EarthRight Institute's Guide to Town Energy Planning in Vermont

with

Model Town Energy Plan

by

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Guide to Town Energy Planning in Vermont

by EarthRight Institute

EarthRight Institute is a nonprofit 501(c)(3) organization which works to protect and enhance the quality of our environment. EarthRight has an active membership and serves as a networking and educational center for environmental concerns in the Upper Connecticut River Valley region of Vermont and New Hampshire, providing information and referrals on crucial issues.

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Contents

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INTRODUCTION

Contents and Use of this Booklet

This booklet contains two main parts, a *Guide to Town Energy Planning* and a *Model Town Energy Plan.*

The *Guide* to *Town Energy Planning* serves as a workbook to lead a town energy committee or planning commission through the steps required to successfully develop and implement a town energy plan and energy-saving initiatives. Included in this section is information on collecting, analyzing and presenting background information, setting goals and objectives, and developing, adopting and implementing an energy plan.

Throughout the *Guide*, a progression of steps will be suggested to accomplish these tasks. However, the actual actions taken will vary from town to town based on how much energy planning has been done in the past, the type and amount of citizen support available, and the resources available for energy planning in the town.

While the *Guide* is comprehensive, it is not exhaustive and should in no way stifle a committee's imagination or drive to pursue other ideas. In fact it is hoped that if users of this *Guide* develop improvements for it, or if they develop new ideas, they will make them available to EarthRight Institute. This will assist in producing an improved edition of the *Guide* in the future.

The *Model Town Energy Plan* provides an example of goals, objectives, and programs which might appear in a town energy plan and a framework through which they might be laid out. While the *Model Plan* is intended as a starting point from which any town's energy plan can be tailored, material from the *Model* may be used verbatim with the permission of EarthRight Institute. Please credit EarthRight Institute for any material used directly from this *Guide.*

The *Appendices* contain additional references, resources, programs, and funding information valuable for developing and implementing an energy plan.

The *Glossary* contains words or phrases which may need further explanation. The first time the words appearing in the glossary are used, they are printed in italics.

Background and Justification for a Municipal Energy Plan

In the hey days of the 1970's, great strides were made in *energy conservation and efficiency* due to the economic forces of increased oil prices. Average automobile fuel efficiencies doubled; federal and state funding was available for home energy audits, low income weatherization, and research to advance renewable technologies; and individuals became more aware of and began to take responsibility for their energy use. However, once oil prices dropped, so did the interest in and support for reducing energy consumption. Today, the United States, representing 4.7% of the world's population, consumes 25% of the world's energy.

A resurgence of interest in conservation, efficiency, and renewable sources of energy seems to be growing in the 1990's, with economic concerns again being one of the prime motivating factors. However, this time the issue is not so much high oil prices, but the general state of the economy. Current energy consumption in Vermont imposes a huge drain on local economies in terms of employment and income. Over 80% of the energy used in Vermont is imported from out of state and more than 85% of the money spent on imported energy leaves the community. The recession of the early 1990's has forced governments, businesses, and individuals to become more frugal, with conservation and efficiency measures being looked to for the financial benefits they offer.

Along with this, the recent swing in world petroleum prices during the war in Kuwait is a reminder of New England's susceptibility to fluctuating oil costs due to unexpected supply cutoffs and wars fought over dwindling fossil fuel reserves. As the OPEC oil embargo of the 1970's threatened the security of our energy supplies, the 1991 Gulf War has caused many to look to our own *renewable resources* to help satisfy our energy demands.

. While the above economic and security concerns alone would justify developing an efficient plan for our energy use, there are many who believe that it is the environmental concerns which make such planning imperative. With an ozone hole three times the size of the United States forming over Antarctica; global warming threatening the world's coastal cities, agricultural zones and the foundations of many of our ecosystems; and with no permanent means yet devised to handle the radioactive wastes from our nuclear power plants, the environmental concerns of energy use are certainly far reaching and serious.

However, there are hopeful signs of change as a broad spectrum of the public is becoming aware of the situation. Economists are beginning to factor the costs of environmental damage into the *real costs* of production and consumption. Utility companies throughout the country are beginning to look to efficiency as a way to conserve energy through their *demand side management* programs. Individuals are starting to take an interest in energy issues the way they did in recycling in the late 1980's. And many state and municipal governments are beginning to plan for their energy future.

The state of Vermont, in its 1992 Comprehensive Energy Plan, states that planning should address the economic, security, and environmental concerns of our energy use. The state is encouraging and promoting town energy planning through the Vermont Planning and Development Act.

Two specific goals of this legislation that directly involve energy use are:

- To provide for safe, convenient, economic and energy-efficient transportation systems that respect the integrity of the natural environment, including public transit options and paths for pedestrians and bicyclers.
- To encourage the efficient use of energy and the development of renewable resources.

The Vermont Planning and Development Act recommends that a town include in its energy plan "an analysis of energy resources, needs, scarcities, costs, and the problems within the municipality, a statement of policy on the conservation of energy, induding programs, such as thermal integrity standards for buildings, to implement that policy, a statement of policy on the development of renewable energy resources, a statement of policy on patterns and densities of land use likely to result in conservation of energy."[1]

Due to the interconnected nature of energy use, transportation, land use, capital budget, solid waste, etc., it is beneficial for a town to develop its energy plan in conjunction with these other aspects of town planning. Since many towns in Vermont are currently undertaking a major planning process in compliance with the Vermont Planning and Development Act, this is a crucial time for those towns to develop an energy component for their town plan.

If a town has decided not to undertake a major planning process at this time, energy planning still makes sense for the economic, societal, and environmental benefits it will bring to the town. And if at some point in the future a town decides to develop a master town plan, the sectors that interface with energy planning will already be developed and can be updated or revised if necessary.

1Vermont Statutes Annotated, Chapter 117, Section 4382, subsection 9.

Purpose of a Municipal Energy Plan

Local energy planning provides a framework through which individuals can become educated about and begin to systematically analyze the patterns of energy production and consumption within their town, and can devise plans which will reduce energy consumption and costs, enhance the local economy, provide secure energy supplies, and increase environmental protection. It is only through the dedicated efforts of a town's citizens that a municipal energy plan will be developed and initiated, and that these crucial changes will become realized.

Several goals of a well-designed municipal energy plan are:

1. To reduce energy consumption, thereby reducing the concomitant harmful environmental impacts of energy production and consumption.
2. To encourage the conservation and efficient use of energy, thereby conserving the town's long term financial resources.
3. When fuels can be substituted for one another, to give preference to the fuel or energy source that is renewable, not imported, and least expensive, after factoring in societal and environmental costs.
4. To increase security and stability through long range planning and a diversified set of energy supply options, including locally developed, renewable energy sources which create local jobs and stimulate investment within the community.
5. To assist consumers unable to pay for basic energy needs or for improved efficiency measures.
6. To manage local renewable energy resources in an environmentally sound and *sustainable* manner.

FRAMEWORK FOR ACTION

I. Forming an Energy Committee

The first step in creating an energy plan is to form an energy committee which will develop a plan in an organized manner. The committee must "sell" the idea of the plan to the community, inform the planning board, and solicit input on the plan from all sectors of the town. The committee will also be responsible for seeking funding and financing options to plan for and implement town energy programs (see Appendix IV).

The key to forming an effective committee is to find individuals who are dedicated to their task. The energy committee should be composed of concerned citizens representing a broad spectrum of the community, including the business and industry, low-income, senior citizens, agricultural, residential, and municipal sectors. In addition, it would be beneficial to have committee members with expertise on planning, energy, environmental, land use, transportation, construction, and economic issues. Since few committees will have experts in all these fields, the committee should develop a resource list of individuals in town with knowledge in these areas who would be willing to assist on an as needed basis. This will help to spread out the work load and to build community support by involving more town residents in the process.

Since the town planning commission is responsible for overseeing development of all aspects of town planning, town energy planning falls within its authority. Therefore, individuals interested in developing a town energy plan should approach the town planning commission for appointment to a town energy committee. Following adoption of the plan, the energy committee should seek formal recognition by the town Select Board. The energy committee would be responsible for implementing the programs laid out in the energy plan, ensuring compliance with the plan, organizing energy education programs in town, and analyzing the effectiveness of programs.

Individuals interested in implementing energy-saving initiatives in a town where the planning commission does not currently want to incorporate an energy component into the town plan, should approach their Select Board directly to form an energy committee.

II. Appointing an Energy Coordinator

In addition to an energy committee, the town may want to fill the position of "Town Energy Coordinator." In accordance with 24 V.S.A. (Vermont Statutes Annotated), Section 1131, a town may authorize its Select Board to appoint a Town Energy Coordinator for a one-year term. Town Energy Coordinator is an unpaid position, with no restrictions on the number of times a Coordinator can be reappointed. Upon approval from the Select Board, the Town Energy Coordinator position is advertised, and residents interested in applying notify the Town Manager or designated municipal officer. After a selection process, the Select Board appoints a Town Energy Coordinator. The process for appointing an Energy Coordinator can be changed if the town so orders.

The duties of the Town Energy Coordinator, as described in 24 V.S.A., Section 1131, include the following:

- Coordinate existing energy resources with the town and cooperate with the municipal planning commission and with those federal, state and regional agencies of government which are responsible for energy matters.

- Study and evaluate sources of energy which are alternatives to those presently available with a view toward the more efficient and economical utilization of existing and potential energy resources.

- Make periodic reports of his [her] activities to the selectmen as they may require and may perform such other duties, studies or examinations as may be required by the selectmen.

III. Formulating an Action Plan

An organized plan of action helps the energy committee to use its time effectively, while ensuring that all important aspects of town energy planning are addressed. Furthermore a well thought out plan of action helps keep the planning process moving, thus keeping the energy committee members excited and motivated.

The action plan should include a work schedule, the period of time the plan will cover, the methods and timing of encouraging public education and participation, and a planning budget.

A. *Setting up a work schedule:*

The work schedule will spell out who will work on each part of the energy plan and will estimate how long each process will take. It is not necessary to rigidly adhere to this schedule, but rather to use it as a guide to ensure that progress is made in an orderly and efficient manner. Some basic steps of organizing a town energy plan which should be included are:

1. collection of background information, including an energy use inventory
2. analysis and presentation of background information
3. preparation of the energy plan including the establishment of goals and objectives
4. development of an implementation plan
5. adoption of the energy plan
6. implementation of the programs
7. evaluation of programs

These steps are explained in further detail later in this publication. The energy committee should review the rest of this *Guide* and develop an idea of the work that needs to be done. A list of tasks can then be developed, individuals, including outside help, can be assigned to complete each task, and a timeline to accomplish the tasks can be determined.

B. *Defining the planning period:*

In developing a plan it is important to determine what period of time the plan will cover. The high front-end costs of many investments in energy efficiency require long range planning to realize the potential payback. Similarly, the proper management of a town's renewable resources on a sustainable basis requires long-term vision. Therefore, the committee may want to consider a 15 or even 20 year planning period. If a town is developing a master plan, the committee should check with the town planning commission to see what period of time the town's master plan covers and try to mesh with that schedule.

The difficulty with energy planning is that technology is changing so rapidly that decisions made today, based on current technology, may be obsolete in several years. Therefore, while long range planning is necessary, the committee should review the plan every two to three years to make sure it keeps pace with advances in technology.

In addition to a periodic review of the plan, the committee should assess its progress on programs and initiatives on an annual basis. An assessment will determine what has been accomplished in the year and would be used to determine priorities and initiatives for the coming year. The committee should share the outcome of all periodic reviews and annual assessments with the planning and conservation commissions, the Select Board, other relevant town committees, the town's people, and local power suppliers.

C. *Encouraging public education and participation*

Public participation in the planning process is crucial to the plan's successful creation, adoption, and implementation. The public must understand that the energy plan will benefit them and the community. The way to assure that is to maintain open communications with the public, to keep them well informed and educated, and to seek out, consider and respond thoughtfully to their input. The public should be encouraged to participate throughout the process, with particular emphasis while the plan's goals are being developed and when the final plan is being ratified.

There are many ways to encourage public participation in the energy planning process. Holding regularly scheduled, well publicized, energy committee meetings is a good place to start. A summary of meetings, including the date, time, location and agenda of the next meeting, can be posted on town bulletin boards, in the local newspaper, in newsletters of various organizations in town, or by direct mailing to the community. Educational articles, posters, and letters can also be distributed in these ways. The energy committee may also want to publish its own newsletter and distribute it throughout the town.

Another way to both gather and disseminate information is through the use of a town-wide energy issues survey. A survey can be used to inform town's people of the energy committee's plans and needs, along with providing a means of gathering public opinion about goals and future use of energy. A surveyor questionnaire can also be used to gather information on costs and current levels of town energy consumption, the amount of conservation and efficiency measures that are currently in use, and the potential for developing renewable energy resources (see Appendix IT).

Holding workshops or public forums featuring a guest speaker, a film, or some other form of presentation which would draw a large crowd may be useful in gathering or disseminating information on particular aspects of energy planning. With the use of public access TV, these meetings may then be able to be broadcast throughout the community. As the energy plan nears the stage of adoption, public hearings should be held to ensure public involvement and acceptance.

Finally, local schools should be a prime target for educational activities by the energy committee. The committee can provide teachers with materials, inform them of energy education curriculum (see Appendix V), and visit the schools to make presentations. Children are a great focus for education because they are eager recipients and sharers of knowledge (see "School & Church Energy Education Initiative," Appendix 1).

D. *Developing a planning budget*

In almost all towns, the development of a town energy plan will be accomplished by citizen volunteers and yet this will not cover all the costs. From the *Planning Manual for Vermont Municipalities:* (Sec. 4.2.6 *Planning the Budget,* pg. 31)

> itA planning budget. .. should include costs for mapping, hiring consultants, conducting special studies, surveying, holding workshops, and printing the plan itself. Funding sources could include general revenues, contributions, and assistance from regional planning commissions and nonprofit grant and loan organizations. Because of municipal budgeting cycles, most communities will have to anticipate their expenses in advance to use the general fund."

Although this refers to a town's master plan, its advice is relevant for completing an energy plan as well. For further information see Appendix IV.

IV. Collecting Background Information

Each Vermont town is uniquely defined by numerous factors, including the demographic and economic characteristics of its residents and its geographic, physical and historic features. Assessing the current energy situation in any given town involves measuring these and other key indicators, and provides a basis for setting goals and developing implementation strategies. An analysis of this information can help point out how, through energy planning, the town can save money and energy, create local jobs, and help the environment.

The following six parts of this section of the *Guide* describe what information needs to be collected and how to collect it. The energy committee should check with the Select Board or head of the town planning commission before beginning to see if any previous studies have been done in town (see Appendix II). The information collected will be used to determine:

- the town's current consumption of energy
- the cost to the town of this consumption
- how much of this expenditure of money recirculates in the community and how much leaves the community
- the town's current use of local renewable resources
- the potential for further development of local renewable resources
- a view of the town's current use of energy conservation and efficiency
- the potential for extended energy conservation and efficiency measures
- the town's potential energy and financial savings from incorporating *cost-effective* energy conservation and efficiency measures and from increasing development of the town's renewable energy resources

Note: The energy committee should coordinate the collection of all questions directed to anyone source, like the town clerk, so the source is not approached repeatedly from different people working on the plan, perhaps even for the same information.

A. The Town as an Energy Consumer

Looking at the town as an energy consumer is a good place to start because the facts and figures are often relatively easy to find. In addition, the information gained affects all of the town's people through taxes paid to cover the town's energy expenditures. Improvements in a town's energy use can directly affect the community's views on energy consumption. By using local renewable energy resources and improving conservation and efficiency standards, a municipality can reduce energy consumption, save money, create local jobs, keep more of the town's money circulating within the community, and set an example which the town's people will be eager to follow.

<u>What information to collect:</u>

The energy committee should collect information on the types, amount, and cost of energy being used by the municipality along with how efficiently that energy is being consumed. In general, (with the exception of transportation which is covered in the Transportation section), this energy consumption consists of:

- electricity used in town buildings
- space heating of all town buildings
- water heating for all town buildings
- electricity used for street lighting
- major town operations (chippers, shredders, loaders)
- recycling operations

Note: Unless otherwise specified, town buildings refers to all municipally owned and operated buildings, including but not limited to, town hall and office buildings, town garage, schools, library, sewage treatment plant, recycling and solid waste facilities.

<u>How to collect the information</u>

The energy committee should obtain figures for both the consumption (e.g. kilowatt-hours, gallons of Fuel Oil #2) and the cost of this energy for a one year period (see example for Norwich, Vermont, in "Current Energy Use" under Model Town Plan, page 44). Figures for the town buildings and street lighting can generally be obtained from the Town Treasurer. Figures for school buildings may usually be obtained from the superintendent's office. (Note: Information on transportation will also need to be collected from these people. It would save work if all this information were gathered at the same time. See subsection on Transportation.)

An energy audit of all municipal buildings should be conducted to determine how efficiently energy is being used. In most cases, energy audits are best done by a certified consultant. Yet recently, a group of ninth grade students at Fair Haven Union High School conducted an energy audit of the school building and compiled a final report in which they "identified ways of saving up to $1,800 in energy expenses per year." (Rutland Daily Herald, May 8, 1991, "School & Church Energy Education Initiative," Appendix I)

Conducting a preliminary background investigation

If the energy committee wants to conduct a quick investigation of the town's energy efficiency, whether it is in place of, or before, hiring an energy auditor, they may contact the town Select Board, public works director, or building inspector to look at such features as:

- the age and efficiency rating of all town boilers and furnaces
- the amount of insulation in town buildings
- use of energy-efficient lighting in town buildings
- use of energy-efficient windows in town buildings
- use of energy-efficient lighting in town street lighting

B. Residential and Commercial Use

While assessing the municipality's energy use is relatively easy, gathering information on the town's residential and commercial sectors is more difficult due to the multitude of information sources which need to be approached and convinced of the importance for collecting this information, the unwillingness of some to cooperate, and poor record keeping by others. However, these are major players in a town's energy use picture, and the energy committee must find ways around these barriers.

What information to collect:

Here the energy committee needs to collect two types of information: first, the types, amounts, costs, and efficiencies of energy consumed for electricity, water and space heating, appliances, and operations by the town's residential and commercial sectors (transportation will be covered in a subsequent section); and second, the public's interest in participating in energy conservation and efficiency programs available to them. This information may be best gained by educating citizens about the availability of these programs and then by surveying them to see if they are aware of, understand, and are interested in participating in these programs. Examples of such programs are:

- Demand Side Management programs currently available to businesses and individuals through the electric utility companies (see Appendix 1),
- energy audits, economic weatherization options, appropriate materials to use, and current installation techniques (information available through electric utility companies, gas and oil suppliers, the Vermont Department of Public Service, local builders, contractors and hardware stores),
- available funding and financing opportunities for energy conservation and efficiency (see Appendix IV).
- a coordinated bulk purchase of home insulation, solar hot water panels , or some other form of renewable or efficiency energy technologies (see "Bulk Purchase of Solar Hot Water Panels," Appendix 1).

How to collect the information

Collecting information on residential and commercial energy use may be difficult, time consuming and somewhat inaccurate due to the large number of users, providers and energy types. However, this information is necessary as these sectors make up a large proportion of the energy use picture. Energy consumption in residential and commercial buildings generally consists of electricity, heating oil, propane, natural gas, coal, and wood. The following sections describe methods of collecting information on consumption of these energy sources (with the exception of wood which will be discussed in a subsequent section on renewables).

Electricity Consumption in *kilowatt-hours* (kwh) and cost may usually be obtained by calling the local electric utilities serving the town. When calling, request:

- kilowatt-hours and dollar cost for the town, broken down into the residential, commercial and municipal sectors,
- the number of utility employees who reside in the town and the median salary range,
- taxes paid to the town for utility property, power lines, flowage rights, etc. (This information may sometimes be obtained more easily from the Town Clerk or Listers),
- an annual utility report which indicates the sources of the electricity provided, and
- the dollar amount of any contributions made by the utility company to the town.

Heating Oil (No.2 or Kerosene), Propane and Natural Gas Consumption figures may be obtained in three ways, listed below from the most to least accurate and preferred methods:

Method 1. Survey every household and business in the town, requesting the number of gallons of each fuel type consumed during a typical year, and the amount paid for the fuel. This is undoubtedly the most accurate method, but is time-consuming and requires a high degree of cooperation from residents and local business people. Many residents do not save their fuel bills over the period of a year.

Method 2. Call all of the local oil distributors, requesting the number of gallons of each fuel type delivered to the town over the course of a typical year, the average price of the fuel, and the current *margin* between wholesale and retail prices. This is the next best method. However, the distribution of oil is quite decentralized and usually highly competitive, therefore it may be difficult to obtain complete figures by calling local distributors. Patience and tact are called for here, because many distributors may find it difficult to retrieve data on their deliveries to a particular geographic area and be reluctant to reveal confidential information, such as the wholesale to retail mark-up. However, general statistics are available in a U.S. Department of Energy publication "Heating Oil Prices & Margins." A recent study by Rocky Mountain Institute- has shown that, on average, $.70 to $.80 of every $1 spent on fuel leaves the community.

Method 3. Estimate the town's consumption by using statewide consumption figures from the *Vermont Comprehensive Energy Plan.*[3] While this method is not particularly accurate for any given town's energy use, it is relatively easy and may be worth doing for several reasons. First, an energy committee short on resources may find it impossible to undertake either methods 1 or 2 above. And while town figures extrapolated from state averages may be somewhat inaccurate, at least they will be something to go on. Using state extrapolated figures also provides a check on figures obtained from other methods, making sure your figures are within reason and not off by a factor of 10 due to some mathematical error. For those able to perform methods 1 or 2, it allows a comparison between more accurate local figures and statewide averages. Finally, the *VeEP* provides projected costs for energy consumption and fuel costs through the year 2010, which would be very hard for a town to do on its own. (See Appendix III for step by step details to conducting this process.

Coal Coal represents a very small portion of energy use in Vermont. It is recommended not to bother collecting information on coal unless there is significant usage in the town. Such usage could be determined through an energy survey.

Wood Information on wood appears in the section on Local Renewables Recovery Resources.

C. Transportation

Unlike other sectors of the U.S. economy which rely on energy from a variety of fuels, transportation runs almost exclusively on oil. In fact, oil consumption by the transportation sector alone currently exceeds our domestic production by more than 60% (1990 figures: 12.2 million bbls/day used in transportation, 7.5 million bbls/day produced.)» Increases in transportation efficiencies, therefore have a direct and positive effect on national security and economic strength.

Nowhere is this more true than in Vermont; virtually 100% of the energy we use to power our current internal combustion engine-based transportation system must be purchased from outside the state with dollars that are lost to our local economies. Given the dispersed rural settlement

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2Rocky Mountain Institute, 1739 Snowmass Creek Road, Snowmass CO 81654-9199, FAX: (303) 927-4178, Phone: (303) 927-3851.

3*Vermont Comprehensive Energy Plan,* Department of Public Service, 120 State Street, Montpelier, VT 05620, (802) 828-2811.

4*Steering a New Course,* Deborah Gordon, Union of Concerned Scientists, 1991, pg. 27

patterns that characterize this state, as well as a landscape and climate that are not always benign, the automobile will undoubtedly remain the primary mode of transport for most Vermonters into the foreseeable future. We must learn to balance our demands for mobility against the availability of energy supplies and the financial, social, and environmental costs of maintaining and expanding a transportation infrastructure that is designed primarily to move cars, and only secondarily to move people.

Under a careful cost-benefit analysis that includes the long-range economics of energy, it is likely that the majority of perceived transportation needs will not be most effectively addressed by expanding road construction programs. Historically, increased road capacities have resulted in increased per capita energy consumption, deterioration of environmental quality, and a degradation of the visual quality of the landscape. Rather than simply accepting projected increases in transportation demand and attempting to satisfy them through expansion of the town's road network, town policy makers can apply a range of alternative transportation strategies aimed at modifying existing demand. A comprehensive town energy plan should, therefore, include policies designed both to increase the efficiency of automobile usage and to promote viable transportation alternatives.

What information to collect:

The energy committee will need to collect information or estimate the amount of energy currently being used by residential, commercial, and municipal vehicles, and the cost of this energy to the town. These numbers will provide a basis from which estimates can be made of the cost savings that could be realized as a result of the adoption of any particular policy intended to decrease the amount of energy used in the town for transportation. The information that will be needed is:

- the cost and amount of fuel consumed (gasoline and diesel), and the total mileage traveled, by all municipal and school vehicles,
- the fuel efficiency in miles per gallon of all municipal and school vehicles and efficiency ratings of available alternatives (vehicles made by other manufacturers),
- an understanding of the scheduling policies for, and routes traveled by, town and school vehicles,
- estimates of the total miles traveled, as well as the cost and amount of fuel consumed, for all private vehicles, both residential and commercial, that are registered in the town,
- the driving patterns of the town's population, including commuter demographics,
- an inventory of the resources available in town which promote and facilitate alternatives to the single-occupant automobile,
- a survey of the public information and educational resources through which town residents learn about transportation issues, and
- a familiarity with existing zoning regulations, town plan, and development strategies.

How to collect the information

Figures for the quantities and costs of transportation fuels which the town purchases directly are usually readily available from the Town Clerk, Road Commissioner, or school officials. A bit of digging may be necessary to quantify that (usually small) portion of the town's transportation bill which is paid out as a mileage reimbursement for the use of private vehicles, rather than as a direct fuel purchase.

> Note: Information on the energy use in municipal and school buildings will also need to be collected from these people. It would save work if all this information was gathered at the same time. (See "Town as an Energy Consumer," page 9)

The total number of miles traveled annually for each town vehicle is sometimes hard to get, although the place to start looking is with the same folks who provided the figures for fuel consumption. Make estimates based on the age and total mileage of the vehicle, and encourage town employees to start keeping mileage logs. If controlling fuel consumption is to be a part of a town's energy strategy, it is important to .establish a policy of quantifying the fuel efficiency of the municipal vehicle fleet.

To obtain information on fuel efficiencies of available alternative vehicles, contact the head of the town department that uses any particular vehicle to find other makes, models, manufacturers, and distributors. Distributors of these vehicles should be able to provide the information needed.

Information on the schedules and routing of school buses is readily available, and these often turn out to be well-planned in terms of cost-effectiveness and fuel efficiency. The energy committee should review this information and consider it as a major component in an overall town transportation strategy. The use of town vehicles other than school buses is often much less structured and well-documented, but talking with town officials and employees about vehicle usage may indicate patterns suggesting that certain policies should be changed or implemented. Do vehicles idle at job sites? Do town employees make unnecessary trips?

The vast majority of energy consumed for transportation is burned by the private sector, so any successful energy-saving policies must be effective in lowering the demand here. Hard data about the amount and patterns of driving done by the average citizen are not regularly available for most towns, and may vary significantly among towns according to geographic and economic factors. Specific data on total intensity of vehicle use, including the private sector, is readily available on a statewide basis, but is often hard to acquire for an individual town. The most accurate way to collect this information, as well as information on driving patterns, is to survey town residents directly.

A town-wide survey, such as is presented in the appendices to this *Guide*, is the most accurate means of gathering the kind of town-specific, baseline information needed for effective policy formulation. It is desirable to ascertain the location of major employers, commuting habits, and the frequency and destination of any vehicle trips that are ongoing and repeated. Patterns of travel to shopping and recreational activities should not be overlooked. Comprehensive town transportation planning can address situations such as serious congestion and parking inadequacies if they are identified. An inventory of existing resources should include specific facilities such as public transit services, sidewalks, bus shelters, trails, bicycle paths and commuter parking lots. Try as well to evaluate subjective resources such as the physical suitability of various town roads and byways for bicycle and other non-motorized use, and the prevailing attitudes and policies about such usage.

It is useful to examine whether the information that a town is presenting to its residents concerning transportation issues is reasonable and adequate to educate them about the town's energy goals. Find out whether the school curriculum, perhaps in environmental education, addresses issues of energy consumption or land use; whether driver's education classes include energy-efficient driving techniques; whether the students are presented with any role models who use alternative transportation. Is information about public transit readily available? Are public services that facilitate alternative transportation, such as Vermont Rideshare, adequately promoted?

Some data on commuting habits can be gleaned from Reports of the Ll.S. Census Bureau. The Bureau publishes a *Subject Report: Place of Work*, which includes statistics, for each town, on average commuting time, mode of transportation, and average commuting vehicle occupancy. A major disadvantage of these data is that the information may be out of date. These reports are not published until 5 or 6 years after the census, so the figures are 5-16 years out of date.

State by state data on gasoline usage, vehicle miles traveled, vehicle occupancy rates, vehicle fuel efficiencies, etc., are published regularly by the Ll.S. Department of Transportation. Figures on statewide vehicle fuel consumption, broken down by residential, commercial, and industrial sectors, as well as projections in the growth of demand for transportation fuels, is also well documented in the *Vermont Comprehensive Energy Plan*. The number of motor vehicle registrations in any town can be obtained from the Agency of Transportation.

In the absence of a town survey, an estimate of private-sector vehicle fuel consumption can be extrapolated by getting information on the following from the sources above:

- statewide vehicle fuel consumption information,
- number of vehicles registered in the town,
- number of vehicles registered in the state.

The Energy Committee should be fully familiar with the Town Plan and zoning ordinances, if these exist. Zoning has significant impacts on energy consumption, as we have found out by observing how traditional zoning over the past quarter century has forced new development into a pattern of suburban sprawl that has resulted in a reliance on the automobile. It is therefore important that zoning and land planning be consistent with the goals of the Town Energy Plan. Under Vermont's planning statutes, state agencies have an obligation to work, wherever possible, within the context of existing town plans; a town plan which stresses alternative transportation will have a direct effect on how future state transportation dollars are spent in the town.

Regional Planning Commissions are an excellent source of information on zoning ordinances that stress land preservation and transportation efficiency (see Regional Planning Commissions in Appendix V for a list of all state RPCs).

D. Land Use and Town Policies

A town's land use policies directly affect energy use within the town. The energy committee should become familiar with these policies to see if they currently allow, prohibit, encourage, or discourage the following:

- development of planned *growth centers* with *cluster housing* and neighborhood commercial services along already established transportation routes. Planned growth centers and cluster housing can save energy by sharing resources and facilities. Allowing controlled development of neighborhood commercial services near residential areas can reduce transportation needs.
- south facing building orientation for maximum solar gain (see Solar section, p. 21)
- protection of solar gain from shadows cast by new construction (see Solar section, P: 21)
- development of renewable energy resources (wind, hydro, solar, and wood). The community may decide that the town's renewable resources are valuable enough that they should be protected for future use.
- upgrading of old town roads. The energy committee may want to review current and historic transportation routes to determine alternative routes which might be created or reopened to provide more fuel efficient travel. Some old roads may have been closed or reduced to unmaintained Class 4 roads. Recent development may make it cost-effective to reopen or upgrade these roads. An assessment of the number of miles which would be saved by opening new routes would have to be weighed against increased energy required for road improvements and maintenance and possible increased development along new routes.

- development of pedestrian and bike paths-and-park and ride areas throughout the town. Zoning ordinances should allow for these; decreased land assessments may be used to encourage them.
- site design which utilizes landscaping techniques and physical features of the land to decrease energy requirements for heating and cooling buildings.
- planting of trees in urban areas and parking lots to provide shade for summer cooling.

E. Renewable Resources

Local renewable energy sources such as wood, solar, hydroelectric, and wind have enormous potential value for Vermont's towns. The U.S. Department of Energy estimates that the renewable resources available each year in the U.S., with today's technology, is more than 200 times annual U.S. energy consumption. Renewable resources can produce energy with little or no net C02 release.

Several renewable technologies are already cost-effective when compared to conventional fossil and nuclear fuels; others are projected to be cost-effective in the near future. They are becoming economically competitive, as dwindling fossil fuel resources become less accessible and thus more expensive to extract, and as least-cost planning begins to incorporate the hidden costs of environmental damage from fossil fuel use into the real price of using these fuels. And a large percentage of money spent on local renewables stays within the community, whereas most of the money spent on fossil fuels leaves the community. It is therefore prudent for towns to become aware of their renewable resources and to have some idea of the potential energy and economic viability of these resources.

Furthermore, these renewables enhance local and regional independence and stability. Hydro-power, for example, by its capital intensive nature and site specific development, cannot pick up and relocate. If managed in a sustainable manner, the region's vast wood resources should remain an inexhaustible source of energy for the future. Therefore, once developed, these local renewable resources will continue to provide power, employment and real estate taxes to the town, with little or no drain on town services. And any Vermonter can directly use solar energy and wood which provide a broad base of energy security. The more broad based and diverse our supplies of energy, the more secure Vermont town's will be from a sudden loss of power or jump in price by any single energy source.

<u>1. Wood</u>

Wood is Vermont's most abundant renewable resource. Approximately 1.15 million cords equivalent of wood is harvested annually in the form of pulp, logs, chips and chunk wood for home heating." Of this, an estimated 293,000 cords are burned to heat homes in the state each year.v This compares with 2.68 million cords of annual wood crop that grows repeatedly without depleting the land's potential for growing more wood.

Vermont's forests produce enough fuel wood each year to provide for all of the state's heating needs on a sustainable basis, if the woodlands were properly managed and if all available energy conservation and efficiency measures were utilized. Such management would improve the quality and vitality of state woodlands through increased harvesting of more poorly formed and lower valued trees, a practice which concentrates growth on more highly valued trees. In addition, sustainable forest management should provide for all forest uses, including wildlife habitat and recreation.

Trees use solar energy to convert water and carbon dioxide into hydrocarbons that make up wood, releasing oxygen in the process. Complete combustion of wood uses oxygen, breaks the chemical bonds, and releases the water and carbon dioxide back to the atmosphere. Decomposition of trees that die in the forest basically completes the same cycle over a longer time period. This cycle of growth and decay, whether through burning or rotting in the for.est, is a zero balance process in terms of oxygen, water and carbon dioxide, as equal amounts are used and produced throughout the cycle. This is important, because carbon dioxide is a leading contributor to the greenhouse effect. Burning fossil fuels, on the other hand, releases carbon removed from the cycle thousands or millions of years ago and increases ambient levels of CO_2.

Modern, EPA-approved catalytic and smokeless or high-tech stoves are now available which, when properly operated, burn at temperatures hot enough to burn wood completely, assuring that toxic, partially combusted hydrocarbons are not released into the air. For larger installations, *wood chip gasifiers* do the same thing. Not only do these stoves operate more cleanly than older stoves, but they are much more efficient, burning less wood to produce the same amount of heat.

Because wood is grown and harvested locally, 88% of the money generated stays in the local economy (Richard Greenfield, Brighton Energy Study. Northeast Kingdom Community Action, Brighton, Vermont, 1981.) Chunk fuel wood typically travels less than 20 miles from the stump, and although chips may be trucked more than 100 miles, they are typically used less than 75 miles from where they were grown. Residential fuel wood has the additional benefit of being abundant

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SVermont Department of Forests, Parks, and Recreation and University of Vermont publication, *Planning for the Future Forests,* 1991, p. 10.

6Vermont Department of Forests, Parks, and Recreation and Vermont Department of Public Service, Planning Division Technical Report #22, *Vermont Residential Fuelwood Assessment, 1989-1990,* March 1991, p. 6.

locally and therefore it is inexpensive and available to almost anyone who can .put the labor into cutting and splitting it.

Owners of forest land should be encouraged to contact their county forester regarding various woodland management programs. A successful example is Vermont's Use Value Appraisal Program. To be eligible, land owners must have over 25 acres of forested land, must develop and abide by a forest management plan which has been approved by the county forester, and must agree not to develop the land. The land under this program is then assessed for taxes on its capacity to produce forest products, a value much lower than most of the state's land is assessed.

Finally, liquid ethanol can currently be produced from wood and the remaining fibrous sludge can be burned. Local ethanol production and use looks promising in the not too distant future, as advancing technology should make this process economically viable.

Collecting Background Information

Wood Supplies

Municipalities should look to their own lands to supply the wood they need. Many towns have municipal forests that are managed by private and state foresters for the benefit of the community. Woodlots differ in too many respects for one to evaluate the quantity and quality of a towns wood resources using statewide averages. Soils, slope, topography and the various ages, species, density and size of trees are all factors that determine not only the volume of wood available in standing trees, but also the amount of additional wood grown and added to the inventory each year.

Foresters are able to help estimate these supplies. The process typically uses sample plots distributed throughout similar stands. To estimate standing volumes, the trees in a plot are measured, the volumes calculated from volume tables, and the data are then expanded to represent the entire stand. To estimate increment, foresters either sample trees to calculate growth rate or use soil productivity estimates available from the Soil Conservation Service. The Department of Forests, Parks and Recreation monitors Vermont's wood supplies and harvests, and the county forester is a good first contact for estimating supplies. Information should also be gathered on the town's current and future management plans from the town planning or conservation commission.

A survey may be employed to determine the amount of privately owned woodlands in the town, how many acres are managed, how many are unmanaged, and how many are under the state's Use Value Appraisal Program.

Wood Use

The attributes that make wood attractive as a home fuel also make precise estimates of use difficult. Because wood is widely available to anyone with a saw and truck, gathering reliable use estimates from suppliers is more difficult than estimating other fuels. The units of measure are also far from exact, making any user survey inexact. A survey of residents and commercial users to determine the number of homes and businesses that currently heat with wood is one way to estimate current town use (see Appendix II). Alternatively, estimates can be made by using statewide or regional figures adjusted for population. The Department of Public Service and Department of Forests, Parks and Recreation periodically estimate and report residential wood use.

A survey of businesses can determine any large users that have an impact on town energy demands. For commercial users of wood fuel using thousands of cords annually, a more thorough analysis is necessary. Planning groups should contact the Vermont Department of Forests, Parks and Recreation for assistance. In some cases, a study may already have been completed.

Environmental considerations

• Incomplete combustion of wood, which occurs in open fires, fireplaces, and old stoves which have not been EPA-approved, is very inefficient and results in emissions of dangerous compounds, particulates. and carcinogens. Improper burning of modern, efficient stoves can have the same results. Such burning could be discouraged through town ordinances prohibiting the use of inefficient stoves and education on proper burning techniques.

• Poor forest management has the potential to destroy forest habitat, reduce future forest growth, and cause erosion. Be sure to use qualified foresters and loggers with good reputations.

2. Solar

Despite the fact that Vermont is one of the cloudiest states in the U.S., direct use of solar energy can playa significant role in meeting Vermont's energy needs. Each square foot of land area in Vermont receives 109 kilowatt-hours of energy from the sun each year. Well-proven technologies exist that enable us to harness this energy to provide space heating, water heating, lighting, and electricity.

People have been using the sun for space heating for thousands of years. By simply orienting buildings toward the south, using appropriate levels of glazing (windows) on the south wall, installing "thermal mass" (such as concrete, brick, quarry tile, or water) to store the sun's energy, and employing high levels of insulation, one can cost-effectively acquire as much as 60% of one's space heat from the sun.

Solar water heating is another well-established solar technology that works well in Vermont. A typical solar water heating system consists of solar collectors to capture the sun's energy, a pump that circulates a non-toxic antifreeze solution through the collectors to extract the heat energy, an electronic controller to regulate the operation of the system, and a well-insulated storage tank to hold the solar heated water for use as needed. An appropriately sized solar water heating system can provide 2/3 of a household's annual hot water needs-typically almost 100% in the summer and as low as 30% in the worst month of the winter. A solar system can usually easily be integrated with an existing hot water system so that the existing system can provide backup heating when there is not enough solar energy. (When a solar system is coupled with a wood-fired water heating system, it is possible to get almost 100% of one's hot water from renewable energy sources.)

Solar energy can also be used to provide natural daylighting in well designed buildings. Appropriate placement of windows and use of clerestory building designs can greatly reduce the energy required for lighting.

Finally, solar electricity (or photovoltaics, or PV's) is cost-effective today in applications further than one-quarter mile off the utility power grid and may be cost-effective in locations connected to utility lines in as little as 10 years, as advancements in photovoltaics technology continue, lowering the price for solar electricity. Twenty years ago, PV generated electricity cost $30 per kilowatt hour (kwh); today it costs about 30¢ per kwh; and the U.S. Department of Energy expects the cost to be 4¢ to 7¢/kwh by 2010. A Japanese company is already incorporating PV's into roofing tiles, and it is only a matter of time before most south facing roofs are covered with electricity-producing shingles.

A typical solar electric system consists of PV modules that convert the energy in sunlight directly to electricity, batteries that store the electricity, and an inverter that converts the "D.C." electricity stored in the batteries to the "A.C." electricity used by conventional electric appliances.

The low pollution levels and operating costs of these solar technologies are compelling arguments for increased use of solar energy. The largest obstacle to widespread use of solar energy is that solar systems often have high initial investment costs that may deter homeowners and businesses. However, the savings that accrue over the lifetimes of the systems typically repay these initial investments several times over. (See Appendix IV and "Bulk Purchase of Solar Hot Water Panels" in Appendix I for ideas on circumventing this problem.)

Beyond economic concerns, clear access to the sun for PV panels is required, which might entail some clearing of trees or moving the placement of the PV panels. Zoning ordinances to prohibit shadows from newly constructed buildings from falling on existing buildings are recommended. With the help of a solar consultant, a town or energy committee can look at what types of current solar technologies are appropriate and cost-effective for each application. A life-cycle cost analysis should be performed to determine which technology offers the lowest total cost for installation and operation over the life of the project (see "Financial Analysis of the Town's Energy Use" in Analysis and Presentation of the Plan, page 34, for information on life-cycle cost analysis).

Collecting Background information:

- Compile an inventory of existing solar applications (solar space heated buildings, water heating, and electric systems) in the town. Gather such information as type of system, manufacturer, age, annual operation costs, customer satisfaction, etc. This information will be useful in convincing other townspeople of the viability of solar systems and may identify problematic systems or designs that should be avoided. This type of information could best be obtained through the energy issues survey.

- Compile a list of potential applications of solar technology in existing buildings determined through and energy survey. An example is to identify all buildings in town with south-facing roofs and electric hot water heaters. These would be prime candidates for solar hot water heating. The energy committee could then organize a bulk purchase of solar hot water heaters for those who wish to participate in the program. The bulk purchase would make this program even more cost-effective (see "Bulk Purchase of Energy-efficient Conservation Products" in Appendix I).

- Identify prime sites for future development of solar buildings. Begin by using aerial photographs and/or USGS topographical maps to find areas of land with good southern exposure. Next, identify all of these areas which overlap areas zoned for future development. Follow that up with a site visit to further evaluate local shading or other problems. Enter the prime solar sites as a town resource onto the official town map.

- Determine possible sources of funding and financing for both municipal and residential solar investments. Vermont's Department of Public Service, local banks, and the Vermont Energy Investment Corporation, are good places to start (see Appendix IV).

- Work with local solar contractors to determine the potential uses for solar technology in all town buildings. Compare the life cycle costs of the solar technology to that of the conventional technology.

- Develop a library of resource materials to assist townspeople in identifying available solar options.

Environmental Considerations

As with all semiconductor products there is a certain level of environmental pollution caused by the manufacture of photo voltaic cells.

In some cases, solar projects may adversely affect the scenic resources of a town. A town's historic center may be one such case.

3. Hydroelectric:

Hydro power was one of the earliest utilized renewable energy resources, with extensive systems of dams and mills operational in the middle ages and earlier. Today almost all hydro power is used to produce electricity, with most systems tied into the electric utility grid. Stand alone systems are most efficient when used for a residence or small business in combination with batteries and other generation systems.

A well built hydro project will operate for upwards of 50 years with only routine maintenance. During this period it will consistently and reliably produce electricity, one of the highest and most refined forms of energy, without producing any global warming, acid rain or other pollution, with a minimal risk of damage due to dam failure, and will utilize a minimal amount of nonrenewable resources, chiefly lubricating fluids.

Hydro systems run in three possible modes: peak power, run-of-river, and pumped storage. Peak power plants store water by restricting the total discharge until demand reaches a high point. Water is then released allowing the most efficient use of the stored energy at the time when demand is also the highest. Unfortunately, this also causes fluctuating water levels above the dam and very erratic flow levels below the dam, which can result in adverse environmental effects on water life and bank erosion. Production can be scheduled to meet peak time of day and seasonal demands. Almost all large utility projects operate with some peak power capacity.

Run-of-river projects maintain a stable water level behind the dam and either pass water over the dam or through turbines on a continuous basis. This results in minimal environmental damage above and below the project, and inefficient use of turbines which are generally too large when the amount of available water is low.

Pumped storage systems are almost all utility projects that utilize excess power production from other generators to store power. Excess electricity is used to pump water uphill to large storage pools during periods of low demand and then electricity is generated by this stored water during periods of high demand. Overall efficiencies may be only 75%, but this is virtually the only way to store large amounts of power produced by generators such as nuclear and run-of-river plants that must run 24 hours a day.

Most of the available sites in northern New England are run-of-river sites except for those that sit at the foot of a large lake. The lake can be used as the storage area for peak power projects with the limitation being a requirement to maintain a minimum flow in the river at all times.

There are two phases in the identification of potential sites:

1) Identifying sites with some potential energy and,
2) Evaluating sites as to their economic feasibility.

The ownership and current use of a site, whether for commercial or residential development, recreation, or abandoned, may well determine its compatibility with expanded uses. Identification of all sites is helpful, because sometimes sites can be combined to efficiently utilize two sites that may be uneconomical individually.

Sites with a total fall of under ten feet are rarely cost-effective for energy production unless on a large river. Potential sites can be located by:

- referencing topographic maps,
- walking or boating a river,
- talking with people familiar with the area,
- noting the locations of previous developments, and
- scanning for town and village names containing "Falls" or "Mills," most probably indicating previous hydro sites.

These last two methods are particularly efficient in terms of locating old sites that may be obscured by modern development, and may, with the advent of cheap oil in the twentieth century, have been considered too small to operate profitably.

The US Army Corps of Engineers commissioned a study (out-of-print) of all sites in New England in 1980, surveying almost all known and potential falls, cascades, gorges, and former mill sites. The Vermont Agency of Environmental Conservation maintains a file of permits and applications for dam projects. The Vermont State Archeologist and local historical society has records of early developments. Almost all of the early mills and many of the town centers were located on or over significant drops in river elevations. Sites identified by historic values are also likely to be subject to strict regulation regarding the disturbance of ruins and remains of historic development. The Public Service Department, Public Service Board, and the local utility companies should be able to identify sites currently operating or licensed for operation.

Sites can be developed for individual use on a seasonal basis when sufficient head can be obtained. Of course the consistency and availability of power decreases greatly as available water decreases, which increases the need for alternative sources of power or the ability to go for long periods without power. Many of the early sawmills ran only in the spring or after heavy rain.

Collecting Background Information

The following is a list of hydro-related information which the energy committee should compile for the inventory.

- Find and list currently operating hydro facilities in town including owner, location, and amount of power produced annually.
- Compile an inventory of previously operating hydroelectric sites within the town, listing owner, location, current use, when they operated, and electrical output or mechanical use when operational.
- Compile a list of potential undeveloped sites, listing owner, location, current use of site, and, if possible, potential energy from site.
- Compile information on micro-hydroelectric systems (small scale hydro facilities), including potential sites and the types of systems currently available.

If a town has a possible site, an estimate of the water's potential energy should be made. This can be done by an energy committee if they have some members or willing contacts with a few technical skills. If the site has enough energy available to warrant further study the town may want to hire a consulting firm to conduct a feasibility study.

Estimating the economic feasibility of a project is difficult. Costs in the 1980's ran approximately $2,000 per kilowatt of installed capacity. A feasibility study includes an estimate of available power and energy, the potential uses and value of the energy, environmental impacts, and hurdles necessary to achieve a license and power sales contract.

Licensed projects go through a three phase review process with numerous federal and state agencies to ensure compliance with laws regarding development, fisheries, water quality, historic preservation, parks, etc. The Federal Energy Regulatory Commission (FERC) licensing process includes exempt projects, minor power licenses, and major power licenses. Exempt projects are generally small projects where the developer owns all of the necessary land and water rights, and would rather be directly subject to Vermont regulation. For a project that is not controversial and has been granted all other permits, this process can be much faster than licensing. FERC considers licensed projects to be the utilization of natural resources for the national good, and a developer can take land needed for a project through private eminent domain (the landowner <u>must</u> sell their land to the developer) with a FERC license.

The end use of the power and its value may well determine the fate of a project. The current price structure and regulatory barriers make development of small, independent hydropower operations difficult. A developer should investigate the price and terms of power sales early in the process to determine the project's potential economic viability. Virtually all of the developers of projects in the 1980's signed long-term power sales contracts with Vermont Power Exchange or their local utility.

Environmental Considerations

There are numerous potential environmental impacts of hydro development which must be mitigated in order for a project to be built. Some of these concerns include:

- historic preservation
- Fish Habitat
- *dissolved oxygen*
- *pond stratification*
- temperature increase due to standing water and a large area to absorb sun
- erosion due to ponding, generating cycles, and high water velocity
- flooding
- aesthetics
- opposition from landowners, abutters and local interest groups

4. Wind

Wind energy can be used in two basic forms: mechanical and electrical. Mechanical wind water pumpers have been used for thousands of years. They are capable of pumping substantial amounts of water at low wind speeds to fill a storage reservoir for livestock use or other purposes. They are still used today where pumping is needed at a site that is not convenient to the utility grid or used by groups such as the Amish, who prefer not to use electricity for religious reasons.

A rough rule of thumb is that a mechanical pumper may be worth looking into if the site where the water is needed is more than one-half mile from utility lines where overhead lines are permitted, or more than one-quarter mile if underground lines must be installed.

Since most wind applications in the Northeast are primarily electric generation facilities, the remainder of this section will focus on that application of wind energy.

Most wind electric systems look much like an airplane propeller and engine mounted on a tower. They can be conveniently divided into

- mini turbines, for very low use situations in remote locations,
- small turbines, suitable for use to supply power to a single home, and
- windfarm-scale turbines, which supply enough power for 20-50 homes and are normally installed in groups at a single site to generate power for the utility grid.

There are significant economies of scale in the manufacture of wind machines:

Size	Use	Installed Cost	Installed *Cost/kW*
1-kW	Battery-charging, remote power	$5,000	$5,000
10-kW	Residential electricity	$25,000	$2,500
100-kW	Windfarm	$120,000	$1,200

For this reason, wind energy is likely to be more economical in installations of several or more large machines. Grouping large machines at a single location also helps to keep the costs of zoning permits and maintenance low.

Wind generators are a proven technology which produce electricity at a cost of about 8¢/kwh, a cost that is expected to decrease to about 5¢/kwh by the end of the 1990's as further advances are made. A 1990 study by Battelle Labs for the U.S. D.O.E. indicated that Vermont could potentially generate an average of 540 megawatts of electricity year-round without affecting environmentally sensitive and urban areas."

Residential wind machines generally interface with the electric utility grid, feeding in electricity when the machine's supply exceeds demand, and drawing from the grid when the demand is larger. The current price structure for excess power sell backs to the utility companies does not encourage installation in most residential settings.

In the Northeast, wind resources tend to be best at mountain or ridge line sites that are exposed to the prevailing northwesterly winds. Where winds are excellent for electric power production, the trees and other vegetation may be deformed away from the prevailing wind. This is a dear indication of high average winds. However, even if a ridge line site appears exposed, a study of the wind speeds over 1-2 years period will be needed to find out whether there is enough wind for electric generation. The terrain of the Northeast is highly "complex," and a mountain can alter wind speeds downwind for several miles.

The optimal wind speed for most residential machines is in the range of 12 to 14 miles per hour, with large scale machines favoring 16 to 20 miles per hour. Minimum average wind speeds of 12 to 13 miles per·hour must be maintained for either category to be economically viable. While the smaller, remote battery charging machines prefer speeds in the 6 to 8 mph range, they may be

7/fAn Assessment of the Available Windy Land Area and Wind Energy Potentialin the Contiguous United States," by D.L. Elliot, L.L. Wendell, and C.L.Cower. August, 1991, Pacifice Nortwest Laboratory. Publication # PNL-7749.

cost-effective in locations with as little as 1 to 2 mph, because the cost of bringing the grid to such distant locations is very high.

The need for measurement of wind resources has been one of the major obstacles slowing wind development. Typically, wind speeds are measured regularly only at local airports, and airports are generally located in sites believed to be not windy. However, in a study released in 1990, the Pacific Northwest Laboratory found that the winds available in Vermont are enough to generate nearly allof the state's electric power requirements by using only 1.6% of its land area.s The figures for Vermont and other New England states:

State	Potential as % of Current Demand	% of Land Area
Connecticut	18	4
Maine	486	7
Massachusetts	56	12
New Hampshire	48	1.6
Rhode Island	15	4
Vermont	99	1.6

The amount of wind energy available to a town, depending on its location and terrain, could be substantial. Since the power available from the wind is a function of the CUBE of the wind speed, small annual variations from site to site canmean large differences in power. A wind turbine installed at a 14-mph site, because of the "cube factor," will deliver 60% more power, all other things being equal, than one installed at a 12-mph site.

That being the case, careful measurement of the winds is required. If a town has a site where wind energy might be developed, it may be advisable to hire a consulting firm to assess the wind speeds. There are several companies in the Northeast with expertise in this area. The American Wind Energy Association (AWEA-see Appendix V) has their addresses and phone numbers. AWEA can also provide suggestions on how a contract with such a firm should be structured to make sure that your town gets valid data for its money.

Collecting Background Information

- Compile an inventory of existing wind powered electric generators within the town. Operators of these systems may have valuable data on local wind conditions obtained from

8"An Assessment of the Available Windy Land Area and Wind Energy Potential in the Contiguous United States," by D.L. Elliot, L.L. Wendell, and G.L. Gower. August, 1991, Pacifice Nortwest Laboratory. Publication # PNL-7749.

measurements made over past years. Furthermore, their experience and acquired knowledge may prove to be useful in looking for other potential wind powered generating sites. Word of mouth is probably the best way to locate current operators. Information obtained through the energy issue survey would be another way.

- Identify potential wind powered electric generator sites and be prepared to indicate them as a town resource on the official town map. Begin monitoring wind speed at feasible town owned sites.

- Identify areas of the town where mechanical wind power may be economically viable, particularly in farm communities. Enter these areas on an official map.

Environmental considerations

One problem which has occurred is that of birds being killed by flying into the turning blades at certain wind generator locations. The problem seems to be site specific, with the positioning of turbines in migration paths a factor. While there have been no conclusive studies to date, this is an issue which should be considered when siting wind power stations.

Since optimal siting of wind machines is often on or near the tops of mountains and ridges, interference with scenic views may be a problem. However, those who value wind machines and their ability to cleanly convert the wind's natural forces into the electricity may find a ridge-lined wind farm thing of beauty.

F. Resource Recovery, Conservation and End Use Technologies

Innovative technologies are advancing at a tremendous rate which result in the more efficient use of energy and in the capture for reuse of energy which previously went unused. Several of these technologies, such as cogeneration, demand side management programs, mining of landfill gasses, infrared and microwave drying techniques, and 'geothermal heat pumps, are currently or will soon be available for use throughout Vermont. The energy committee should become aware of these and other *emerging technologies* so that it can inform and advise the community as to their existence and applications.

1. Cogeneration

Conventional electrical generating facilities convert one third of the heating value from burned fuels to electrical energy, while venting roughly two thirds off as waste heat. Cogeneration facilities capture and use this waste thermal energy for space heating and / or industrial processes, thereby using up to twice the potential energy in the fuel as conventional generating facilities.

Typically, a cogeneration facility is sized either to match the electrical demand and use the heat as needed or to match the thermal energy required and the electricity is used as needed or fed back into the grid. Cogeneration works best in situations where large thermal and electrical needs are located near one another. Since thermal transfer losses are greater than electrical transfer losses, siting considerations favor locating cogeneration facilities close to the thermal demand.

Approximately ninety percent of the cogeneration industry are large energy users. The use of an on site generator, whether for *peak shaving*, cogeneration, or a total energy system, should be investigated for any facility with electric bills exceeding $50,000 per year. Use $30,000 as a threshold for facilities that have an existing generator, or have a large quantity of combustible waste. Businesses with large thermal loads should also investigate the feasibility of cogeneration. Neighboring facilities should consider the possibility of a joint cogeneration facility to match the thermal load of one facility with the electrical demands of another.

The installation of cogeneration facilities makes the most economic sense at either the time of new construction or when replacing heating or generating facilities. A town energy plan could encourage the development of cogeneration by requiring businesses which are either building new or replacing facilities and which meet the criteria listed above to investigate the feasibility of cogeneration as an option.

Cogeneration would become an economically viable alternative.in more and smaller operations if the financial and regulatory barriers of interfacing with the grid to feed extra power back to the utilities were less cumbersome and expensive. Currently, it may not be economically worth interfacing with the grid for systems that produce less than 100 kilowatts. However, many factors affect the economic viability of a cogeneration facility - cost of fuel, available funding and financing, interest rates, cost of electricity, electric and thermal demand, and equipment costs. Small operations may want to conduct a feasibility study to determine if cogeneration is appropriate for them on a self-contained basis.

Collecting Background Information

- Identify large users of electricity with electric bills exceeding $50,000 per year.
- Identify businesses which use $30,000 of electricity per year and have an existing generator, or have a large quantity of combustible waste.
- Identify businesses with large thermal loads.
- Determine which municipal buildings, residences and businesses require heating and cooling technologies that may be appropriate for cogeneration.

Environmental Considerations

Cogeneration facilities using renewable fuel sources have limited applications due to the high cost of infrastructure - boiler, turbine and generator - needed to convert renewables in their raw form to electricity. The majority of small cogeneration facilities burn fossil fuels, often diesel fuel, in internal combustion engines. Wood cogeneration operations do make sense for many businesses in the lumber industry which have a readily available, low cost fuel source. Moreover, advancing technology in liquid renewable fuel development - ethanol and methanol - show promise for more widespread use of renewables in cogeneration. Anyone investing in new cogeneration facilities should investigate the feasibility of purchasing equipment which is easily convertible to liquid renewable fuels as they be come readily available in the near future.

2. Demand Side Management Programs

The primary responsibility of electric power companies is to provide an adequate, uninterrupted supply of electricity to the public. Traditionally, utilities have looked to expand their supply side (i.e, build a new power plant or purchase more power from another power generator) in response to increased demand from the public. However, Vermont utilities have recently begun working with environmental groups and the Vermont Public Service Board to develop programs which promote conservation, efficiency, and fuel switching among electric users to satisfy the demand for power. Because these programs focus on reducing demand rather than on increasing supply, they are called demand side management (DSM) programs. Electric utilities offer these comprehensive energy efficiency programs to their residential, farm, commercial, and industrial customers to encourage them to make cost-effective investments in energy efficiency.

Collecting Background Information

The energy committee should call the utility company serving their town and request full information on all of their demand side management programs for all sectors of the community. Make sure to get the implementation date for each program, as well as the program coordinator's name and phone number. Check back with them occasionally to learn about new programs coming on line. Notify town residents and businesses about the availability of the programs, and encourage them to take full advantage of them.

3. Methane Gas Collection

Systems are currently developed to capture methane gas which is produced in landfills from the anaerobic breakdown of organic materials. The methane is then either used on site or trucked as a liquid fuel for use elsewhere. Towns with operating or capped landfills larger than .75 million cubic yards, should investigate the feasibility of installing a landfill gas collection system. Other potential sources of methane are municipal sewage systems and dairy farms (see Appendix V for methane gas collection company).

IV. Analysis and Presentation of the Plan,

At this point the energy committee will need to organize all of the background information in a way which can be clearly presented to the town's people, boards, and commissions. A preliminary list of goals and objectives should be developed, taking into account the input the energy committee has already received from the community and what they have learned about the town's energy use. The information presented should show the energy committee's reasoning for the suggested goals and objectives.

Public comment is critical at this point; any plan guiding a town must reflect the wishes of the town. Public education early in the process and a clear, well-reasoned presentation now are crucial to developing this support. The energy committee should present areas in which the town and its residents are already using energy in an efficient manner, as well as suggestions for improvements in efficiency and how local renewables could be increasingly utilized the future. This may include items such as:

- a map of potential renewable resource sites within the town along with the potential energy which could be achieved by each.

- a list of town's people and businesses which are currently using local renewable resources.

- who the major employers are in the town and information about the common routes traveled by town's people to and from work. Along with this could be included a discussion on the possibility of supporting car or van pooling.

- any ideas or possibilities of joint town and/or private energy initiatives which have come up in the energy committee's preceding work.

- areas where the town is currently using energy very inefficiently, such as an old furnace in the town hall, or single pane windows in the town library.

- any current town policies and/or ordinances which would impede or assist the town in achieving better energy efficiency, conservation or implementation of the use of local renewable resources.

A primary part of the presentation will be to show the town's current energy consumption, the cost of that consumption, and the amount of that cost which is leaving the community. Estimates of future energy needs and costs should be made to show where the town will be if it continues to use energy as it does now. This should be compared to projected costs with the implementation of energy conservation and efficiency measures, and a shift in consumption to local renewables.

Financial Analysis of the Town's Energy Use

The energy committee should now have fairly complete information on energy consumption by fuel type and cost for the municipal, residential, and commercial sectors of that energy over the past year. Along with that, they should have an idea of how much of the money spent on energy returns to the town in the form of wages, taxes, fees and contributions made by utility companies.

One of the best ways to look at this information is to lay it out in a table which compares consumption and costs of different fuel types. In order to compare consumption of different fuel types, the units they are commonly measured in (kilowatts, gallons, cords, etc.) will have to be converted to the same energy unit (usually the Btu, or British Thermal Unit). A table to assist in making this conversion appears in Appendix III along with tables for current and projected state-wide energy consumption for the residential and commercial sectors. When combined with information gathered by the committee, these tables can be used to determine:

- the town's total energy bill, which could be compared to other town expenses, such as the school budget,
- the most expensive form of energy,
- the amount of money spent on energy per sector (residential, municipal, commercial), and
- projected energy consumption and costs for the year 2010.

From the information in the table and the number of households in the town, the energy committee can find out the average amount of money spent on energy per household. This could be compared to the town's median adjusted gross income, available from the Vermont State Tax Department. It is this type of information which will develop a sound reasoning and support for a comprehensive town energy plan.

Life-cycle costing (LCC) is a financial decision making model which allows for a direct economic comparison of alternatives, such as photovoltaics, gas generators, or extending utility power lines, by reviewing the whole financial picture of the program. LCC may be helpful in deciding what programs the town should pursue and in preparing the presentation. The formula for figuring Lee is: Lce = capital cost + maintenance costs + energy costs + replacements costs minus salvage value.

An excellent, detailed explanation of Lce is available in an article entitled "Economics: Life-Cycle Costing" from *Stand Alone Photovoltaic Systems - A Handbook of Recommended Design Practices,* by the Solar Energy Industries Association, 777 North Capitol Street, NE, Washington, DC 20002, (202) 408-0660: The Vermont Department of Public Service Energy Efficiency Division recommends a life-cycle computer program and user guide put out by the U.S. Department of Commerce, National Institute of Standards and Technology. Free copies of this public domain software and reference guide are available by request to the Vermont DPS, 802/828-2811. The Department also has a free publication that covers life-cycle costing entitled "Guide to Evaluating Energy Conservation Opportunities Under Act 250," which is available by request.

Financial drain on the community

There are three primary ways to figure out how much of the money spent on energy remains in the community. The first is to sum up the fees, taxes, and contributions paid to the town by the energy suppliers along with the total salaries paid to the company employees residing in the town. The second way is to use figures on the local margins (wholesale to retail mark-up) of the fuel or energy source being looked at. This may be a difficult number to obtain because margins are often confidential business information. The third method is to use an estimate of the amount of money retained in the community for certain fuels. The Rocky Mountain Institute, an energy research organization, estimates that roughly 20% of the money spent on heating oil, propane, and coal, is retained in the community. A study in Vermont indicates that 88% of the money spent on wood stays in the community (Richard Greenfield, Brighton Energy Study. Northeast Kingdom Community Action, Brighton, Vermont, 1981). See "Financial Drain on the Community," page 72 for more information.

V. Preparing the Energy Plan - Goals, Objectives and Initiatives

Once the collected background information has been analyzed, the energy committee must develop a plan which will guide the town in its future energy decisions and use. The energy committee should work closely with the town planning commission in developing the energy plan as it will have valuable information as to the content and format of the rest of the town plan. The regional planning commission may also be helpful in this process.

The energy plan has three basic tiers of directives ranging from broad and conceptual to specific and concrete. The goals of the plan are the broad, overriding purposes which reflect the town's vision regarding its future energy use. They give direction to, and provide a context for developing the plan's objectives or policy recommendations. Once the goals and objectives have been formulated, the energy committee can develop programs and initiatives which often have specific targets and deadlines and are designed to accomplish the goals and objectives.

An example of this three tier structure would be:

Goal: The town will reduce its dependence on costly, imported energy resources.

Objective: The town will promote cost-effective energy efficiency in all town buildings.

Initiative: The town will complete energy audits on all town buildings to determine areas of energy waste and areas of potential savings.

Community participation is crucial in developing the goals. (See "Encouraging Public Education and Participation" under "Formulating an Action Plan" of this *Guide* for specific strategies.) The most successful community planning programs are designed to represent the needs and values of the whole community. In addition to ideas and visions of the energy committee members themselves and comment from the general public, the following are some of the ways to start developing a set of energy goals which will have a broad base of community support:

- Read your town's current master plan to find any already stated energy goals within the town's regulations, codes and planning programs.
- Talk to local boards, commissions and municipal department heads to determine what energy related problems or priorities they might have.
- Conduct an energy use and attitude survey to learn how your town feels about energy use and costs, and to help publicize your efforts and invite volunteers.

The energy plan may be a stand alone document or part of the town's master plan. This difference will influence how the plan is organized. If it is a part of the master plan many of these topics will overlap with other aspects of town planning and the plan's organization will be influenced by the rest of the master plan. If the plan is an independent document, the energy committee should organize the plan in whatever way they believe the information will be most clearly received by the public. In this booklet's *Model Town Energy Plan,* information has been laid out in accordance with the sectors as described in "Collecting Background Information" in this *Guide.*

There are many sections in a town plan where energy issues can be addressed. The *Planning Manual for Vermont Municipalities* describes the function of a town's regulations, codes and planning programs. The following examples show how these regulations, codes, and programs can be used to implement various energy programs. For ideas on how to finance these programs refer to Appendix IV.

Zoning Regulations:

> "Zoning usually involves dividing the community into districts or zones, each having a different set of uses, densities, dimensional requirements, and standards for development." *(Planning Manual for Vermont Municipalities,* Sec. 6.3.1, pg. 96)

Through zoning regulations a town can specify how a building is placed on a lot, the heights of buildings and their relationship to other buildings. These types of specifications can be used to ensure direct access to sunlight, for either *passive or active solar* collection, in residential and commercial buildings in areas of compact development.

Subdivision Regulations:

> "[Subdivision regulations] provide standards for lot layout; sighting of buildings; improvements of streets, utilities and open spaces; landscaping and screening; recreation areas; the protection of natural areas and other important features; and allocation of costs for improvements." *(Planning Manual for Vermont Municipalities,* Sec. 6.3.1, pg. 97)

Subdivision regulations may be used in areas where the potential for solar collection is high; on south facing hill slopes for instance. In these locations the streets may be required to run in east-west, north-south directions so buildings are situated to take full advantage of the available solar gain. Subdivision regulations may also be used to protect potential hydro and wind generated power sites. Setting standards for the improvement and layout of roads could be used while planning town transportation to take into account energy efficiency and the length of common routes traveled.

Official Map:

> "The official map enables the reservation of lands for drainage, streets, parks, schools and other public facilities for future public acquisition." *(Planning Manual for Vermont Municipalities,* Sec. 6.3.1, pg. 97)

Through the use of the official map, towns could guide and/or limit areas to be used for the construction of electric-power transmission and distribution lines and corridors, and to specify certain town areas as renewable energy resource zones.

Building Codes:

> "Communities may adopt codes that regulate the construction of buildings. Such codes are a way to upgrade substandard buildings and to insure adequate and safe construction of new buildings." *(Planning Manual for Vermont Municipalities,* Sec. 6.3.2, pg. 97)

Building codes could be used to specify energy efficiency standards in new construction and for upgrading old buildings.

Capital Budget and Program:

> "The capital budget and program provides an approach for municipalities to select, schedule, and finance their capital projects." *(Planning Manual for Vermont Municipalities,* Sec. 6.3.3, pg. 97)

Items such as upgrading the town hall's heating system, or installing energy-efficient windows into the town's library, or upgrading to more fuel efficient town vehicles will all entail some initial cost. The capital budget and program is the place to schedule and finance projects such as these. The community may then wish to reinvest the savings monetary savings from these programs into other energy programs.

Community Development Program:

> "A community development program can be designed to conserve, expand, and improve housing; to create and retain employment; and to improve public facilities in support of housing and economic development." *(Planning Manual for Vermont Municipalities,* Sec. 6.3.3, pg. 99)

The energy committee could work with the planning board, or whatever other committee is developing or upgrading the community development program, to help develop energy efficiency measures and local renewable resources. Some possible projects may include upgrading the energy efficiency of low income housing, or developing local jobs through an investment in local renewable resources.

Coordination of Public Actions:

> "Coordination of public actions can be an effective way of ensuririg that goals, objectives, and plans are carried out. How this coordination will take place should be spelled out in the implementation program... Communities may need to coordinate with each other on transportation improvements or solid waste disposal. This coordination may occur through the regional planning commission or by the formation of an intermunicipal district." *(Planning Manual for Vermont Municipalities,* Sec. 6.3.4, pg. 100)

Transportation planning and the disposal of solid waste are both strongly tied to Vermont's energy use. Reuse and recycling use less energy and raw materials to produce goods than using virgin materials. As another example, many large landfills are now being eyed as sources of methane gas to be used as a local fuel source. Setting up car and van pooling projects between large employers and towns with large residential employee populations may best be worked out through a regional planning commission.

Coordination of Private Actions:

> "Citizens, government, and private enterprises all have vested interests in the community... Partnerships between the public and private sector can bring together the talents and resources to develop innovative solutions to common problems." *(Planning Manual for Vermont Municipalities,* Sec. 6.3.5, pg. 100)

From developing educational programs with the private sector to working with area industries to develop cogeneration facilities, perhaps with town buildings using some of the electricity produced, coordination between citizens, government, and private enterprises can be effective at promoting an energy-efficient community. This is an area where it is worth keeping your eyes and imaginations open.

The above are just some of the ways in which these techniques can be used to implement a town energy plan and should in no way limit the energy committee's imagination in coming up with new ways to use them. The energy committee may find that not all of the ideas generated during this process will be appropriate for use at this time. However, it would be worthwhile keeping records of all ideas as they may become appropriate for use in the future. Additional examples of energy goals, objectives and initiatives can be found in the *Model Town Energy Plan* and in Appendix I.

VI. Developing an Implementation Plan

Developing an implementation plan entails prioritizing the programs and initiatives listed in the energy plan. It should specify the means of implementing and funding each program, develop a timeline for implementing programs, and assign an individual or group to take responsibility for each program. The implementation plan is intended to insure that the programs are reasonable and achievable. It is meant to be a flexible, working guide to provide direction for the committee once the plan is adopted and to insure that progress is made.

Although the criteria for setting priorities for each program will depend on each community's specific situation, some of the criteria which should be taken into account are:

- amount of energy savings provided
- cost-effectiveness of the program - this may be based on life-cycle costing
- environmental impact of implementing or not implementing the program
- jobs produced by the program
- effectiveness of the program at meeting the community's established goals and objectives
- funding needed/available to implement each program
- human resources needed/available to implement each program

Furthermore, some consideration may want to go to projects which will help motivate the town toward further energy saving measures. Small successful projects that yield short-term economic benefits will lay the ground work for larger, long range ones. Thus the town may want to start with projects that:

- are easily evaluated for their effectiveness
- are easily implemented
- yield short term benefits
- can be easily promoted or are in the public's eyes
- will be pertinent to a broad array of town's people

Programs which address the town as an energy user may meet many of these criteria and therefore be prime candidates for early action.

The Town may want to establish standards of *cost-effectiveness* for energy investments. These standards can be used, for example, when evaluating decisions concerning the purchase by the Town of any equipment, vehicle, or other item requiring the consumption of energy, or when undertaking conservation modifications of town buildings.

VII. Adopting the Plan

Information gained through the inventory and analysis, along with previous public input on the goals and objectives, should be used to create a presentation on the goals, objectives, initiatives, and implementation plans that have been developed. This presentation should demonstrate how the energy plan will save the town money, use less energy, create local jobs, and protect the environment. Whether it is through public meetings, neighborhood discussions, a newsletter, mail or telephone surveys, or by some other means, the energy committee should present their ideas and reasonings to the town for public comment. The energy committee should then take this public comment into account and develop a final draft of the energy plan.

When the final energy plan is ready, the committee should work with the planning commission and the Select Board, to set up final public hearings and reviews before the planning commission and Select Board. Proper public notice of these reviews will need to be posted. Again, it will be the energy committee's responsibility to present their ideas and reasonings supporting the energy plan. The town's Select Board is responsible for the final adoption of the plan.

VIII. Implementing the Programs

When the energy committee is ready to begin implementing programs it should refer to its previously developed implementation plan which lists the priority of the programs, the potential sources of funding for each program, a timeline for undertaking the programs, and what individual or group will be responsible for each program. This will provide a good place from which the committee can begin its program implementation. The committee should remain flexible and feel free to alter the implementation plan as needed.

The energy committee should notify the public about programs it is implementing, and try to involve volunteer community members in the programs whenever appropriate. This will build community support for current and future programs, stretch the resources available for energy programs, and increase public awareness of energy use. The committee may also want to seek business sponsors and bids for services for any programs they are organizing to help stretch resources (see Appendix IV for other ideas).

Thorough notes on implementation procedures and pre and post program data should be kept to assist in the evaluation of current programs. This information will also prove helpful in undertaking future programs.

IX. Evaluating the Programs

Once energy programs have been implemented, the energy committee should monitor and evaluate their effectiveness. The results of this evaluation - including facts and figures on money, energy, and resources saved, local jobs created, and money kept in the local community instead of being exported - should be made public through a newsletter or other means mentioned earlier in this guide, and be used to develop community support for and participation in future programs.

Evaluations should take place at the conclusion of each initiative implemented, or periodically if the programs are continuous. An annual review of the past year's accomplishments will be valuable to the committee in assessing its progress and in setting priorities and goals for the coming year. This information may also prove valuable for other towns which are undertaking energy planning.

A MODEL TOWN ENERGY PLAN

The following Model Town Energy Plan is a compilation of ideas from various sources - Paul Markowitz, Town Energy Planning: A Framework for Action 1983; *Community Plan for Weybridge, VT, Feb.* 1992; *Village of Essex Junction Comprehensive Plan, March* 1991; *and original material from the EarthRight Institute Energy Committee. We have tried to be thorough in including many good ideas. The degree to which any town decides to be so inclusive will depend upon the interests of the town's people, the resources available to them, and the energy use of that particular town.*

The Town Energy Plan serves as the conceptual and legal basis for energy related zoning and subdivision ordinances and as an official policy for the town which can be used as the basis for energy related planning and decision making. It begins with a Statement of Purpose which describes the town's overall visions toward energy production and use. Financial, environmental, security, and stability issues can be addressed, using key figures gathered in the collection of background information. This is followed by a summation of the town's Current Energy Use and Available Renewable Resources. Together with the purpose, this information establishes the justification and reasoning for developing and adopting the town energy plan. Furthermore, it will become a record for use in evaluating the effectiveness of the town's energy programs. The plan then lists a set of Goals, Objectives and Programs for energy use deoeloped by the town which are separated into five sectors: The Town as an Energy Consumer, Residential and Commercial Buildings & Operations, Transportation, Land Use, and Renewable Energy Resources and Recovery Technologies. The plan lays out the Implementation Strategies for these energy programs. Finally, the Appendices to the plan contain all of the remaining information that was collected in preparing the plan that was not included in the Current Energy Use and Available Renewable Resources sections.

We have chosen a format which we believe clearly lays out the information and statements supporting the town energy plan. The energy committee producing the plan may elect to change this formatting according to the needs and circumstances in their town. For example, if the energy plan is being adopted into the town's master plan, certain sections of the energy plan, like transportation and land use, may be dealt with elsewhere in the master plan. If any sections dealing with energy issues appear elsewhere in the plan, they may be referred to in the energy section of the plan.

Any sections appearing in italics in this Model Town Energy Plan are notes to the users of the model and are not intended to appear in a final version of the plan. Places where blanks have been left in association with dollars, percentages, or numbers are meant to be filled in by the town using the town's figures. Material from this model may be copied for use in other town plans with credit given to EarthRight Institute. Its use, however, should not restrict users from generating their own new ideas.

I. Statement of Purpose

Energy is an important factor in the economic, environmental, and social well-being of our community. Practically every decision we make or action we take affects energy use or production. And in turn, energy use and production affect our future decisions and actions.

Economically, energy costs for all the residential, commercial, industrial, municipal, and transportation uses in {town} are currently estimated at $ per year, or $ per household. It is estimated that these annual energy expenditures will rise to $ for the town and $ per household by the year 2010 if no conservation and efficiency measures are introduced. *(See Appendix III for help in determining these figures.)* As long as we remain dependent on limited and dwindling, nonrenewable fuel sources for energy, and as long as we continue to consume more and more energy, the costs of that use will grow to play an even larger role in the future.

Because the Town relies heavily on fuels imported from outside our region, most of the money spent on energy is exported from our local economy and does not return to create jobs or buy goods locally. In addition, foreign fuel sources are insecure and unstable, subject to huge price swings and supply shortages beyond our control.

Our air and water quality as well as the quality of life in (town) are affected by our energy use. With an ozone hole three times the size as the United States forming over Antarctica; global warming threatening the world's coastal cities, agricultural zones and the foundations of many of our ecosystems; and with no permanent means yet devised to handle the radioactive wastes from our nuclear power plants, the environmental concerns of energy use are certainly far reaching and serious. Just as our Town bears the environmental impacts from energy used in other parts of the nation - the effects of acid precipitation from Mid-western coal plants on our lakes and forests, for example - we affect others through our energy consumption and production activities. We must take responsibility for the environmental effects of our energy use, in consideration of generations yet to come.

The Town's energy future is inextricably linked with energy policies and economic forces at the state, federal, and international levels. While we recognize that the Town has limited abilities to affect a national energy policy, we believe that the Town government has influence that is far reaching. The town is the unit of government closest to the citizens, and is therefore most accessible to the participation of every individual. Participation is the heart of the democratic process, and by adopting and implementing this Town Energy Plan, the Town makes a public policy statement on energy issues and acknowledges the importance of energy planning in the overall development of the community and the country.

The Town views the implementation of this Town Energy Plan as the initial step in the development of a sustainable energy future. Our long-term vision is to become a model of sustainable energy practices by: reducing our energy use through utilization of energy-efficient end-systems; achieving the maximum development of local renewable resources that is economically feasible; and thoroughly evaluating and modifying, wherever feasible, our patterns of energy use, settlements, transportation, and industry to minimize environmental impacts. By implementing these, we expect to reap the long-term economic, environmental, and quality-of-life benefits that these changes will bring.

Therefore, the Town of (town) resolves to take action which will create a sustainable energy future; one that minimizes environmental impact, supports our local economy, and emphasizes energy conservation, efficiency and the increased use of local and regional renewable energy sources.

II. Current Energy Use

Information on the town's energy use and expenditures should be presented here using graphs, pie charts, and tables of comparative figures and percentages in dollars and energy used (BTU's). Similar figures should be provided for the town's projected energy use, both with and without the plan's recommended programs in place. (See Appendix III *for help in determining these figures for your town.) The following* is *an example of information collected from and prepared for Norwich, Vermont in* 1991 *which show the kind of information that would be helpful in this section. Additional information, such as current and projected energy consumption and expenditures broken down by sectors within the community displayed in tables, graphs or charts should be provided in an appendix to the Town Energy Plan. [Note: Some of these figures are based on the April* 1992 *census showing Norwich with a population of 3093 and* 1187 *households.]*

Tables 1 and 2 present an estimate of Norwich's energy consumption now and in the future. Table 1 provides figures for the year 1990, from information provided by Green Mountain Power Corporation, local fuel oil and propane distributors, and the Treasurer of the Dresden School District. Coal, wood, solar, and automotive fuel consumption (gasoline and diesel) was estimated from the *Vermont Comprehensive Energy Plan,* 1991. Table 2 provides an estimate of how the Town's energy use will increase if present use patterns continue. These figures assume that energy consumption in Norwich will increase at the same rate as that of Vermont as a whole, estimated from the *Vermont Comprehensive Energy Plan, 1991.*

The information in the tables is arranged as follows. The first, second, and third rows contain figures for consumption (in familiar units, e.g. gallons), total cost, and cost per unit (e.g. $ per gallon). The fourth row shows that the cost of energy varies enormously depending on its source. To make the comparison the familiar units for each energy source (e.g. gallons of heating oil) must be converted to the same energy unit, the MBtu. The MBtu stands for a million British Thermal Units. 1 British Thermal Unit is the energy needed to heat a pint of water by 1 degree Fahrenheit. For example, to heat 10 gallons of water from 50· F to 110· F (to take a shower) would cost about $.14 when done electrically, but only $.02 if done with coal.

Sample Analysis and Presentation for the Town of Norwich

Table 1

Summary of Norwich's Present Energy Use (Municipal, Residential, Commercial), Year 1990

	Electric (kWh)	Heat Oil gallons	LPG gallons	Coal tons	Wood cord	Solar MBtu	Gasoline Gallons	Diesel Gallons	Totals
Amount	15,400,000	46,6473	310387	51	1829.	319	941,356	344,630	
Cost	$1,165,842	$382,376	$337,787	$4,511	$146,341	$1,753	$1,082,559	$396,325	$3,517,495
$/Unit	$0.076	$0.820	$1.09	$88.00	$80.00		$1.15	$1.15	
$/MBtu	$22.18	$5.91	$11.92	$3.46	$3.96	$9.20	$9.20	$8.77	

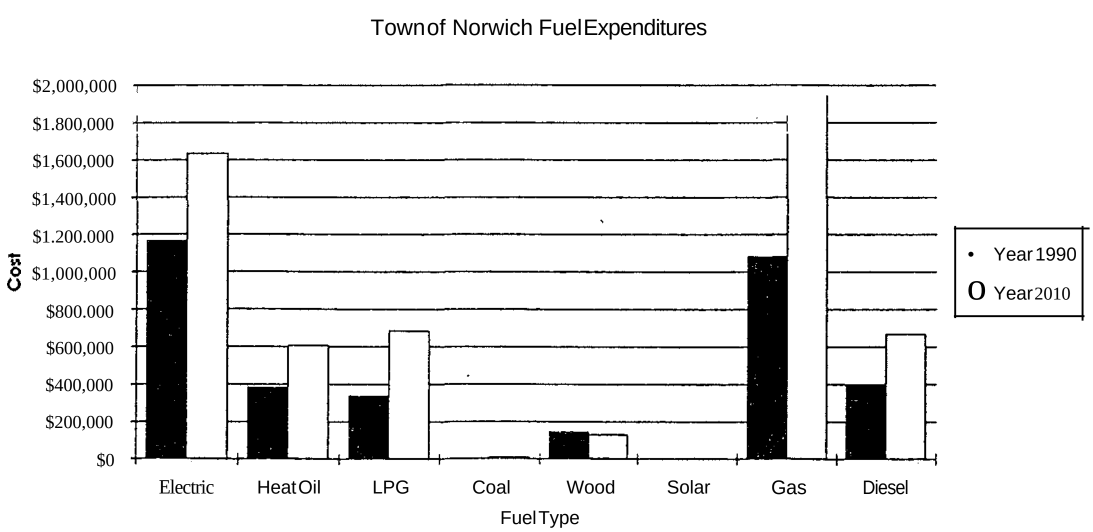
Total 1990 energy consumption/number of year-round households in Norwich: $2,963.35

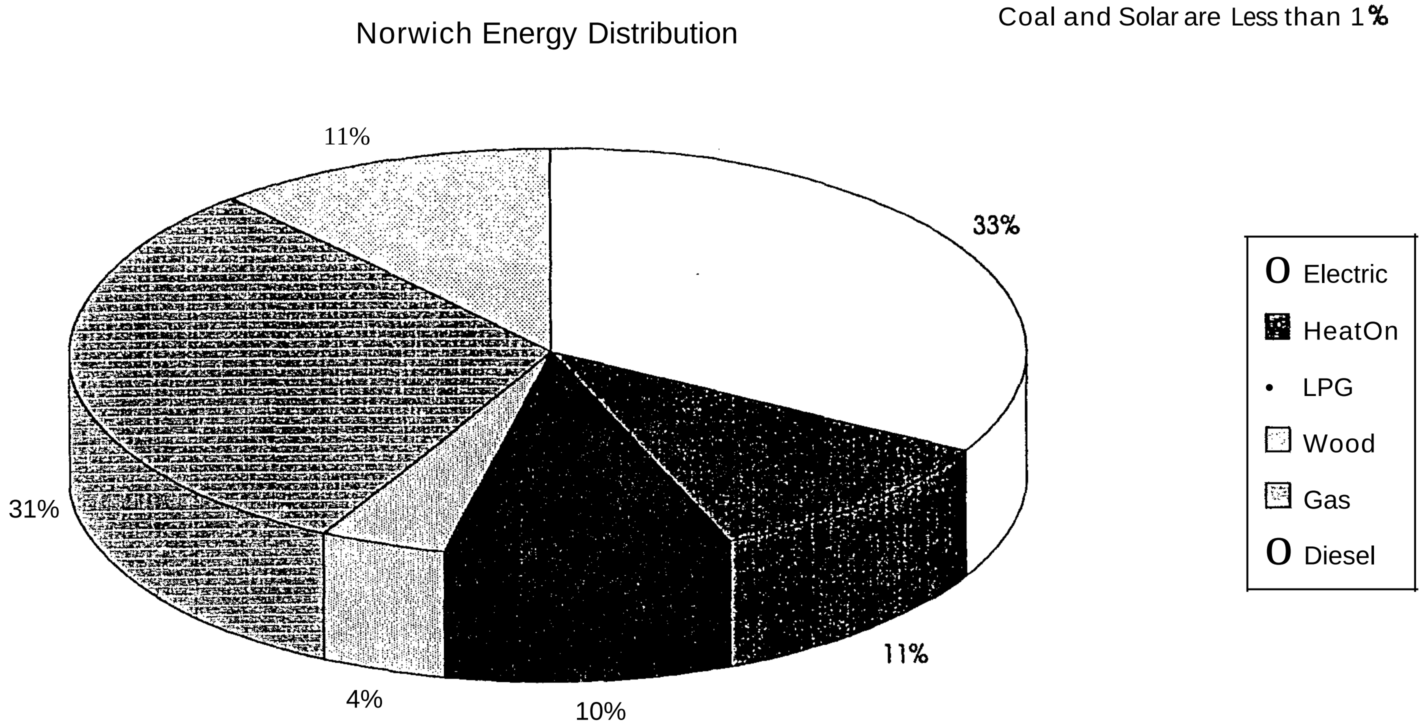
Table 2.

Norwich's Projected Energy Use (Municipal, Residential, Commercial), Year 2010

	Electric (kWh)	Heat Oil gallons	LPG gallons	Coal tons	Wood cord	Solar MBtu	Gasoline Gallons	Diesel Gallons	. Totals
Amount	22,400,000	628,735	561,285	105	1,748	850	1,444,773	493,720	
Cost	$1,633,111	$606,559	$685,122'	$8,946	$130,481	$4,888	$1,955,412	$668,219	$5,692,738
$/Unit	$0.073	$0.965	$1.22	$85.50	$74.66	$5.75	$1.35	$1.35	
$/MBTU	$21.39	$6.96	$13.36	$3.37	$3.70	$5.75	$10.83	$10.32	

Projected 2010 energy consumption/number of year-round households in Norwich: $4,795.90





Studies and field experience in New Hampshire and Vermont predict 20-30% cost and energy savings through energy conservation and efficiency programs. The potential savings for the town of Norwich, with a current annual energy bill of about $3.5 million, would be between $700,000 and $1,050,000 per year if the programs in this plan are enacted.

III. Justification & Energy Resources

Information here might include:

- *examples of cost and energy savings possible through certain energy conservation and efficiency programs,*
- *a map depicting town woodlands, current and potential wind and hydro sites, and areas optimal for solar applications, and*
- *tables or graphs will show the amount of current energy used and the potential energy available to the town through each of these renewables. These figures could be displayed in Btu's and as a percentage of the town's current and projected (with and without conservation and efficiency measures) energy demand.*

Projections for energy expenditures which leave the town or region versus those which remain varying with the fuel source could be included here. Depending upon how the rest of the town plan is formatted, this information may appear here or in an appendix at the end of the Town Energy Plan.

IV. Goals, Objectives, and Programs

The following represents a broad range of goals, objectives, and programs, yet the list should not be considered exhaustive. Each town's goals, objectives, and programs will be unique, based on the community's needs, aspirations, resources, and available technologies.

Implementing energy conservation and efficiency measures in town buildings and operations is a good starting point for several reasons: town energy programs will be highly visible; the town's residents, organizations and businesses can participate in the programs, thereby building support; and the savings that are gained benefit all the town's people and set an example for the rest of the community. It is also important to begin with workable projects that yield short-term economic benefits. A small successful project lays the ground work for larger, long-range ones.

The following represents a broad range of goals, objectives; and programs which, if implemented, would save the Town money, conserve energy, protect the environment, produce local jobs, and provide a secure, economical, and sustainable energy supply for the Town.

Goals of the (Town) Energy Plan

1. To save money by reducing the overall energy consumption within the town through conservation and efficiency, and thereby decreasing the adverse environmental impacts associated with energy consumption.
2. To promote the development of local renewable resources as a replacement for imported nonrenewable resources.
3. To provide and ensure that energy supplies will be reliable, affordable and environmentally sound.
4. To increase public awareness of energy issues and build public support for energy efficiency and sustainable energy policies.

A. The Town as an Energy Consumer

Objectives

1. To reduce energy consumption in all town buildings and operations.
2. To investigate and consider cost-effective energy conservation and efficiency measures for use in all town buildings and operations.
3. To encourage the sustainable development and use of local renewable energy resources for all town buildings and operations.

Programs

1. The Town will conduct complete energy audits of all Town buildings to:
   a. identify areas of energy waste and areas of potential savings,

b. determine whether the end-uses of energy are properly matched with the types of energy sources used,
c. recommend cost-effective energy conservation and efficiency measures and modifications that will make use of renewable energy,
d. prioritize these modifications and incorporate them into the Town's Capital Budget, and
e. implement programs as prioritized by the previous steps.

2. The Town will construct all new buildings according to standards of energy efficiency at least equivalent to Energy Rated Homes of Vermont 4-star level or other state energy code where it can be demonstrated to be cost-effective.
3. The Town will develop and implement a program of upgrading to, and maintaining, energy-efficient and non-polluting exterior lighting.
4. The Town will use life-cycle cost planning> and least-cost planning in evaluating all decisions concerning the purchase by the Town of any equipment, vehicle, or other item requiring energy consumption.
5. The Town will engage in long range planning for the sustainable use and acquisition of energy.

B. Residential, Commercial and Industrial Buildings & Operations

Objectives

1. To encourage and support public energy education and awareness programs.
2. To encourage and support cost-effective energy conservation and efficiency measures for use in the town's residential, commercial, and industrial sectors.
3. To encourage and support the sustainable development and Use of local renewable energy resources for the town's residential, commercial, and industrial sectors wherever economically feasible.

Programs

1. The Town will provide information (possibly through the town library or energy committee newsletter) on conservation and efficiency; efficient transportation; local renewable resources; related town, state, and federal energy programs; and available funding and financing for these programs.
2. The Town will seek local and regional funding for residential programs to provide an energy audit and cost-effective weatherization services on all existing homes, with special emphasis on low income housing.

9Ufe-cycle cost planning incorporates operation and replacement costs as well as purchase price into the decision making process. The formula for figuring life-cycle cost is: Lee =capital cost + maintenance cost + energy cost + replacement cost minus salvage value.

3. The Town will support emergency energy supply programs, with special emphasis on low income households.
4. The Town will develop and adopt recommended efficiency standards for new construction and retrofits which:
   a. specify insulation, lighting and appliance performance levels,
   b. meet or exceed the Energy Rated Homes of Vermont 4-star code levels,
   c. limit electric use to those applications where it functions most efficiently, such as lighting, operating motors and in certain industrial processes, and discourage the use of electric space and hot water heaters.
5. The Town will encourage the town's people and developers to use local and/or renewable resources on a sustainable basis.
6. The Town will encourage landlords to bring apartment buildings up to town standards for efficiency, especially those in which tenants are responsible for their own heating bills. Methods can include, but are not limited to, a combination of local property tax incentives, revisions to the municipal housing code, and time-of-sale efficiency standards <these require energy efficiency improvements to be made when a building is sold).
7. The Town will develop a revolving loan fund or other financing mechanisms to facilitate capital-intensive conservation, efficiency, and renewable energy investments.
8. The Town will recommend an energy impact analysis for all major development proposals, assessing the quantity and source of increased energy consumption result from the development.

C. Transportation

Objectives

1. To promote cost-effective energy efficiency in future transportation planning.
2. To increase the efficiency of all town vehicles.
3. To educate the public about energy-efficient transportation.
4. To coordinate land-use and transportation planning which promote energy-efficient transportation.
5. To promote and implement strategies to encourage ridesharing, public transit, bicycling, and walking.

Programs

1. The Town will investigate the use of alternative fuels in town vehicles. For example, ethanol made from wood will be available in a very few years.
2. The Town will incorporate fuel economy standards into the Town's Capital Budget when replacing old town vehicles.

3. The Town will analyze the routes and travel of all town vehicles to in order recommend changes which will reduce transportation costs.
4. The Town will cooperate with local communities to develop commuter facilities to:
    a. increase access to bus routes including frequent cycles during peak transit hours,
    b. encourage education programs on the benefits of using public transportation,
    c. establish commuter trains, and
    d. develop car-pooling and van-pooling initiatives and programs. It is recommended that, as part of this program, a bulletin-board, possibly computerized, be established for exchanging names and destinations.
5. The Town will encourage major employers in the town and the region to promote energy-efficient commuting.
6. The Town will promote the development and use of a system of trails, greenways, sidewalks, bicycle paths, and commuter parking lots as viable transportation components, with particular attention given to connecting schools, recreation facilities, shopping centers, major places of employment, and mass transportation facilities. This could be accomplished through tax incentives or by acquiring easements.
7. The Town will encourage the installation of bicycle parking racks at major activity areas such as schools, recreation facilities, shopping centers, major places of employment, and mass transportation facilities.
8. The Town will provide shelters, where needed, for pedestrians and bicyclists at bus stops and rideshare pickup locations.
9. The Town will include bicycle paths as a component of the Capital Budgeting process and will pursue Federal and State funding for their construction.
10. The Town will consider bicycle paths, pedestrian walkways, and mass transportation access in the review of all proposals for commercial development and new town recreation facilities.
11. The Town will adopt zoning regulations that support development of mixed-use growth centers containing daily residential services, thereby reducing transportation needs.
12. The Town will consider transportation efficiency issues and bicycle use when making road expansion decisions.
13. The Town will encourage the schools to:
    a. teach and promote cycling in the schools as a viable transportation alternative,
    b. teach the true costs of various energy options, including car ownership, and
    c. teach energy-efficient driving techniques in driver's education.

D. Land Use

Land use planning can have significant effects on reducing long term energy costs. By considering energy in land use planning the town can save, or even produce, energy that would otherwise be lost with less efficient developments and site designs.

Objectives

1. To encourage and support settlement patterns and densities which reduce travel requirements for work, services, shopping and recreation.
2. To adopt land use and zoning ordinances which encourage energy conservation and efficiency and the sustainable development of local renewable sources of energy.

Programs

1. The Town will encourage growth centers <Co-mingled residential development, employment areas, commercial districts, shopping areas, and ride share lots with access to mass transit) in order to discourage land use that would create or lead to energy inefficient sprawl and strip development.
2. The Town will, through site plan review, encourage the use of these energy conservation measures, such as:
    a. vegetation as winter wind buffers and summer shading,
    b. building development on southern slopes, in order to take advantage of natural light and heat,
    c. building development orientation to the south through any combination of street, lot, or building layout, in order to take advantage of natural light and heat,
    d. protection of solar access for existing buildings from shadows cast by new structures, and
    e. building development in areas sheltered from the wind.
3. The Town will protect potential hydro and wind power sites and forest land for use as renewable energy resources by using zoning ordinances, by working with land owners to obtain easements, or through outright purchase of the land.
4. The Town will encourage agricultural activities and seasonal farm stands so that local produce can be marketed locally.
5. The Town will allow appropriate home occupations to reduce commuter transportation.

E. Renewable Energy Resources and Recovery Technologies

Objectives

1. To protect the town's renewable energy resources.
2. To promote the cost-effective, sustainable development of the town's renewable energy resources.
3. To encourage use of locally produced renewable energy sources instead of imported non-renewable energy supplies.

Wood Programs

1. The Town will promote state and/or local tax abatement programs for stimulating sustainable fuel-wood production, and for improving the management of forests.
2. The Town will protect designated productive forest lands from development by working with land trusts and owners to acquire *conservation easements* to protect forest lands and/or by offering tax stabilization agreements to landowners who agree to manage their forests for fuel-wood, other wood resources, recreation uses, and wildlife habitat in a sustainable manner.
3. The Town forest will be managed, where possible, to provide fuel-wood and other wood products, recreation uses, and wildlife habitat, for the benefit of the town and its residents in a sustainable manner.
4. The Town will establish a policy of maintaining roads to productive forest land in a condition adequate to transport forest products but to discourage other vehicular travel.
5. The TOwn will encourage that all wood burning installations meet all applicable National Fire Protection Association (code # 211) safety requirements and Federal EPA emissions standards.
6. The Town will support bulk purchase of efficient wood stoves which meet Federal EPA emissions standards.
7. The Town will coordinate with local fuel-wood suppliers, foresters and loggers to evaluate the. options of developing a fuel-wood cooperative and information brokerage between dealers and consumers for the use of securing fuel-wood.
8. The Town will develop an emergency stockpile of fuel-wood for use by elderly or disabled citizens, and citizens in economic crisis.
9. The Town will study the feasibility of converting municipal buildings and schools to wood heat and hot water.
10. The Town will not increase tax assessments for energy efficiency or renewable energy investments and improvements.

Solar Programs

1. The Town will recommend construction design standards and siting requirements which encourage solar heating and lighting in all new buildings.
2. The Town will not increase tax assessments for energy efficiency or renewable energy investments and improvements.
3. The Town will promote campaign to educate builders and architects on solar technologies, such as passive solar heating and natural lighting.
4. The Town will organize cooperative purchases of insulation, solar water heating systems, photovoltaic modules, or other energy saving devices.
5. The Town will require that cost-effective solar designs and techniques be incorporated into all new publicly-funded structures erected in the town.

6. The Town will support solar building guidelines to be used for new construction.

Wind and Hydroelectric Programs

1. The Town will provide information to residents about existing and potential wind and hydro-powered generating sites, procedures for developing wind power and hydroelectric power, and available wind and hydro-powered generating systems.
2. The Town will not increase tax assessments for energy efficiency or renewable energy
3. The Town will protect potential wind power and hydroelectric sites by using zoning ordinances, by working with land owners to obtain easements, or through outright purchase of the land.

Resource Recovery Technologies Programs

1. The Town will encourage existing and proposed large electrical energy consumers and large thermal users to manage their energy load and require them to study the feasibility of cogeneration.
2. The Town will investigate cogeneration facilities for municipal buildings.
3. The Town will encourage the development of renewable and recovery resource-based businesses in town - such as, but not limited to, methane gas collection, alcohol-based fuels production, and cogeneration facilities - through appropriate tax incentives.
4. The Town will study the feasibility of, and implement if deemed appropriate, a landfill gas to energy system.

V. Implementation Strategies

An implementation strategy can be used to ensure that the town's recommendations and policies are carried out. The implementation strategy spelled out in an Energy Plan should be broad and open enough to allow the responsible parties leeway in deciding how to carry out the actions called for in the plan. Yet, it should be specific enough to help guide these parties in developing strategies.

The town will form an energy committee responsible for:

1. Implementing programs laid out in the energy plan - The energy committee, in conjunction with the other boards and commissions, will develop an implementation program which will assign responsibility for all actions called for in the Town Energy Plan, and will specify a time period for completion of each. The town's boards, commissions, and the energy committee will place a priority on the modifications and

actions which will enable the municipality itself to achieve a higher level of energy efficiency and conservation. Of these modifications and actions, all of short range should be completed within one year while the long range studies and/or programs should be started within one year.

2. Ensuring compliance with the plan - The energy committee will review decisions and actions by town boards, commissions, residents, and businesses to make sure they are in compliance with the guidelines and regulations set forth in the energy plan.
3. Organizing energy education programs in town - The energy committee will develop or obtain and disseminate energy education materials and programs for town employees, residents, businesses, and schools.
4. Analyzing the effectiveness of programs - The energy committee will conduct an annual review and analysis of program implementation and submit a report of its findings to the Town select board and make it available to the Town's people.

VI. Appendices

Include here any of the important information, tables, charts graphs, survey results, etc. which were obtained or developed in the Collection of Background Information phase of preparing the plan, but was too much to include in the Current Energy Use and Available Renewable Resources sections. This material will prove helpful when developing and implementing the town's energy programs and initiatives. It will also be helpful in answering questions from the town's people about the town's energy use and resources, and about how the committee came to its conclusions. If this material is voluminous, towns may chose to keep it on file in the energy committee or town planning office, rather than include it in the plan.

APPENDICES

I. Town Energy Programs

One of the primary roles of town energy committee is to educate community members about the programs developed by the state, electric utility companies, and non-profit organizations which currently exist to encourage energy conservation in towns, and about the available funding and financing options for implementing these programs. There are also numerous programs which can be created by energy committees which will reduce energy consumption, improve the environment, and save the town money. The following are examples of energy initiatives which can be implemented and promoted by citizens. For additional funding and financing options, see Appendix IV.

A. Utility Demand Side Management Education Program

Vermont utility companies have recently begun working with environmental groups and the Vermont Public Service Board to develop programs which promote conservation, efficiency, and fuel switching among electric users to satisfy their demand for power. These programs offer financial, educational, and technical assistance and training.

Although many of these programs are currently available for residential, commercial, industrial, and agricultural users, many individuals are not aware of their existence. A town energy committee could conduct and education campaign to let the town's people and businesses know about these programs and encourage them to take advantage of them. Committees should call the utility company serving their town and request full information on all of their demand side management programs for all sectors. Make sure to get the implementation date for each program, as well as the program coordinator's name and phone number. Check back with the company occasionally to learn about new programs coming on line.

Information collected could be shared with the community through a mailing to the town, public forum, or door-to-door campaign. A door-to-door campaign could be done in conjunction with a campaign to sell compact fluorescent light bulbs (see "Community Energy-Efficient Lighting Program," next initiative) and to educate the community about other valuable programs (see "Community Energy Conservation Teams" initiative).

B. Community Energy-Efficient Lighting Program

Replacing incandescent light bulbs with energy-efficient compact fluorescent bulbs is one of the most cost-effective programs possible. This is particularly true in most areas in Vermont, where the electric utility companies are helping to subsidize the cost of the new bulbs through their demand side management programs.

An example of one such program is Green Mountain Power Company's *Power$avers HOMEUGHTS PROGRAM.* In this program, GMPC allows each household to purchase up to 8 compact fluorescent light bulbs at a substantial discount. A compact fluorescent light bulb produces the same amount of light but uses only 25% of the electricity of the standard incandescent light bulb which it replaces. In Table 1, the life-cycle cost of a 15W compact fluorescent (which lasts 9000 hrs) is compared to the cost of using 9 standard 60W bulbs (which last only 1000 hrs),

GMPC Power$avers Homelights Program
9000 Hour Analysis of Replacing Nine 60W Incandescent
Bulbs with One 15W Compact Fluorescent Bulb

Table 1. Example of Cost Savings

	Nine 60 Watt Incandescent Bulbs	One 15 Watt Compact Fluorescent
Light bulb Cost	$7.40	$4.50
Power Cost	$40.87	$10.22
Total Cost	$48.27	$14.72
Cost/hr.	$0.00536	$0.00164

Using standard incandescent bulbs, the total cost over 9000 hours is $48.27[10]. Using the compact fluorescent replacement (which gives the same amount of light), the cost is $14.72[11], a savings of $33.55 per light bulb. Note that some of the savings is in the cost of the light bulb itself, while the greater savings are in reduced energy costs.

GMPC offers their discount to up to eight light bulbs per households. The potential savings over a 9000 hour lighting period if every household in Norwich participated is shown in Table 2.

Table 2. Potential financial Savings for Norwich

Households	1187
Light bulbs/House	8
Savings/Light bulb	$33.56
Total Savings	$318,642

These figures do not take into account any labor time for changing the nine incandescent bulbs as compared to the single fluorescent. For many, especially in businesses where there are numerous lights and a ladder may be required to change the bulbs, this can be a significant factor which further favors the compact fluorescents.

A community education and assistance project could be organized to encourage the adoption of energy-efficient lighting products by households and businesses. This can include:

- home and business visits by people trained to explain the use of the various light bulbs and accessories (the utility companies can provide effective training for volunteers), display them, examine lighting needs with the house or business owner, and order the desired light bulbs from the subsidized utility light bulb program
- fundraising to supply light bulbs to low-income households
- group purchase programs for energy-saving light bulbs where utility programs do not exist
- extension of a public education campaign to energy-saving demand side management programs for appliances and motors

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10Based on electricity costs of $0.076/kWh, and a standard 60W light bulb cost of 4 for $3.29 (cost at the general store in Norwich).

11Based on electricity costs of $0.076/kWh, and the cost of a 15W magnetic tube, option C in the GMPC program, costing $4.50 (a discount of $6.50 off the normal price of $11.00).

C. Low Income Weatherization Programs

These programs are available in many states and are funded in part by the US Department of Energy. In Vermont, the program is administered through the State Economic Opportunity Office 802/241-2452 and is free to Vermont residents who qualify on the basis of income. The office has extensive experience performing energy audits on homes and then carrying out improvements.

The office runs a five-day course to train Certified Energy Auditors. The auditors then work through local community action councils to visit homes and implement conservation measures. During a typical visit, an auditor will complete a computerized worksheet, entering data about insulation in walls, attics and crawl spaces, efficiency of appliances, etc. Air leakage in the house is checked with a blower door test. The combustion efficiency of oil and propane heating systems and distribution efficiency are measured.

The data is entered into a computer program at the State Office, at which time the most effective energy conservation measures are determined. Residents who qualify may then have the work done at no charge. Typical energy saving measures include:

- switching heating systems from electric to oil or propane
- installing compact fluorescent fixtures
- insulating the hot water tank
- installing low flow shower heads
- modifying oversized heating systems
- curing central heating distribution problems
- reducing building leakage
- adding insulation
- installing interior storm windows

The town should check to ensure that all residents who might qualify for the program are aware of it. Beyond that, the town could consider sending one of its residents to become a Certified Energy Auditor, at a cost of $250, so that at least the audit service could be extended to residents at all income levels.

For a list of the five Community Action Agencies which administer the program throughout the state, see "Weatherization Program" in Appendix V.

D. Energy Rated Homes Information Campaign

Energy Rated Homes (ERH) of Vermont[12] is a non-profit organization which inspects homes and issues home energy ratings, a standard measurement of a home's energy efficiency. These rating are then used by banks and the secondary mortgage market as a basis to qualify buyers for special, more lenient "Energy-efficient Mortgages."

An Energy-efficient Mortgage can help a buyer obtain a home mortgage in two ways:

1. If the home has received a Four Star rating (considered energy-efficient) or higher, the buyer qualifies for higher than normal mortgages. The logic is simple: the lender knows that energy bills will be lower, so there will be more money available for the mortgage. This makes it possible to buy a house that may initially seem beyond the buyer's reach.

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12 Energy Rated Homes of Vermont, 7 Lawson Lane, Burlington, VT 05401, 802/865-3926 or 800/639-6069 toll free outside the Burlington area.

2. If the home is rated below Four Stars, the costs of energy improvements can be financed through the mortgage. These improvements are tax-deductible because they are included in the mortgage, and they will result in savings from lowered energy costs.

If the home rates less than Four Stars, the rating also includes:

- a list of the most cost-effective improvements, along with their estimated costs, needed to bring the home up to Four Stars,
- the projected energy costs after improvements have been made to illustrate how much the owners will save, and
- the additional mortgage amount (based on current interest rates) the owners will pay if the suggested improvements are financed through the mortgage.

This program affects and benefits home owners, buyers, sellers, Realtors, builders, architects, and lenders, and all should be notified of its existence. Several things could be done to promote the program; from least to most obtrusive they are:

- ERH of Vermont could be asked to send information on their program to a list of all Realtors, builders, and architects in town.
- The town energy committee could invite a representative of ERH of Vermont to speak at a forum for home owners, buyers, sellers, Realtors, builders, architects, and lenders on the ERH program.
- The town could require its zoning administrator (for those towns requiring zoning and building permits) to give information on the ERH program to anyone requesting a building permit.
- The town could require its town clerk to give information on the ERH program to anyone buying property in town.
- The town could adopt a minimum building code equivalent to a Four Star rating by ERH of Vermont.
- The town could require all buildings to be improved to a minimum Four Star rating by ERH of Vermont at the time of sale.

E. Property Tax Exemptions for Alternative Energy Facilities

Vermont towns can use their property tax structure to encourage the use of alternative energy sources in private residences, businesses, and farms. Property tax exemptions or reduced tax rates can be used to encourage the development, purchase, and use of wood, wind, solar, hydro, cogeneration, and organic methane energy facilities, which typically have high capital costs that are included in the property value. Such tax incentives could also be employed to encourage the use of energy efficiency and conservation devices such as thermal window shades, additional insulation, and energy-efficient appliances.

F. Saving Energy in Town Buildings and Equipment

A program to assess the potential for energy conservation and renewable energy use in the town's municipal buildings and to recommend projects and funding can have both a direct and an educational effect on energy use.. Citizens can collect and assess information, conduct energy audits, research alternative energy sources for town buildings, figure the cost-to-benefit ratios, and recommend financing options (see Appendix IV). Citizens can conduct a life-cycle cost analysis on proposed town purchases and leasing of vehicles and equipment for energy efficiency. Discussion of information gained and recommendations in town meeting will educate the public on energy conservation.

G. Land Use Policies

Land use policies offer an effective means to encourage energy conservation and use of renewable energy resources, through the town plan, zoning ordinances, subdivision regulations, conditional use review, site plan approval conditions, and variances. An energy committee can study the many possibilities here and educate on and advocate the incorporation of a constructive energy policy into town policy. Examples include zoning to permit compact settlement patterns and mixed-use development, protection of solar access, subdivision ordinance encouragement of passive solar heating and cooling, bike and walking paths, and energy conserving landscaping.

H. Energy-efficient Construction Demonstration and Education Project

A public demonstration project to retrofit an existing residence for energy efficiency and to build a new energy-efficient residence can be used to educate the public, construction professionals, and vocl tech students, and to document the effectiveness of various technologies. Seminars can be held on site throughout the project to demonstrate the techniques and products. Donations or reduced rates on materials can be sought from local businesses. Local building trades people can donate or offer reduced rates for their services. Grants to fund the construction can be repaid by the sale of the finished houses.

A workshop or conference on energy-efficient building materials and designs, use of renewables, and efficient land planning would be another way to educate builders, architects, and homeowners.

I. Energy-efficient Home and Business Tour

Tours of homes and businesses currently using state-of-the-art energy efficiency and conservation measures and renewable energy sources can be organized for home and business owners and contractors to show them what possibilities exist. Information can be provided on the amount and cost of energy used monthly in these homes and businesses as a point of comparison for those on the tour.

J. Bulk Purchase of Energy Efficiency and Conservation Products-Solar Hot Water Panels

While many of today's state-of-the-art energy efficiency devices will save money and energy over the life of the device, large initial purchase costs for them are an obstacle to their use for many individuals. One way to help lower these up front costs is to organize a bulk purchase of the product. Bulk purchasing helps lower the price in several ways:

- stronger bargaining power of the buyer
- better financing terms for the buyer
- lower administrative costs for the seller
- lower delivery and installation costs for the seller
- possibly more time and resources to investigate alternative products by the buyer
- possibly less packaging and energy for delivery of the product

Bulk purchases can be organized at various levels depending upon the interest demonstrated by the potential customers and the amount of resources available to the group organizing the bulk purchase. The municipality itself is one obvious entity – energy-efficient compact fluorescent bulbs can be purchased for all town buildings, for example. Bulk purchases can also be organized for members of civic or non-profit organizations, housing complexes, apartment buildings, city blocks or districts, or even whole towns.

An example of a very cost-effective project which can be organized by a town energy committee or other group would be the bulk purchase of solar hot water heaters. A survey can be conducted to determine the number of homes and businesses in town which currently use electricity for heating water and which have south-facing roofs. [Electric hot water is used as an example since it is the least efficient and most costly source for space and water heating, and therefore yields the quickest pay-back period. South-facing roofs simplify the installation of the panels, but neither south-facing roofs nor electric hot water need to be a requirement for participation in this program.]

The organizing committee can then seek bids from various companies for the purchase and installation of various quantities of panels (depending upon how many would eventually participate). Average estimates for the initial cost and payback period for each potential buyer can then be determined depending upon participation rate (the larger the participation, the lower the cost) and can be used to encourage individuals to sign up for the purchase. The company coming in with the best cost, service, and product would get the contract.

Similar bulk purchases can take place with energy-efficient compact fluorescent bulbs, water-saving shower heads, insulation, fire wood, heating oil, low-E insulating windows, insulating window quilts, and numerous other products.

K. Public Brainstorm for Town Sustainable Energy Policies

Citizens can convene and facilitate a public brainstorming session on sustainable energy policies for the town, with educational handouts available, as part of the process of development or review of the town energy plan and how it is to be implemented.

L. Sample Outdoor Lighting Efficiency and Pollution Code

Objectives

1. Promote energy-efficient lighting (use low pressure sodium where possible)
2. Minimize up light (night sky light pollution)
3. Avoid light trespass (light going where it is not wanted or needed)

All outdoor lighting plans must be submitted to and approved by the planning commission in site plan or subdivision review procedures. This code applies to outdoor artificial illuminating devices, outdoor fixtures, lamps and other devices, permanently installed or portable, used for flood lighting, general illumination or advertisement induding but not limited to search, spot and flood lights for:

- buildings and structures
- recreation facilities
- parking lots
- landscape lighting
- advertising and other signs
- street lighting
- walkway lighting

This code applies to the initial installation of light fixtures following the effective date of this ordinance and replacement of existing luminairs as they become inoperable with the following exemptions:

- light used for holiday decorations
- airport lighting which must be visible from the sky
- fluorescent lights 20 Watts and less per fixture and incandescent lights 60 watts and less per fixture

- incandescent lights between 60 and 150 Watts per fixture when controlled by a motion sensor to allow operation only when the lit area is occupied

Prohibitions and Requirements for Shielding

- The installation of street lights other than low pressure sodium is prohibited.
- Operation of searchlights for advertising purposes is prohibited between 11:00 pm and sunrise.
- All outside illumination for aesthetic or decorative purposes is prohibited between 11:00 pm and sunrise. Security lighting is excluded from this prohibition.
- No outdoor recreational facility, public or private, shall be illuminated between 11:00 pm and sunrise except to complete a specific organized recreational event in progress and under illumination in conformance with this ordinance.
- All lamps, except as noted in "exemptions", shall be fully shielded so that light rays emitted by the fixture are projected below the horizontal plane passing through the lowest point on the fixture from which light is emitted.

Illumination of Structures

- When illumination is required for all or part of a structure, the illuminating device shall be designed, located, and adjusted to deflect light downward so as to not cast light directly onto adjacent properties or roadways.

Illumination of Areas

- Lights used to illuminate parking areas and drives shall be so arranged to deflect light downward and away from adjacent areas and public highways. Lights shall be of a "downshield luminair" type where the light source is not visible from any public highway or adjacent properties.
- Illumination of other areas, either permanent or intermittent, shall be designed, located, and adjusted to deflect light downward so as to not cast light directly onto adjacent properties or roadways.

Illumination of Signs

- Signs shall have no moving parts.
- Signs shall have no flashing, moving intermittent lights or lighting of varying intensity.
- Light sources shall shine downward and shall be shielded from view from roadways and adjacent properties. No internally lit signs shall be permitted.
- The maximum surface brightness shall be five foot-candles,measured at the brightest point on the sign from a distance equal to the smallest dimension of the sign.
- All illuminated advertising signs, on and off premises, shall be off between 11:00 p.m. and sunrise, except that on premises signs may be illuminated while the facility on the premises is open to the public.

M. Van Pooling, Car Pooling, and Public Transportation

A project to encourage car and van pooling and public transportation can take several actions, such as setting up a computerized ride-share information center with inexpensive existing software, encouraging employers to facilitate the organization of ride-sharing groups and offer parking privileges for them, establishing ride-share commuter parking spaces in town, publicizing the considerable financial advantages and state assistance for ride-sharing, and educating on the use of existing public transportation.

N. School & Church Energy Education Initiative - S.T.E.M. Program

Savings Through Energy Management (S.T.E.M.) is an educational curriculum taught by Wilson Educational Services in Vermont and other states throughout New England, New York, and the provinces of Ontario and Nova Scotia, Canada. They are currently working to expand the program to other states throughout the country. The five day-long (one day per week) sessions in schools train students (grades 8 through 12), teachers, and custodians how to conduct an energy audit on the school and prepare a report with recommendations for cost-effective energy saving retrofits for presentation to the school board.

The S.T.E.M. training is partially funded by the state and the electric utilities, with the remainder provided by the school. S.T.E.M. has conducted trainings in about 30 Vermont schools to date with payback periods for the school's portion of the training equalling one year or less in all cases. Following the initial training, schools can incorporate a unit on energy use and auditing into the science curriculum, and students can learn to conduct audits of their school, student's homes, and other buildings in town.

S.T.E.M. has recently devised a similar program for church groups called Genesis. For information on the S.T.E.M. program in Vermont, contact Art Doty, Rural Box 204, Salisbury, VT 05769, Phone: 802/352-4344. To learn more about the S.T.E.M. program in other states, contact Carol Wilson; Wilson Educational Services, 314 Main St., Wallingford, CT 06492, Phone: 203/949-1570.

O. Compact Fluorescent Lamp and Lampshade Design Contest

Sponsorship of a design competition among Vermont craftspeople and businesses for lamps, lampshades, and fixtures to fit the various new compact fluorescent light bulbs would encourage their use, spread information about them, and promote Vermont businesses. Utilities and retailers can be asked to contribute prizes and publicity. Displays in town buildings and businesses would educate the public.

P. Idling Vehicle Program

Town energy committees can conduct an educational campaign, informing drivers that they will save gas, money, and the environment by turning their vehicles off if they are going to be stationary for longer than one minute.[13] This information might be conveyed through an energy committee newsletter, driver education courses, or signs posted throughout the town in locations where cars often sit idling (bank drive-up windows, local stores, parking lots, school pick-up locations, parking areas near recreation fields, etc.).

Q. Community Energy Conservation Teams

Perhaps the most efficient and effective means of implementing many of the initiatives suggested above would be to train a team of concerned citizens who would canvas homes and businesses throughout the community, sharing information and encouraging participation in the programs. The Community Energy Conservation Team (CECT) members can be equipped with information and materials to facilitate education and program implementation. Some of the materials CECT members might carry with them include:

- An energy survey which would help the town energy committee or CECT determine which programs would be most effective for which individuals and for the community as a whole.
- Informational materials on available utility Demand Side Management programs

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13 Environmental Action Magazine, July/August, 1989, *Reforming the Automobile.*

Table 3. 1990 State-wide Expenditures, All Fuels, by Sector[16]

Fuel Type	$ Million/Yr	% of Total Expenditures
Residential	$370.88	32%
Commercial	$203.31	18%
Industrial	$155.58	14%
Transportation	$420.17	37%
Total	$1,149.94	100%

The *VCEP* contains projections for energy costs and consumption. Using estimates for potential energy and cost savings from recommended policies and programs, a town energy committee can apply the state projections to a town's figures to determine future consumption and costs both with and without proposed conservation and efficiency measures in place. This information can be used to support the committee's recommendations, and priorities can be determined by considering energy savings, pollution reduction, and potential cost savings from possible options.

Estimating town energy consumption based on state consumption figures is not a particularly accurate or preferred method because the demographics and characteristics of any given town can vary from state averages. However, if a town energy committee does not have the time or resources to conduct a more accurate assessment of the town's energy consumption through a survey, or is unable to get fuel dealers to provide the necessary information, such estimates may be a necessary substitute. The following is a step by step process for extrapolating a town's residential and commercial energy use figures from state figures. While this process could be used to estimate town figures for all fuel types, much more accurate electric use figures can generally be obtained from the electric utility companies which serve the town.

Extrapolating Town Residential Energy Use From State Figures

1. Obtain the state-wide consumption figure for any particular fuel source from Table 4 below. This number will have units of TBtu, a "general purpose" energy unit equal to one trillion BTU's. (A conversion to more familiar units will be done in Step 5).
2. ObtaIn the April 1990 census population of your town from your town clerk.
3. Divide the town population by the April 1990 figure for the total population of Vermont (566,000).
4. Multiply the state-wide consumption figure from Step 1 by the factor from Step 3, to yield an estimate of the town's consumption (in TBTU) in the residential sector.

16Vermont Comprehensive Energy Plan, Table 3.1, p. 35

5. Multiply the figure obtained in Step 4 by the appropriate conversion factor in Table 6 to yield an estimate of the town's consumption in any given fuel's commonly used measurements.

6. Multiply the town's consumption in common fuel units from Step 5 by the average local price per unit, to obtain the total town's expenditure for residential fuel use.

Note that this technique is subject to the following errors:

a. In some towns, a significant number of homes may be seasonal. In such a case, instead of using the census population of your town (Step 2) use the number of year-round housing units for the town, identified by using 1990 Census data to get the total housing units and subtracting the number of seasonal, recreational or occasional use housing units. (The 1990 Census data is available from many resources including town clerks, regional planning commissions, State Libraries 802/828-3268, and the Department of Public Service.) Then, for Step 3, divide the number of town year-round housing units by the state-wide number which is approximately 226,000, and use this factor in Step 4.[17] It may be wise to calculate the factor both ways (by population and by year-round household) and use the average.
b. The pattern of fuel use may vary significantly from town to town (e.g. some towns may burn more wood and less oil than the statewide average).

Extrapolating Town Commercial Energy Use From State Figures

1. Obtain the statewide consumption figures (see Step 1 in the residential procedure) using instead Table 5.
2. Obtain the April 1990 census employment population of your town. This number gives an. indication of the level of business activity in the town.
3. Divide the town employment population from Step 2 by the April 1990 figure for the employment population of Vermont (251,958).
4. Complete the calculation as in Steps 4 -6 in the residential section (see above). Note that the commercial figures from Table 5 include municipal consumption (schools, town hall, etc.).

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[17]According to the 1990 U.S. Census, total housing units for Vermont is 271,214, less 45,405 seasonal, recreational, or occasional use housing units results in 225,809 year-round housing units in Vermont.

Table 4. Statewide Residential Energy Demand in TBTUs[18]

Fuel	Year 1990	2010
Natural Gas	2.06	4.62
Oil	9.96	13.36
Coal	0.16	0.26
Wood	6.79	6.55
Solar	0.06	0.16
Electric	7.38	10.74
LPG	2.37	4.36
Total:	28.78	40.05

Table 5. Statewide Commercial Energy Demand in TBTUs[19]

Fuel	1990	2010
Natural Gas	1.23	2.01
Oil	4.43	6.1
Coal	0.17	0.48
Wood	0.33	0.19
Solar	O	O
Electric	5.02	7.25
LPG	0.58	0.96
Total:	11.76	16.99

Table 6. Energy Conversion Factors[20]

Cubic feet of Natural Gas/TBTU	1,000,000,000
Gallons of Heating Oil/TBTU	7,210,300
Short tons Anthracite/TBTU	39,370.08
Cords of Wood/TBTU	49,504.95
kWh of Electricity/TBTU	293,000,000
Gallons of LPG/TBTU	10,948,905

Financial Drain on the Community

Estimating the amount of money spent on energy which leaves the community varies from one fuel source to the next.

18Yermont Comprehensive Energy Plan, Table 3;6, p. 42
19Yermont Comprehensive Energy Plan, Table 3.10, p. 44
20personal communication, Vermont DPS, Montpelier, VT

Electricity The amount of money returned to the community would comprise: taxes paid to the town for power lines, rights of way, etc.; salaries paid to utility company employees residing in the town; and contributions made by the utility to the town. These figures can be obtained from your utility company.

Heating Oil, Propane and Coal Calculation of the amount of money retained in the community for these fuels may be estimated from the margin (difference between the wholesale and retail price of the fuel). It can be assumed that most of the margin stays within the community in the form of wages, taxes, and materials purchases. [This information is available in a US Dept. of Energy publication "Heating Oil Prices & Margins." A recent study by Rocky Mountain Institute[21] has shown that, on average, $.70 to $.80 of every $1 spent on fuel leaves the community.]

Wood and Solar It is difficult to estimate the amount returned to the community for these fuels. Most of the wood is harvested locally is used locally - chunk fuel wood typically travels less than 20 miles from the stump, and although chips may be trucked more than 100 miles, they are typically used less than 75 miles from where they were grown. Therefore, most of the money spent for wood is recycled in the community. The 1981 Brighton Energy Study by the Northeast Kingdom Community Action found that 88% of the money generated through fuel wood stays in the local economy. It can be assumed that all of the relatively small amount spent on solar leaves the community for towns with no solar businesses.

21Rocky Mountain Institute, 1739 Snowmass Creek Road, Snowmass CO 81654-9199, FAX: (303) 927-4178, Phone: (303) 927-3851.

IV. Funding and Financing Options

A variety of options exist to assist a town with planning and implementing energy conservation, efficiency and renewable energy measures. These measures include volunteer assistance, funding (grants, gifts, or other funds that do not have to be paid back), and financing (borrowed funds, like low-interest loans and revolving loan funds, which do have to be paid back).

The sources of the funds/materials/labor requested should be appropriately matched to the size of the improvements. For instance, a small town which only needs to insulate the town clerk's office may need only a volunteer team on a Saturday and a small investment of the cost of the materials from the town budget.

The following is a list of some of the options available to towns.

A. Funding and Financing Opportunities for Town Energy Planning

- Volunteer energy committee members and town residents with specific expertise
- State planning funds available through your regional planning commission
- Funds from the town's general budget
- Town's discretionary funds
- Line item in the town's budget
- Special item on the Town Warning
- Foundation grants
- Town fundraising events for this purpose

B. Funding and Financing Opportunities for Implementing Town Energy Plans

- Volunteer labor - town residents, student interns, etc.
- Student volunteers or interns ("student brigades") for construction, retrofit, etc.
- Donations of materials - from local building and equipment suppliers, manufacturers, etc.
- Funds from the town's general budget
- Town's discretionary funds
- Line item in the town's budget
- Special item on the Town Warning
- Tax-free municipal bond funds
- Town revenue-raising initiatives
- Borrowing from endowment
- Grants - from foundations, state agencies, donors, etc.
- Loans from conventional sources (banks)
- Loans or leases from non-traditional sources, such as socially-responsible investment companies.
- State aid available to schools and sites
- Vermont electric utility companies and Vermont Gas Systems are in various stages of developing and implementing demand-side management programs which provide funds and services to their customers to help with implementing energy saving initiatives. The services available vary from utility to utility, and may include: an energy assessment, reduced prices for energy-efficient lighting, technical assistance, fuel-switching

information, financing information and assistance, and free installation of a comprehensive package of cost-effective electrical or natural gas measures.

- Town revolving loan funds for energy investments - money from this fund can be loaned to town residents and businesses to invest in energy-efficient devices and conservation measures. Borrowers repay the loans through the savings on energy bills resulting from conservation and efficiency measures. The money is then available for additional energy investment loans.
- Energy service companies (ESCOs), both non-profit and for-profit, can provide "shared-savings" arrangements, a way to finance energy improvements with little or no risk and no up-front cost to the town. An ESCO can develop an arrangement with a municipality whereby the ESCO purchases and installs (and sometimes operates) the energy improvements and the town pays the ESCO an agreed-upon portion of the savings (the difference between the "before" and "after" energy bills, with appropriate adjustments). This option is limited to buildings with large energy bills.

C. Specific Funding and Financing Opportunities in Vermont

Vermont Energy Investment Corporation (VEIC), a non-profit ESCO (see above), operates the Home Energy/Improvement Loan Program which provides technical assistance, energy audits, and financing to low and moderate income Vermonters for energy improvements to their homes. VEIC has provided innovative financing for energy efficiency installations in public housing developments. VEIC also developed and now delivers Energy Rated Homes of Vermont and the "Energy-efficient Mortgage" - programs to incorporate energy efficiency into the mortgage lending process in Vermont (see Appendix I, page 56 for a more complete description of these programs). Contact Beth Sachs, VEIC, 7 Lawson Lane, Burlington, VT 05401, 802/658-6060, FAX: 802/658-1643.

Vermont Department of Social Welfare and the regional Community Action Agencies run the Low Income Home Energy Assistance Program which provides monthly assistance to those who qualify. Funds are also available to cover extreme or unanticipated emergencies. See the white pages of the phone book for local Vermont Department of Social Welfare contacts. See 'Weatherization Program - Community Action Agencies," page 87 in Appendix V for regional Community Action Agency contact information.

Vermont Economic Opportunity Office administers the Low Income Weatherization Program (see Appendix I, page 56) which provides free effective energy conservation measures to those who qualify. Contact 802/241-2452.

Vermont Department of Forests, Parks and Recreation in cooperation Vermont Department of Transportation have grants available for planning and implementing bike paths. Contact Mike Frasier, Vermont Department of Forests, Parks and Recreation, 802/244-8713. 1

Vermont Department of Transportation has state and federal funds available for planning and implementing mass transportation, rail, and air projects. Contact Jeff Squires, Director of Planning for the Agency of Transportation, 802/828-3441.

Vermont Department of Forests, Parks and Recreation channels federal matching funds for acquisition and development of land for recreational trails. Contact Mike Frasier, Vermont Department of Forests, Parks and Recreation, 802/244-8713.

Vermont Regional Planning Commissions have federal and state Agency of Transportation funds available to orchestrate a cooperative, collaborative planning process with town selectboards for decentralized transportation planning to sort and address local/regional priorities. See Regional Planning and Development Commissions, page 86 in Appendix V for regional contact.

Vermont Department of Public Service Energy Conservation Planning and Interest Reduction Programs for Schools, Public Housing and State-supported Non Profit Organizations. Contact Lois Jackson at 802/828-2393 or 800/642-3281.

Vermont electric utilities have developed demand side management (DSM) programs which offer financial incentives as well as education, technical assistance and training to encourage and assist customers to incorporate conservation, efficiency, and fuel-switching changes (see "Demand Side Management Education Program" on page 54). Contact your electric utility to ask for details on their DSM programs.

V. Information Resources

A. Renewable Energy Resources

1. Wood Resources - Forestry consultations are available to towns and private landowners through the Vermont Department of Forests, Parks, and Recreation's County Foresters and from private foresters.

Vermont Department of Forests, Parks, and Recreation is the state agency that administers all state programs relevant the management and use of Vermont's woodlands, including the Use Value Appraisal Program. The address and phone number for the forestry division are:

Vermont Department of Forests, Parks, and Recreation
Forestry Division
103 S. Main St., Building 10 S
Waterbury, VT 05671-0602
802/244-8713

District Forestry Managers are the regional representatives of the Forestry Division of the Department of Forests, Parks, and Recreation. They are the supervisors of the county and state land foresters and are responsible for overseeing the implementation of the Department's programs.

DISTRICT 1 - 802/886-2215
John (Jay) Maciejowski
Forests, Parks & Recreation
RR 1, Box 33
North Springfield, VT 05150

DISTRICT II - 802/483-2314
John (Jay) Maciejowski
Forests, Parks & Recreation
RR 2, Box 2161
Pittsford, VT 05763

DISTRICT III - 802/879-6565
James Cronin
Forests, Parks & Recreation
111 West Street
Essex Junction, VT 05452

DISTRICT IV - 802/479-3241
William Moulton
Forests, Parks & Recreation
324 North Main Street
Barre, VT 05641

DISTRICT V - 802/748-8787
James Horton
Forests, Parks & Recreation
184 Portland Street
St. Johnsbury, VT 05819

Vermont County Foresters County foresters are responsible for implementing the Department's programs. They answer questions about forestry activities and management, provide referrals, and conduct site visits for towns, conservation commissions, and individuals. They may also be able to assist a town energy committee in estimating the quantity and quality of the town's wood resources and to give advice on how to manage it. The following is a list of Vermont County Foresters:

James Tessmann
Franklin/Grand Isle Counties
6 Valley Crossroads
St. Albans, VT 05478
802/524-6501 FAX 524-6062

George Buzzell
Orleans County
P.O. Box 474
Newport, VT 05855
802/334-7325

Paul Frederick
Lamoille County
RFD 1 Box 2300
Morrisville, VT 05661
802/888-5733

William Hall
Chittenden County
111 West Street
Essex Jet., VT 05452
802/879-6565

Russell Barrett
Washington County
324 North Main St.
Barre, VT 05641
802/479-3241

Steve Slayton
Caledonia/Essex Counties
184 Portland St.
St. Johnsbury, VT 05819
802/748-8787

Dave Brynn
Addison County
RFD #4 Box 1308
Middlebury, VT 05753
802/388-4969

David Pagnelli
Orange County
324 North Main St,
Barre, VT 05641
802/479-3241

James Philbrook
Rutland County
Pittsford Academy
RFD 2 Box 2161
Pittsfield, VT 05763
802/483-2314

Jon Bouton
Windsor County
6 Gilman Office Center
White River Jet., VT 05001-2037
802/296-7630

James White
Bennington County
P.O. Box 980
Bennington, VT 05201
802/447-7106

Bill Guenther
Windham County
P.O. Box 2430
West Brattleboro, VT 05301
802/257-7967 FAX 257-0112

Vermont Association of Consulting Foresters provides a list of qualified and conscientious independent foresters in the state. Call the county foresters to get a current directory of Vermont Association of Consulting Foresters.

Vermont Department of Public Service has a wood energy specialist who can provide information and assistance to larger users - 802/828-2811.

Written Resources

Planning for the Future Forest: A Supplement to the Planning Manual for Vermont Municipalities will help raise awareness of forest issues and enable towns to identify their more important forest lands. Vermont Department of Forests, Parks, and Recreation and University of Vermont Extension Service, 1991,54 pages.

Vermont Fuel Wood Assessment Survey, 1989-1991, Vermont Department of Public Service, 1991. Technical Report #22, 15 pages.

Forest Statistics for Vermont: 1973 *and* 1983, Frieswyk, Thomas S. and Anne M. Malley, 1985. USDA Forest Service Resource Bulletin NE - 87, 102 pages.

Biomass Statistics for Vermont - 1983, Frieswyk, Thomas S. and Anne M. Malley, 1986. USDA Forest Service Resource Bulletin NE - 91, 105 pages.

Developing Markets for Low Quality Wood: Wood Supply in Bennington County and Surrounding Area, U.S. Forest Service, Green Mountain National Forest, 1990, 37 pages.

Governor's Task Force on Wood as *a Source of Energy,* State of Vermont, 1975, 73 pages.

2. Solar Resources

Organizational Resources:

American Solar Energy Society
2400 Central Avenue, Suite B-1
Boulder, CO 80301
303/443-3130
(National association of firms and individuals interested in solar energy)

Independent Power & Light
RR1 Box 3054
Hyde Park, VT 05655
802/ 888-7194
(Firm specializing in design, sales, installation, & service of solar electric and micro-hydro systems)

National Renewable Energy Laboratory
1617 Cole Boulevard
Golden, CO 80401-3393
303/231-1243
(Primary national renewable energy research agency)

Solar Components Corporation
Manchester, NH
603/668-8186
(Solar equipment retail company)

NESEA (NorthEast Sustainable Energy Association)
23 Ames Street
Greenfield, MA 01301
413/774-6051
(Regional association of firms and individuals interested in renewable energy and energy efficiency)

Passive Solar Industries Council
1090 Vermont Avenue NW, #1200
Washington, DC 20005
202/371-0357
(National association of passive solar firms)

Solar Energy Industries Association
777 North Capitol Street, NE
Washington, DC 20002
202/408-0660
(National association of solar manufacturers, distributors, and contractors)

Solar Works, Inc.
64 Main Street
Montpelier, VT 05602
802/223-7804
(Firm specializing in design, sales, installation, & service of solar thermal, solar electric, micro-hydro, and wood-fired water heating systems)

Sunnyside Solar
RD4 Box 808
Brattleboro, VT 05301
802/257-1482
(Firm specializing in design, sales, installation, & service of solar electric systems)

Vermont Department of Public Service (DPS)
120 State Street
Montpelier, VT 05602
802/828-2393
(Vermont's primary energy information agency)

Vermont Solar Electric Systems
69 Thibault Parkway
Burlington, VT 05401
(Firm specializing in design, sales, installation, & service of solar electric systems)

Marc Rosenbaum
Energy Smiths
POBox 194
Meriden, NH 03770 603/469-3355
(Solar, architectural design, and engineering consultant)

Library Resources:

Books:

The Homeowner's Complete Handbook for Add-On Solar Greenhouses & Sunspaces, Andrew M. Shapiro, Rodale Press, Emmaus, PA, 1985.

The New Solar Home Book, Bruce Anderson, Brick House Publishing, Andover, MA,1987.

Passive Solar Design Strategies: Guidelines for Home Builders, Burlington, VT, Passive Solar Industries Council, 1989 (Available from Vermont Department of Public Service, Montpelier, VT)

The Solar Electric House, Steven J. Strong, Rodale Press, Emmaus, PA, 1987.

Journals:

Home Power, The Hands-On Journal of Home-Made Power/ PO Box 130, Hornbrook, CA 96044-0130/ 916/475-3179

Northeast Sun/ NESEA (see above for address)

Solar Today/ American Solar Energy Society (see above for address)

3. Hydroelectric Resources

Organizational Resources:

Vermont Independent Power Producers, 26 State St., Montpelier, Vt.

Granite State Hydropower Association, Inc., c/o National Hydro, 99 Bedford St., Boston, MA 02111, 617/357-9027

Agency of Natural Resources, Waterbury, Vt., 802/244-5638

Department of Environmental Conservation, (part of above)

Department of Public Service, Montpelier, Vt., 802/828-2811 information on rates available for independent power producers

Federal Energy Regulatory Commission, 825 North Capital St., NW. Washington, D.C. 20426

US Army Corps of Engineers, Waltham, MA. (also each flood control dam maintains it own records).

US Geological Survey, Montpelier, Vt. (detailed statistical data on stream and river flow).

Contractors and Consultants

David Palumbo, Independent Power and Light, RRl Box 3054, Hyde Park, VT 05655, 802/888-7194 (Firm specializing in design, sales, installation, & service of solar electric and micro-hydro systems)

Giovanna Peebles, Vermont State Archeologist, Montpelier, Vt.

Richard Balagur, RR 1, Box 68, Thetford Center, VT 05075, 802/785-4514.

Jay Boeri, P.E., Woodstock, Vt., 802/436-521

Mark Drabrick, Homestead Energy Systems, 28 Elm St., Lebanon, NH 03766, 603/448-0571. Stand alone and utility interface systems under 100 KW.

Roger Lamson, Attorney, North Hartland, Vt., 802/295-3316

Robert DesRosiers, Fairbanks Mills, Emerson Falls, RD 2, Box 66, St. Johnsbury, VT. 05819,802/748-8094 (office) / 748-5060 (home).

Daniels Construction, Ascutney, Vt.

Quicksilver Construction, Burlington, Vt.

Textbooks

Justin and Kreeger, *Hydroelectric Development* (Out of Print) (The classic text available at Baker Library, Dartmouth College)

C.C. Warnick, *Hydropower Engineerings*, Prentice Hall, Engelwood Cliffs, NJ., 1984 - (Excellent, somewhat technical and oriented toward larger projects.)

A.F. Patzig, V.P. - A most reliable, and simple low head turbine Ossberger Turbines
5709 South Laburnum Avenue
Richmond, Virginia 23231
804/226-9180

4. Wind Resources

American Wind Energy Association, 777 North Capitol Street, NE, Suite 805, Washington, DC 20002, USA, phone 202/408-8988, FAX 202/408-8536. AWEA is the national trade association for the wind energy industry and has a number of background documents on wind available.

"Wind Energy Technical Information Guide," a basic bibliography of all kinds of wind technical literature developed by the Solar Energy Research Institute (now the National Renewable Energy Laboratory) in 1989. This is the best guide to wind literature available today. Contact the Technical Information Program at the National Renewable Energy Laboratory, 1617 Cole Boulevard, Golden, CO 80401, USA, phone 303/231-1000.

Towns that Use the Wind

Princeton, Massachusetts: The first municipal wind power plant to be installed in the United States is still operating on Mount Wachusett in central Massachusetts. Eight Enertech 13-meter turbines were installed by the Princeton Municipal Light Department on the 1,800-foot mountain's top in 1983 at a cost of $700,000. According to Sharon A. Staz, manager of the utility, the turbines generate 40,000-45,000 kWh per year, or about 4.5% of the town of Princeton's electrical needs.

Hamilton College, Clinton, New York: Hamilton College began operating a wind generator February 18, 1992, to power one of its student dormitories. The wind turbine was proposed by Steedman Bass, a 1991 Hamilton graduate who convinced his classmates to present it to the college as their senior gift. The machine was installed by Bannertown Power and Light of Forest Hills, NY. It is a used 20-kW Jacobs turbine with a 120-foot tower and cost the college $42,000.

Marshall, Minnesota: The town of Marshall, MN, has signed an agreement to purchase 1 million kWh of electricity per year from Minnesota Windpower. The wind company was hoping to install five windfarm-scale turbines by the end of 1991.

5. Cogeneration and Methane Collection

Vermont Department of Public Service - 802/828-2811 or 800/642-3281

Dynamic Integrations (cogeneration)
POBox 103
Thetford, Vermont 05074
802/333-9689

Cogeneration Journal $82/yr
PO Box 14227
Atlanta, Georgia 30324
404/925-9388
(Published by the Association of Energy Engineers, Cogeneration Institute

Cogeneration and Small Power Production Manual
Scott A. Spiewak
Published by Fairmont Press, 1988
Lilburn, GA 30247

Envirologic, Inc. (methane collection)
139 Main St.
Brattleboro, VT 05301
802/254-9456

5. Energy Conservation Engineers and Consultants

Catalyst Group (economic energy analysis)
139 Main Street
Brattleboro, VT 05301
802/254-8144

Dynamic Integrations (cogeneration)
POBox 103
Thetford, Vermont 05074
802/333-9689

Energy Conservation Group
P.O. Box 185
Montpelier, VT 05602
802/492-3541

Energy Efficiency Associates
P.O. Box 78
Calais, VT 05648
802/229-4675

Vermont Energy Investment Corp.
7 Lawson Lane
Burlington, VT 05401
802/658-6060

B. Transportation Resources

Books

Gordon, Deborah. 1991. *Steering A New Course: Transportation, Energy, and the Environment.* Union of Concerned Scientists. Island Press, Washington, D.C.

Zuckermann, Wolfgang. 1991. *End of the Road: The World Car Crisis and How We Can Solve It.* Chelsea Green, Post Mills, VT.

Organizations:

American Public Transit Association. 1201 New York Ave., NW; Washington, D.C., 20005.

Vermont Public Transportation Association. PO Box 1169; White River Junction, VT, 05001.

Information Sources

Hall, Bob and Kerr, MaryLee. 1991 (published annually). *Green Index.* Island Press, Washington, D.C.

Federal Highway Administration, U'S. Dept. of Transportation. 1990. *Selected Highway Statistics and Charts,* 1988.

Highway Users' Federation. 1990. 1776 Mass. Ave, NW; Washington, D.C. 20036. 1990. *Highway Fact Book.*

Bicycle Institute of America, Washington, D.C.. 1990. *Bicycling Reference Book.*

C. Land Use Resources

Planning Advisory Service (PAS) Reports, available from the American Planning Association, 1313 E. 60th St., Chicago, IL 60637. Phone: 312/955-9100 FAX: 312/955-8312.

- *Energy-Efficient Planning: An Annotated Bibliography.* Efraim Gil. March 1976. 22pp. $16; PAS subscribers $8.
- *Energy-Efficient Land Use.* Duncan Erley, David Mosena, and Efraim Gil. May 1979. 25pp. Xerox. $16.
- *Energy in the Cities Symposium.* Joel T. Werth, ed. April 1980. 44pp. $20. PAS subscribers $10.
- *Energy-Conserving Development Regulations: Current Practice.* Duncan Erley and David Mosena. August 1980. 58 pp. Xerox. $16.

D. Town Energy Planning Resources

1. State Resources

Vermont Department of Public Service (DPS)/Energy Efficiency Division. The Energy Efficiency Division of the Vermont DPS has an energy engineer and staff, and can provide information and technical assistance on energy conservation programs, renewable energy resource use and assessment, building codes, and transportation systems. The Energy Office is eager to coordinate its work with local planning to encourage the inclusion of provisions which promote efficiency, conservation and development of local renewables. It has a wood energy specialist on staff and it maintains a listing of businesses that advise on and assist with developing energy efficiency and renewable energy resources. Vermont Department of Public Service /Energy Efficiency Division, 120 State Street, Montpelier, Vermont 05620, 802/828-2811 or 800/642-3281.

2. Environmental Organizations

Town Energy Planning EarthRight Institute, the Global Climate Change Project, and the Vermont State Energy Office can assist towns in developing and implementing a town energy plan in Vermont. EarthRight Institute, Gates-Briggs Building, Room 322, White River Ict., VT 05001, 802/295-7734; Global Climate Change Project, do Jean Rosenberg, RD 1 Washington S1. Extension, Middlebury, VT 05753, 802/388-6453

Energy-Related Legislation For a review of proposed energy and other environmental bills before the state legislature, contact the Vermont Public Interest Research Group and the Vermont Natural Resource Council. They can also be helpful with other information and contacts on energy issues in Vermont. VNRC,9 Bailey Avenue, Montpelier, Vermont 05602,802/223-2328. VPIRG,43 State Street, Montpelier, Vermont 05602, 802/223-5221.

3. Resources Outside Vermont

There is growing interest in the implementation of energy conservation at the town level throughout the United States and Canada. Towns interested in implementing energy plans should obtain ideas and experience on what works and doesn't from these other sources:

Rocky Mountain Institute
1739 Snowmass Creek Road
Snowmass CO 81654-9199
FAX: 303/927-4178
Phone 303/927-3851

The Institute is currently preparing a guide to towns for conserving energy and implementing renewable energy sources as part of their economic development program. They have completed a pilot project in their county (Pitkin) which tests their methodology. Contact RMI for information and availability.

Union of Concerned Scientists
26 Church St.
Cambridge, MA 02236
617/547-5552

The UCS is also preparing a conservation and renewable energy guide for towns, as part of their Renewables Are Ready program. They expect to complete the guide during the summer of 1992. ContacfUCS for information and availability.

Urban C02 Project
International Council of Local Environmental Initiatives
City Hall, 8th Floor
East Tower
100 Queen St. West
Toronto, Ontario M5H 2N2
Canada
Phone: 416/392-1462
Fax: 416/392-1478

The project is determining ways to reduce C02 emissions by implementing energy conservation measures in towns and cities in Canada.

Osage Municipal Utilities
PO Box 207
Osage, IA 50461
Contact person: Weston Birdsall
515/732-3731

The town of Osage, Iowa adopted and then implemented an ambitious energy plan which enabled them to substantially reduce dependence on energy sources outside their town.

4. Regional Planning Commissions (RPCs)

RPCs are a valuable resource to anyone involved in any phase of town planning. More and more towns will be writing thoughtful and creative energy plans which may be a useful resource for other towns. Your regional planning commission can help locate and obtain them.

Addison County Regional Planning and Development Commission
RD 1 Box 275
Middlebury, VT 05753
Phone: 802/388-3141
Executive Director: Sandi Young
Chair: William Sayre

Bennington County Regional Commission
Box 342
Arlington, VT 05250
Phone: 802/375-2576 or 375-9964
Executive Director: Gregory G. Burke
Chair: Gedeon LaCroix

Central Vermont Regional Planning Commission
26 State Street
Montpelier, VT 05602
Phone: 802/229-0389
Executive Director: Susan M. Sinclair
Chair: Phil Tone

Chittenden County Regional Planning Commission
P.O. Box 108
Essex Junction, VT 05452
Phone: 802/658-3004
Executive Director: Arthur R. Hogan, Jr.
Chair: Raymond E. Sterns

Franklin-Grand Isle Regional Planning & Development Commission
140 South Main Street
St. Albans, VT 05478
Phone: 802/524-5958
Executive Director: Sharon Murray
Chairman: Bernard Keefe

Lamoille County Planning Commission
RR1 - Box 2265
Morrisville, VT 05661
Phone: 802/888-4548
Executive Director: Barbara Farr
President: Duncan Nash

Northeastern Vermont Development Association
P.O. Box 640
St. Johns bury, VT 05819
Phone: 802/748-5181
Executive Director: Charles E. Carter
President: Francis Emmons

Rutland Regional Commission
P.O. Box 965
Rutland, VT 05701
Phone: 802/775-0871
Executive Director: Mark Blucher
Chair: Mary Okin

Southern Windsor County Regional Planning & Development Commission
P.O. Box 88
Windsor, VT 05089
Phone: 802/674-9201
Executive Director: Thomas Kennedy
Chair: John Stahura

Two Rivers-Ottauquechee Regional Planning & Development Commission
King Farm
Woodstock, VT 0509C71
Phone: 802/457-3188
Executive Director: Don A. Bourdon
Chair: Peter J. Hennison

Upper Valley-Lake Sunapee Regional Planning Commission
Heater Road, RR1 Box 123
Lebanon, NH 03766
Phone: 603-448-1680
Executive Director: Bruce Bender
President: David Roby

Windham Regional Planning & Development Commission
39 Main St.
Brattleboro, VT 05301
Phone: 802/257-4547
Executive Director: Colonel L. (Lew) Sorenson
Chair: Hendrick W. Van Loon

5. Conservation Commissions

Municipal conservation commissions can be established in Vermont by act of the selectmen or by public vote, according to 1977 state legislation. The major goal of a conservation commission is to establish effective community responsibility for its natural resources. They have considerable scope in what they can do.

Municipal conservation commissions can work effectively with local, regional, and state organizations and agencies. A conservation commission can carry out an inventory, write a natural resource plan, and make recommendations that may be included in the town plan. Conservation commissions can also assist planning commissions with the review, evaluation, and development of proposals. The conservation commission can form solid waste and energy committees to deal with those issues in town. It might also appoint a joint member to those committees and the planning commission as a means of providing effective communication between planning and conservation commissions and town committees.

In addition, whereas a planning commission must plan for a variety of needs, including housing, economic and educational, and environmental concerns, a conservation commission can focus its energies on conservation and thereby ensure that the conservation interests of their community are being addresses. An unexpected benefit of conservation commissions is that the mere presence of such commissions has encouraged residents to approach commissions with conservation concerns.

6. Weatherization Program - Community Action Agencies
This program offers horne energy audits, energy conservation and efficiency products, and installation and retrofit services FREE to Vermont residents who qualify on the basis of income. In Vermont, the program is run by the State Economic Opportunity Office 802/241-2452 and administered by regional Community Action Agencies.
To find out who is eligible for Weatherization services and to sign up as a client, individuals should call or write the Community Action Agency listed below for their county.

County	Community Action Agency	Phone
Bennington Rutland	Benntngton-Rutland Opportunity Council (BROC) P.O. Box 327 (257 South Main SO Rutland, Vermont 05701	802/775-0878
Lamoille Orange Washington	Central Vermont Community Action Council (CVCAC) 15 Ayers Street Barre, Vermont 05641	800/622-4495
Addison Chittenden Franklin Grand Isle	Champlain Valley Office of Economic Opportunity (CVOEO) P.O. Box 1603 (191 North Street) Burlington, Vermont 05402	800/642-5078
Caledonia Essex Orleans	Northeast Employment & Training Organization (NETO) P.O. Box 186(144 Railroad Street) S1. Johnsbury, Vermont 05819	802/748-8935
Windham Windsor	Southeastern Vermont Community Action (SEVCA) P.O. Box 369 Bellows Falls, Vermont 05101	800/464-9951

7. Energy Publications
Energy Publications Lists The following organizations have published articles, papers, booklets, information sheets, and/or teaching curriculums on many energy related issues. Write or call them for a list of their publications.

Non-Governmental Organizations
Alliance to Save Energy
1725 K Street N.W., Suite 914
Washington, D.C. 20006-1401
202/857-0666

American Council for an Energy-efficient Economy
1001 Connecticut Ave, N.W., Suite 801
Washington, D.C. 20036
202/429-8873

Center for Rural Studies
[Town Energy Planning: A Framework for Action, 1983]
Morrill Hall
University of Vermont
Burlington, VT 05405
802/6563021

EarthRight Institute
Gates Briggs Building Room 322
White River Junction, VT 05001
802/295-7734

Energy Conservation Group
P.O. Box 185
Montpelier, VT 05602
802/492-3541

National Energy Foundation
5160 Wiley Post Way
Salt Lake City, Utah 84116
801/539-1406

Rocky Mountain Institute
1739 Snowmass Creek Road
Snowmass, CO 81654-9199
303/927-3128

Union of Concerned Scientists
26 Church Street
Cambridge, MA 02238
617/547-5552

Vermont Natural Resources Council
9 Bailey Avenue
Montpelier, VT 05602
802/223-2328

Vermont Public Interest Research Group
43 State Street
Montpelier, VT 05602
802/223-5221

World Resources Institute
1709 New York Avenue, N.W.
Washington, D.C. 20006
202/638-6300 FAX 202/638-0036

Worldwatch Institute
1776 Massachusetts Avenue, N.W.
Washington, D.C. 20036
202/452-1999

State Agencies

Vermont Agency of Transportation
133 State Street
Montpelier, Vt. 05602
802/828-2573

State of Vermont Agency of Natural Resources
103 S. Main Street Laundry Building
Waterbury, Vermont 05671-0407
802/244-9616

Vermont Department of Public Service
120 State Street
Montpelier, VT 05620
802/828-2811 or 800/642-3281

N.H. Governor's Energy Office
2 1/2 Beacon Street
Concord, N.H. 03301
603/271-2711

Federal Agencies

U.S. Department of Energy
Editorial Services Office of Public Affairs
Washington, D.C. 20585
202/586-5000

The Conservation and Renewable Energy Information Service
PO Box 8900
Silver Spring, MD 20907
800/523-2929

National Appropriate Technology Assistance Service
U.S. Department of Energy
PO Box 2525
Butte, MT 59702-2525
800/428-2525

8. Vermont Electric Utility Companies

There are twenty eight electric utility companies providing service to municipalities, businesses and individuals throughout the state of Vermont. At the printing time of this guide, five of these utilities have already developed demand side management programs for their customers which encourage energy conservation. The remaining utilities will soon be developing their own programs. The names and contact information for the Vermont electric utilities are listed below – those currently with demand side management programs are listed first, followed by the others. For information on what programs are presently or will soon be available to you, contact the electric utility serving your area.

Vermont Electric Utilities with Demand Side Management Programs

Burlington Electric Department
585 Pine Street
Burlington, VT 05401-4891
802/658-0300

Central Vermont Public Service Corp.
77 Grove Street
Rutland, VT 05701
802/773-2711

Citizens Utilities Company
Mary Ann Shepherd,
Energy Services Coordinator
P.O. Box 604
Newport, VT 05855
802/334-6538

Green Mountain Power Corp.
Energy Management Services
Green Mountain Drive
Box 850
South Burlington, VT 05402
802/864-5731
800/499-5731

Washington Electric Corp.
Box 8
East Montpelier, VT 05651
802/223-5245

Vermont Electric Utilities Developing Demand Side Management Programs

Allied Power and Light Co.
218 Elm St.
P.O. Box 26
Pittsford, VT 05763
802/483-2211

Barton Village Electric Department
Box D
Barton, VT 05822
802/525-4747

Enosburg Falls Water & Light
Department, Inc.
RR4 Box 80
Enosburg Falls, VT 05450
802/933-5544

Franklin Electric Light Co,
P.O. Box 96
Franklin, VT 05457
802/285-2912

Hardwick Electric Department
2 Church Street
Box 516
Hardwick, VT 05843
802/472-5201

Hyde Park Electric Department
P.O. Box 37
Hyde Park, VT 05655
802/888-2310

Jacksonville Electric Company
Jacksonville, VT 05342
802/368-7010

Johnson Water & Light Department
P.O. Box 603
Johnson, VT 05656
802/635-2301

Ludlow Electric Light Department
P.O. Box 289
Ludlow, VT 05149
802/228-7766

Lyndonville Electric Department
24 Main Street
Lyndonville, VT 05851
802/626-3366

Morrisville Water & Light Dept.
P.O. Box 325
Morrisville, VT 05661
802/888-3348

New England Power Company
25 Research Drive
Westborough, MA 01581
617/366-9011

Northfield Village Electric Department
26 South Main Street
Northfield, VT 05663
802/485-5411

Orleans Electric Department
Municipal Building
Memorial Square
Orleans, VT 05860
802/754-8584

Readsboro Electric Light Dept.
P.O. Box 246
Readsboro, VT 05350
802/423-5405

Rochester Electric & Light Co.
P.O. Box 6
Rochester, VT 05767
802/767-4291

Stowe Electric Department
P.O. Box 190
Stowe, VT 05672
802/253-7215

Swanton Electric Light Dept.
First & Elm Street
Swanton, VT 05488
802/868-3397

Vermont Electric Cooperative, Inc.
School Street
Johnson, VT 05656
802/635-2331

Vermont Electric Power Co., Inc.
P.O. Box 548
Rutland, VT 05701
802/773-9161

Vermont Marble Company
61 Main Street
Proctor, VT 05765
802/459-3311

Vermont Public Power Supply
Authority
P.O. Box 425
Williston, VT 05495
802/878-5274

Vermont Yankee Nuclear Power Corp.
RD #5 Ferry Road
Box 169
Brattleboro, VT 05301
802/257-5271

GLOSSARY

BTU, MBTU, and TBTU

The BTU (British Thermal Unit) is the amount of energy required to raise I lb. of water by 1 degree Fahrenheit, and is a useful unit to compare energy from different fuel sources. MBTU is equal to one million BTU'S. TBTU is equal to one trillion BTU'S.

Carcinogens:

Any substance or agent that produces cancer.

Cluster Housing

Housing units concentrated near to each other which improve energy efficiency through shared resources and facilities, and decreased transportation distances. It also conserves land for other valuable uses, like farming and forestry, which are more efficiently pursued in larger, undivided tracts.

Compounds:

A substance formed by chemical combination of two or more substances.

Conservation Easements:

A conservation easement is a legally enforceable agreement between the land owner and a governmental or private conservation organization where in the land owner permanently separates certain ownership rights from a particular tract of land and the organization agrees to monitor the land for the purpose of ensuring that the provisions of the agreement are honored.

Cost-Effective:

A cost-effective program or development is one where analysis shows that benefits over the life of the program or development exceed costs, where benefits and costs have been calculated to include impacts on air, water, and local economic development.

Demand Side Management:

Traditionally, electric utility companies have looked to expand their supply side (i.e. build a new power plant or purchase more power from another power generator) in response to increased demand from the public. Some utilities have recently begun working with environmental groups and public service boards to develop programs which promote conservation and efficiency among electric users to satisfy the demand for power. Because these programs focus on reducing demand rather than on increasing supply, they are called demand side management (DSM) programs.

Dissolved Oxygen:

The amount of oxygen molecules dispersed in a liquid such as water.

Emerging Technologies:

Technologies which are currently being developed and will have an effect on future energy use. Many of these technologies increase the efficiency with which energy is used, while others make use of renewable energy resources more feasible and cost-effective. The following are some examples of current emerging technologies:

- Cogeneration: When fuels are burned to produce electricity, the heat is generated as a by-product. Cogeneration captures and uses this heat for heating, cooling, and/or industrial processes, thereby increasing the efficient use of the fuel source.
- Ethanol/Methanol fuel: A liquid fuel produced by the fermentation of organic biomass, such as corn, sugar cane, and wood. Burning liquid fuels produced from biomass releases no more carbon dioxide than is consumed by the plant during its growth.
- Photovoltaics: Panels of semi-conductors which absorb the sun's light and convert it into electricity which can be used directly or is more often stored in batteries for future use.
- Solar cars: Run on electricity produced by roof or hood mounted photovoltaics and stored in batteries. Current technology limits these cars to short, commuting use between recharges, but innovations in solar and battery technology should expand solar vehicle range capability in the future.

Energy Conservation vs. Energy Efficiency:

Energy conservation means changing behavior, such as turning off lights or increasing insulation, to decrease energy consumption. Energy efficiency makes use of advancements in technology to use less energy while achieving the same result - for example, energy-efficient 18 watt compact fluorescent bulbs use one-quarter the electricity to produce the same amount of light as conventional 75 watt incandescent bulbs.

Growth Centers:

Employing land use development patterns to concentrate development in central areas can allow the preservation of rural character, provide more efficient transportation, and minimize energy use overall. Such development can significantly reduce automobile travel by providing access to a variety of mixed uses, such as work, shopping, and recreation, thereby reducing the energy spent on transportation.

Kilowatt Hour:

A kilowatt hour is a basic unit of electric energy equal to one kilowatt of power used for one hour's time. One kilowatt hour equals 1000 watt hours. For example a 100 watt light bulb must run 10 hours to equal 1 kilowatt hour.

Non-Renewable Resources:

Non-renewable resources generally refer to fossil fuels such as oil, coal, and natural gas which take thousands or millions of years to regenerate and are being used at such a fast rate that they are considered finite and exhaustible.

Peak Shaving:

Peak shaving refers to actions taken to assure that the maximum electrical demand is met by the maximum available electrical supply. This is done by decreasing peak electrical demand or by increasing the supply of power.

Pond Stratification:

Pond stratification is the formation of layers of water based on temperature which occurs when there is a lack of circulation in a body of water. Stratification may result in insufficient oxygen conditions in the water if it is prolonged and if there is abundant organic matter to oxidize. This could adversely affect the production of living matter in the pond.

Real Costs:

Real costs are all the costs of energy production and use, which include societal and environmental costs. For example, the real costs of transportation fuel include the health care costs of treating people with respiratory illness related to breathing pollution created from the burning of the fuel.

Renewable Resources:

Renewable resources generally refer to sources of energy such as solar, wind, water, and wood that are a result of the effects of the sun on the earth (direct solar radiation, gravity, photosynthesis). If used on a sustainable basis, these renewables will continue to be generated as long as the sun's energy continues.

Solar, Active:

Active solar heat collecting designs are made up of collector panels, storage tanks, and pipes or ducts which carry water or air heated by the sun and include moving parts such as pumps, fans, or panels.

Solar, Passive:

Passive solar heat collecting designs take advantage of the sun with few or no moving parts. The heat is moved around by natural or convective forces.

Sustainable Energy Practices:

Sustainable energy practices can be repeated on an on-going basis without depleting resources that are necessary for the practice to continue. For example, trees can be harvested for fuel on a sustainable basis as long as annual tree growth equals or exceeds annual tree harvest. This may require additional human intervention of replanting to maintain a sustained forest level. In the case of forests, other forest uses, such as animal habitat, water conservation, and recreation must be considered when attempting sustainable management.

Wood Chip Gasifiers:

Wood chip gasifiers, modern "smokeless" stoves, and catalytic stoves use various means to trap the smoke from the wood fire and combine it with high temperatures (≥500 OF) which ignite and burn the gasses in the smoke. This results in higher efficiency ratings and lower pollution emissions. Wood chip gasifiers use wood chips moved by dump trucks, bucket loaders, conveyor belts, hoppers, and shovels, rather than conventional chunk wood.