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Guide to Improving Energy Efficiency in Vermont Municipal Buildings

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I) Introduction

Vermont municipalities are facing increasing costs and demands for their services with ever-tightening budgets. Municipalities have enormous opportunities for reducing energy costs in municipal buildings through improved energy efficiency; thus providing multiple benefits of reducing or flattening municipal costs, CO2 emissions, and property taxes. Fuel oil prices have more than doubled in the last ten years alone, and are subject to wild fluctuations as Vermonters witnessed in 2008. These price increases mean that a greater percentage of municipalities' budgetary funds are being spent on energy costs -- which means less money available for meeting other town needs.

This guide is designed as a basic step-by-step roadmap to help Vermont town energy committees and municipalities improve energy efficiency in municipal buildings.¹

II) Steps to Take

Some basic steps for improving energy efficiency in municipal buildings include:

- A) Form a Team
- B) Build Support among Elected Officials and Residents
- C) Compile Data on Your "Municipal Energy Bill"
- D) Identify & Prioritize Energy Saving Opportunities
- E) Decide on Funding Approach
- F) Undertake Efficiency Improvements and Monitor Results

These steps are described in more detail below.

A) Form a Team

Forming a team of individuals committed to working on reducing municipal energy costs is a critical first step in tackling municipal energy use. Vermont has more than 130 volunteer town energy committees or energy coordinators which are active in promoting energy efficiency and renewable energy in their communities. Energy committees can play a key role in ushering the energy auditing and investment process through your community, including gaining support from selectboards/city councils/school boards, undertaking public outreach efforts, and securing funding for municipal efficiency investments.

A group or committee of five to seven people with a diverse range of skills and experience will provide the foundation for a good team. Consider asking people with the following experience and skills to be on the committee: individuals in the energy efficiency/building trades, school

¹ For a more detailed guide, see the "New Hampshire Handbook on Energy Efficiency & Climate Change: Volume II" at www.carboncoalition.org/community/EnergyCommitteesResources.php.

board and/or selectboard members, individuals with economic/financial backgrounds, individuals with writing skills (to prepare grant proposals) and organizing skills (to get people involved), and students and/or teachers from the local high school. Other desirable backgrounds include local business owners, members and staff of environmental and community organizations, long-time residents and newcomers, retirees and elderly, people from different geographic regions of your town, journalists, and marketing specialists. Perhaps the most important qualification for potential committee members is time and energy! It may be helpful to establish term lengths for energy committee members as people are more likely to serve if they know it is for a finite period.

B) Build Support among Elected Officials and Residents

One of your first steps as a committee will be to enlist the support of your local elected leaders, such as selectboard, city council and/or school board members. Your committee should be working in lock-step with your selectboard throughout the entire process to help ensure their endorsement of any funding requests. It is absolutely critical that your committee build support among elected officials and residents for making energy efficiency improvements – before you ask for funds. If you have done your job, the selectboard/city council will work with you to develop the appropriate funding approach.

Ask to be on the agenda of a selectboard's meeting to inform them of your interest in reducing municipal building energy costs, to find out what work has been done to date, and to solicit their input on how to best proceed. You might ask them to consider appointing your group as an official town committee!

One of your key tasks is to clearly communicate information about the costs and potential savings in manner that is easy for the public and elected officials to digest. Thus, it is worthwhile spending the necessary time to prepare clear and factual informational materials about what efficiency improvements will be made, associated energy savings and costs, and the payback period. It is also helpful to use graphics to display the information. Further, your committee should make the information available through a variety of forums, including setting up a table at town meeting, publishing articles in the local newspaper, sending out e-mail alerts, and even holding a public information meeting.

For more information on starting a town energy committee, get a copy of the Town Energy and Climate Action Guide prepared by the Vermont Energy and Climate Action Network (VECAN). Check out the VECAN website at www.vecan.net.

C) Compile Data on Your “Municipal Energy Bill”

Most towns have very little idea about their total energy bill. Municipal energy costs are usually embedded in different departmental budgets, such as road crews, buildings, and street lightings. Thus, an important first step for your committee is to compile data on the total energy bill for your municipality.

Some basic steps for compiling your town's “municipal energy bill” are:

- Collect information for a one-year period – usually the calendar year – which corresponds to the town's annual report.

- Compile electrical and fuel bills for each municipal building; this data can usually be obtained from the town treasurer and/or clerk.
- In addition to building energy use, look at municipal transportation fuel bills (i.e. public works department (road crew), public transportation, police, fire, etc.) and electrical bills for street lighting.

Your committee might also consider compiling data on how much the town spent on energy 5, 10, and 15 years earlier – as a way of showing how energy usage and costs have changed during that time. This information might be available by digging through previous town bills and annual reports. An alternative approach is to assume comparable usage levels between then and today, and then substitute energy costs from these time periods to estimate total energy costs for these years.

You can also prepare estimates on future costs with various price escalators (2%, 4%, 10% annual increases), and show what the magnitude of the impact would be on town energy costs in the future. We suggest that you display this information graphically and on large display boards to help bring the message to life. These displays can be valuable for presentations before the selectboard/city council – as well as at town meeting.

Larger communities might want to consider taking Environmental Protection Agency's (EPA's) Community Energy Challenge. This Challenge is an online, interactive energy management tool that allows municipalities to track and assess energy and water consumption across all buildings, helps set investment priorities, identifies under-performing buildings, and verifies efficiency improvements. For more information, visit: www.epa.gov/region1/eco/energy/energy-challenge.html.

Further, several New Hampshire organizations² have developed a valuable tool for helping your town understand how it spends money on energy and the sources of the majority of your town's greenhouse gas emissions. Known as the Small Town Carbon Calculator (STOCC), this tool provides all of the technical information, the data input structure, and the calculations necessary to complete a basic energy-use and emissions inventory for your municipality. To download the STOCC, visit: http://www.cleanair-coolplanet.org/for_communities/stocc.php.

Your town may already have an energy assessment completed by Efficiency Vermont through a federal Department of Energy grant in 2006 or 2007.

D) Identify Energy Saving Opportunities

1) Conduct Walk-Through Energy Assessment of Buildings

A walk-through assessment is an important step toward improving energy efficiency levels in municipal buildings. A walk-through assessment is a basic information-gathering tool and should not be considered as a professional audit upon which to make investment decisions. The purpose of the assessment is to provide enough information about potentially significant

² These organizations include non-profit organization, Clean Air-Cool Planet in collaboration with Carbon Solutions New England and The University of New Hampshire

energy saving opportunities in one or more of your municipal buildings to help convince your selectboard to have a professional energy audit performed.

Walk-through assessments usually involve a visual inspection of buildings to identify potential air leaks in basements, attics, and walls; examine insulation levels; look at the status/quality of heating equipment; and, examine lighting and other electricity-using equipment. For more information on elements of a walk-through assessment, see *“What to Look for During a Walk-Through Assessment”* below.

Municipal energy use data provides a nice foundation for identifying which municipal buildings appear to have biggest potential for thermal energy savings. One useful tool to help determine which buildings are the biggest energy guzzlers is to calculate the relative thermal efficiency of the building by dividing total energy usage (e.g. gallons of oil) by the square footage of heated space. In general, buildings that use over 40,000 BTUs/square foot have cost-effective thermal energy-saving opportunities (See Attachment A: “What is the Relative Thermal Efficiency of Your Building?”).

Your committee should consider having one or more individuals who are knowledgeable about building energy performance, such as a certified energy auditor, participate in the walk-through assessment. Other assessment team members might include the municipal staff person responsible for building maintenance, a recorder/scribe, and other interested individuals. Consider taking pictures of energy-saving opportunities you identify during the assessment to include in any public presentations.

Once you have completed the walk-through energy assessment, ask your selectboard/school board for time on their agenda to present your findings and request funding to have a professional energy audit conducted on selected buildings. The cost of these audits can range widely depending on the scope of improvements and size of the building.

What to Look for During a Walk-Through Assessment³

- How old is the heating and distribution system?
 - What year was the boiler installed?
 - What type of fuel does the system use?
- 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 caulking?
- 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 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 Audit

- ✎ Pen / pencil
- ✎ Notebook to write findings
- ✎ Digital camera
- ✎ Tape recorder
- ✎ Flashlight
- ✎ Compass
- ✎ Tape measure
- ✎ Stepladder

³ New Hampshire Handbook on Energy Efficiency & Climate Change: Volume II" at www.carboncoalition.org/community/EnergyCommitteesResources.php.

2) Hire a Professional to Conduct an Energy Audit

Once your team has compiled some basic information about the building energy performance through a walk-through assessment (and secured the funding!), it is time to call a building performance professional to conduct an energy audit. It is important to distinguish between commercial-type and residential-type buildings in terms of the expertise needed and the relative cost of the audit. Most municipal buildings occupy commercial spaces and contractors with commercial building energy experience are best suited to provide energy audit and installation services. To find a list of commercial energy contractors, please visit www.encyvermont.com and search the Business Marketplace.

If your municipal offices or workspace occupy residential-type buildings, energy services might be better provided by a Home Performance with ENERGY STAR (HPwES) contractor. Efficiency Vermont supports a network of Home Performance with ENERGY STAR contractors. These independent contractors are certified by the Building Performance Institute to perform energy audits on residential buildings, diagnose building problems such as moisture, mold, and ice dams, and install the recommended energy efficiency improvements. Efficiency Vermont provides contractor training and quality assurance. To find a list of HPwES contractors, please visit www.encyvermont.com/homeperformance.

A complete energy audit includes most or all of these components:

- Visual inspection of the building envelop from top to bottom
- Visual inspection of insulation levels and possibly an infrared scan
- Air leakage (blower door) test
- Health and safety diagnostic testing, including moisture evaluation, combustion safety testing, and carbon monoxide detection
- Recommendations for electrical upgrades, such as lighting and appliances
- Audit report

The audit report is a written assessment of findings, a priority list of energy efficiency measures, and associated cost estimates and savings. A comprehensive project involves air sealing, insulation, heating/cooling/ventilation system improvements and tune-ups, moisture control, lighting and appliance upgrades. One of the key tasks of your committee will be to review the findings of the energy audit report and determine which efficiency measures the town should move forward with implementing. The selection of efficiency measures will be determined by a number of factors, including relative payback period of the measures, total amount of funding your group is comfortable requesting from the town/voters, and the amount of grant funding secured.

You should anticipate that all contractors providing energy services will work on a fee-for-service basis. For more information about your efficiency options, call Efficiency Vermont toll-free at 888-921-5990.

E) Decide on Funding Approach

Energy efficiency improvements require upfront capital investments that pay for themselves in reduced energy costs over time. Efficiency investments should be considered on par with other

investment decisions by your town. In general, efficiency improvements can often yield a return on investment of 10-20% or higher, depending on the measure. Inefficient buildings and higher fuel prices make returns on efficiency investments even greater.

Municipalities have a variety of funding options at their discretion that can be utilized for energy efficiency improvements. Your municipality may choose to combine or leverage several of these options which include:

- ***Discretionary Funds:*** Many towns have a budget line item called “Building Repairs/Maintenance/ Improvements.” These monies are appropriated at the selectboard’s discretion and are a good source of funding for relative small sums (up to \$1,000), such as for energy audits or low-cost, do-it-yourself measures.
- ***Budget items:*** A line item in the town budget is probably the most common approach to financing building efficiency measures. Budgets serve as a way of communicating with residents about the scope of the proposed improvements, and the relative costs and benefits of the project. This financing mechanism is ideally suited for moderate amounts of funding.
- ***Bonding:*** If the cost of efficiency improvements is substantial, a bond issue may be appropriate. Bonding for energy efficiency is usually financed through general obligation bonds (i.e., the bonds are paid in yearly increments out of general revenues.) Bonds can be a favorable financing option depending on the expected net energy savings and costs. If the annual expected energy savings exceed the annual debt service of the bond, this results in a favorable cash flow. Factors affecting whether to bond include receptiveness of residents toward additional indebtedness and other capital needs of the town.
- ***Energy Saving Performance Contracting:*** Larger communities might consider financing energy savings measures through a performance contract. Performance contracting involves entering into an agreement with a private energy service company (ESCO) which identifies and evaluates energy-saving opportunities and then recommends a package of improvements to be paid for through savings. The ESCO will guarantee that savings meet or exceed annual payments to cover all project costs— usually over a contract term of seven to 10 years. If savings don't materialize, the ESCO pays the difference. To ensure savings, the ESCO offers staff training and long-term maintenance services. For a list of qualified energy service companies, visit the U.S. Department of Energy website of http://www1.eere.energy.gov/femp/pdfs/doe_ql.pdf.
- ***Grants:*** There are a number of potential grant funding sources for municipal building efficiency improvements. These include:
 - ***American Recovery and Reinvestment Act:*** has monies available through the Energy Efficiency and Conservation Block Grant (EECBG) program. This grant program is designed to assist eligible entities, including municipalities, in implementing energy efficiency and conservation strategies to reduce fossil fuel emissions, reduce total

energy use, and improve energy efficiency in the transportation, building, and other appropriate sectors. These funds are administered through the Vermont Clean Energy Development Fund (CEDF). See <http://recovery.vermont.gov/energy> for current information on the Vermont-specific energy funding and www.eecbg.energy.gov/ for more information on the block grant program.

- ***Vermont Community Climate Change Grants:*** In 2009, the Vermont Agency of Natural Resources awarded over \$500,000 in grant funds through the Vermont Community Climate Change Grants. This grant program is designed to enable Vermont communities to implement measures that will improve energy efficiency and reduce greenhouse gas emissions. Grants of up to \$12,000 are available to Vermont municipalities and non-profit organizations to support community-based projects. Monies for this program are potentially available for another four years. See www.anr.state.vt.us/air/Planning/htm/ClimateChange.htm for more information.
- ***Clean Energy Development Fund (CEDF):*** In addition to funds listed above under the American Recovery and Reinvestment Act, the Clean Energy Development Fund manages a separate grant program to fund a wide variety of clean electrical and thermal energy technologies. The goal of the Fund is to increase the development and deployment of cost-effective and environmentally sustainable electric and thermal energy resources primarily with respect to renewable energy resources, and the use of combined heat and power technologies in Vermont. The CEDF will make grants to individuals and organizations for projects that meet the Fund's objectives and advance the Fund's overall goals, as more specifically set forth in 10 V.S.A §6523 and the CEDF Strategic Plan. See www.publicservice.vermont.gov/energy/ee_cleanenergyfund.html for a copy of the strategic plan and for more information on the grant application process.
- ***Efficiency Vermont:*** Efficiency Vermont, the state's energy-efficiency utility, provides technical assistance and financial incentives to Vermont households and businesses, to help them reduce their energy costs with energy-efficient equipment and lighting and with energy-efficient approaches to construction and renovation. For more information, contact Efficiency Vermont at 1-888-921-5990 or visit their website at www.encyvermont.com.

F) Undertake Efficiency Improvements and Monitor Results

Once you have secured funding, the next step may be to contact a building energy professional. Oftentimes, the contractor who performs the energy audit is the same company that installs the energy efficiency improvements. To find a list of contractors, please visit www.encyvermont.com and search the Business or Residential Marketplace sites.

One option to help offset some of the costs of improving thermal and electrical efficiency in municipal buildings is to tap into assistance from community volunteers to help implement efficiency measures. Volunteers participate in a basic do-it-yourself training on energy-saving

techniques prior to assisting with the work. These projects should be supervised by a qualified energy performance contractor. In Vermont, several community groups have moved ahead with this approach, including the Middlesex Energy Committee and the Thetford Energy Committee. Contact the Sustainable Energy Resource Group at www.serg-info.org for more information about the Thetford program.

One year after the energy efficiency work has been completed, your committee should compile data on building energy use and share this savings data with the selectboard and residents. Consider comparing estimated savings with real savings to determine whether the project met or even exceeded expectations.

III) Conclusion

Vermont municipalities are eager to move forward with improving energy efficiency in their buildings. For town energy committees in the formative stages, improving building efficiency is a great “starter project” because it results in tangible energy savings that benefit all residents. This guide is intended as primer to help Vermont town energy committees take the steps necessary to reduce municipal fuel bills and carbon footprint.

Attachment A: “What is the Relative Thermal Efficiency of Your Building?⁴”

You can easily determine the relative energy efficiency of your building just by knowing the square footage of your building and how much fuel you consumed last year. Complete the steps below to figure out how energy efficient your building is.

Step 1. Determine how much fuel you use.

Determine how much fuel you used last year from all sources, such as oil, wood, propane, etc. You can look at your old bills or call your fuel dealer(s) for this information.

Step 2. Convert “fuels used” to BTU equivalents.

(BTUs or British Thermal Units are a standard unit of measurement for heat content in fuels and will give you a common denominator for measuring your fuel usage.) Multiply the quantity of each fuel you use (Step 1 above) times its BTU equivalent (in chart below) to get total BTUs for each fuel used. If you use more than one kind of fuel, add the BTU amounts together to determine the total amount of BTUs used in your building.

Use the chart below to convert your fuel use to BTUs.

Converting Fuel Use to BTUs

Fuel Type	Number of BTUs (A)	Amount of Fuel Used (B) <i>(from step 1)</i>	Total BTUs by Fuel Used (A) x (B)
Oil	138,200 BTUs/gallon		
Kerosene	136,600 BTUs/gallon		
Propane	91,600 BTUs/gallon		
Natural Gas	100,000 BTUs/therm		
Electricity	3,412 BTUs/kWh		
Wood	22,000,000 BTUs/cord		
Coal	24,000,000 BTUs/ton		
Wood Pellets	16,000,000 BTUs/ton		
Total BTUs Used			

Step 3. Determine the square footage of heated or conditioned space.

Multiply the width of your building times the depth of your building times the number of floors of heated or conditioned space. (Basements do not usually count unless they are a heated part of the working/living space. Include rooms that are not being heated but are in the workable area.)

Step 4. Calculate number of BTUs per square foot.

⁴ These worksheets are adapted from materials developed by Sustainable Energy Resource Group, Thetford, Vermont. You can find an on-line automatic calculator to run the numbers for your building at their website: web.valley.net/serg/energy-assessment.

Divide the total BTUs used (Step 2) by the total amount of square feet of heated or conditioned space (Step 3).

Total BTUs (Step 2) _____ ÷ total square footage (Step 3) _____ = BTUs/square foot _____

Step 5. Compare your BTU/square foot to an energy-efficient building.

If your building uses less than 40,000 BTUs of energy per square foot per year, you have a relatively energy-efficient space. If you use over 40,000 BTUs per square foot, you probably have opportunities to improve your building efficiency, such as improving the efficiency of the building shell (insulation and plugging leaks) and/or improving the efficiency of the heating system. If so, consider getting a Building Performance Energy Audit as a next step. You can also reduce your BTU usage by turning down your thermostat. For every degree you lower your thermostat for the whole day, you will use about 3% less energy for heating.

Example for Calculating the Relative Energy Efficiency of Your Building

Assumptions:

Size of building: 1,600 square feet

Amount of fuel used: Two cords of wood and 422 gallons of oil

Calculations:

Step 1. Two cords of wood x 22,000,000 BTUs = 44,000,000 BTUs

Step 2. 422 gallons of oil x 138,200 BTUs = 58,320,400 BTUs

Step 3. 44,000,000 BTUs (wood) + 58,320,400 BTUs (oil) = 102,320,400 BTUs total

Step 4. 102,320,400 BTUs ÷ 1,600 square feet of heated or conditioned space = 63,950 BTUs/square foot

This building is relatively inefficient and has relatively good opportunities for improving efficiency.