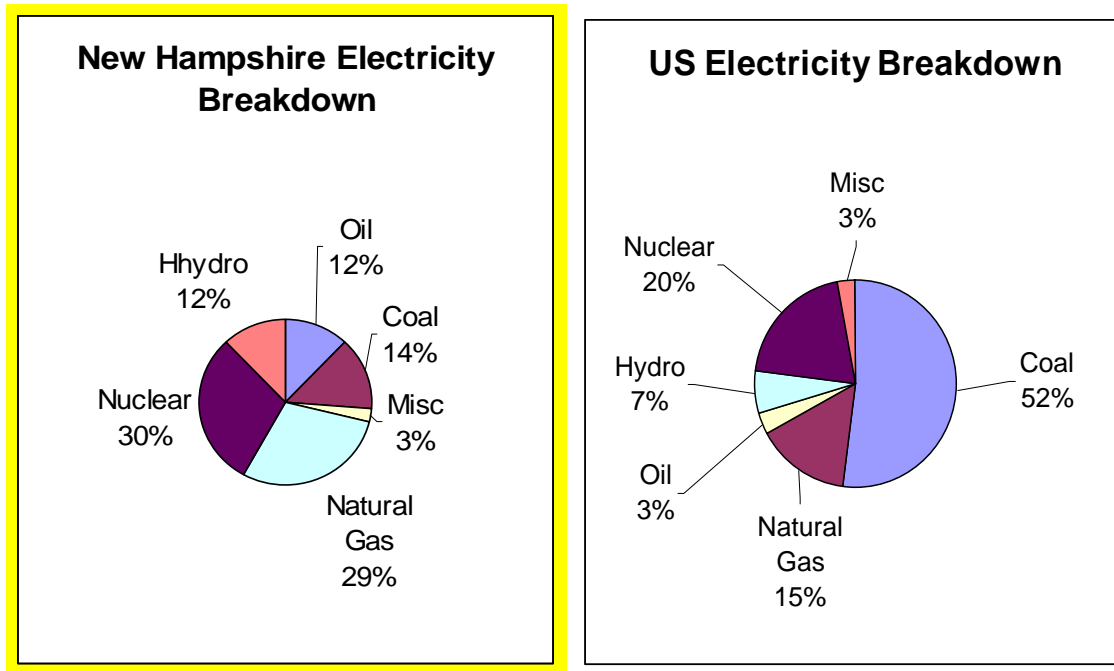
Appendix IX: Carbon Cycle



Sources: Center for climatic research, Institute for environmental studies, university of Wisconsin at Madison; Okanagan university college in Canada, Department of geography; World Watch, November-December 1998; Climate change 1995, The science of climate change, contribution of working group 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge press university, 1996.

Appendix X: National and NH Emissions and Energy Facts for Decision-Makers

Electricity and GHG Emissions



National Electricity Portfolio:

Electricity generators consumed 35 percent of U.S. energy from fossil fuels and emitted 40 percent of the CO₂ from fossil fuel consumption in 2002.⁷³ Electricity generators rely on coal for over half of their total energy requirements and accounted for 93% of all coal consumed for energy in the US in 2002.⁷⁴ Coal emits around 1.7 times as much carbon per unit of energy when burned as does natural gas and 1.25 times as much as oil.⁷⁵ In terms of tons of gas emitted, methane emissions are dwarfed by carbon dioxide emissions (a ratio of 1 ton of methane for every 175 tons of carbon dioxide). Yet, because the heat-trapping capacity of methane is some 21 times that of carbon dioxide, the overall effect of methane on global climate is significant.⁷⁶

New Hampshire Electricity Portfolio:

New England gets its electricity from a range of sources including coal, nuclear, natural gas and oil. Given

⁷³

[http://yosemite.epa.gov/OAR/globalwarming.nsf/UniqueKeyLookup/RAMR5WNMK2/\\$File/04executivesummary.pdf](http://yosemite.epa.gov/OAR/globalwarming.nsf/UniqueKeyLookup/RAMR5WNMK2/$File/04executivesummary.pdf)
p.10

⁷⁴

[http://yosemite.epa.gov/OAR/globalwarming.nsf/UniqueKeyLookup/RAMR5WNMK2/\\$File/04executivesummary.pdf](http://yosemite.epa.gov/OAR/globalwarming.nsf/UniqueKeyLookup/RAMR5WNMK2/$File/04executivesummary.pdf)
p.10

⁷⁵

<http://www.eia.doe.gov/emeu/cabs/carbonemiss/introduction.html>

⁷⁶

<http://www.eia.doe.gov/oiaf/1605/archive/gg96rpt/chap3.html>

the predominance of natural gas as a fuel, New England's electricity supply is one of the nation's cleanest. However, this dependence has resulted in higher-than-average electricity prices, potential natural gas shortages, and several proposals for Liquefied Natural Gas (LNG) import terminals.

New England Greenhouse Gas Emission Rates 2005⁷⁷

Calculated New England CO₂ Marginal Emission Rates (lbs/MWh)

Year	Annual Average	Annual Average Percentage Change
1993	1,643	-
1994	1,573	-4.3
1995	1,584	0.7
1996	1,653	4.4
1997	1,484	-10.2
1998	1,520	2.4
1999	1,578	3.8
2000	1,488	-5.7
2001	1,394	-6.3
2002	1,338	-4.0
2003	1,179	-11.9
2004	1,102	-6.5
2005	1,107	0.5

2005 Calculated New England CO₂ Marginal Emission Rates by State (lbs/MWh)

State	Annual On-Peak	Annual Off-Peak	Annual Average
Connecticut	1,182	1,133	1,167
Maine	1,033	994	1,020
New Hampshire	1,100	1,014	1,070
Rhode Island	919	877	910
Vermont	1,898	1,889	1,897
Massachusetts	1,172	1,152	1,165
New England Average	1,116	1,087	1,107

⁷⁷ http://www.iso-ne.com/genrtion_resrcs/reports/emission/2005_mea_report.pdf

Appendix XI: STOCC Check List



Data Required for the Small Town Carbon Calculator (STOCC)

Buildings & Facilities		
Information	Where you may find it	<input checked="" type="checkbox"/>
Building name	Building manifests/tax forms, town offices, town administrator, town clerk, or selectperson. May be on town website	
Annual electricity (KWH) used	Sum monthly totals from the electricity bills to calculate annual KWH used. Data can be found at: town archives/offices/administrator. May need to contact provider company to get copies of old bills	
Annual cost of electricity	Sum monthly totals from the electricity bills to calculate annual cost. Enter total cost of bill which includes fees	
Annual units of other fuel used (oil, gas, etc.)	Oil bills, natural gas bills, etc. Sum all bills from one year to calculate annual amount delivered	
Annual cost of other fuel	Sum all the oil bills, natural gas bills, etc. to calculate annual costs.	

Vehicles		
Information	Where you may find it	<input checked="" type="checkbox"/>
Vehicle name/Number	Highway garage manager or town administrator. There may be a vehicle manifest for the town. May need to contact fire and police departments separately.	
Amount of fuel used per vehicle	Find out if records were kept from vehicle fill-ups. If it is broken down by type of fuel (diesel, regular, etc), capture that information. Sum all fuel by vehicle to calculate annual total	
Annual cost of fuel per vehicle	Sum all vehicle fill-up records to calculate annual costs	
**If you do not have the annual amount/cost of fuel per vehicle, it can instead be calculated using following information **		
Average cost per unit of fuel	For New England, the average cost of regular unleaded gasoline has been: \$2.59 (2006), \$2.82 (2007), and \$3.89 (2008). More info at: www.eia.doe.gov	
Miles travelled per vehicle	Odometer readings: town records, vehicle inspection records, vehicle registration records	
MPG for each vehicle	Owner's manual or online from: http://www.fueleconomy.gov/mpg/MPG.do?action=browseList	

Streetlights		
Information	Where you may find it	<input checked="" type="checkbox"/>
Number of streetlights	Bill from electricity provider: in town archives or get copies from electricity provider. If the bill does not specify the number of streetlights, ask town administrator or secretary how to get the number.	
Annual electricity (KWH) used	Sum monthly totals from the electricity bills to calculate annual totals. Data found at: town archives/offices/administrator. May need to contact provider company to get copies of old bills	
Annual cost of electricity used	Sum monthly totals from the electricity bills to calculate annual totals. Enter total cost of bill which includes fees	

Data Required for Portfolio Manager (per building)*

Buildings & Facilities		
Information	Where you may find it	<input checked="" type="checkbox"/>
Building name	Building manifests/tax forms, town offices, town administrator, town clerk, or selectperson. May be on town website	
Gross floor area	Building manifests/tax forms, town offices, town administrator, town clerk, or selectperson. Square footage is noted on municipal property liability insurance for the building	
Year built/renovated	Building manifests/tax forms, town offices, town administrator, town clerk, or selectperson.	
% Heated/air conditioned	Building manifests/tax forms, town offices, town administrator, town clerk, or selectperson. May need to call someone at each building	
Number of personal computers	Ask town administrator or secretary, or call each building	
Number of employees	Ask town administrator or secretary, or call each building	
Name of electricity provider	Ask town administrator, secretary, or financial person (whoever pays the bills)	
Monthly kWh used	Town archives/offices/administrator. May need to contact provider company to get copies of old bills	
Monthly cost of electricity	Electricity bills. Enter total cost of bill which includes all fees	
Monthly units of other fuel used (oil, etc.)	Oil bills, natural gas bills, etc.	

* Note that this data is NOT required if you are only completing a STOCC inventory. Consult the User's Guide for further information regarding Portfolio Manager (http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager)