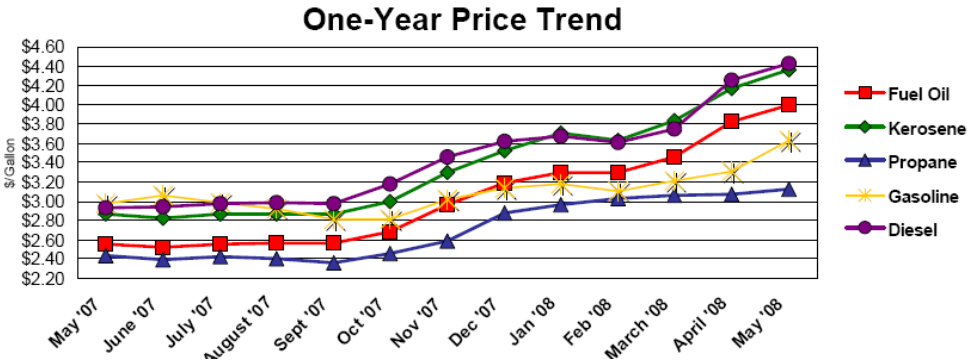
VIII. Energy

A. Introduction

Vermonters rely on energy to support their modern lifestyles. However, dramatic increases in Vermont energy costs since 2007 have impacted people's lives and the choices they make (see **Fig. 8.1**). Planning for our energy future and how it will affect our day-to-day lives is important. Energy planning needs to not only address demands in a cost effective manner, but should also be proactive and comprehensive. Challenges affecting energy prices include supply, affordability and environmental issues such as global warming. Other planning areas such as transportation, land use, and natural resources are impacted by energy supply and demand influences. On the national level, crude oil has reached unprecedented prices, and Americans are feeling the consequences of their fossil fuel dependency. Awareness around resource scarcity has spotlighted the human race's ability to exploit natural resources. The Regional Plan recognizes that production, consumption, and conservation play interdependent roles in effective energy planning. As such, the implementation of sound energy goals and policies will provide the necessary framework to aid towns in making practical and valuable energy decisions.



Source: Vermont Public Service Department

Fig. 8.1 Vermont Fuel Report – May 2008

B. Climate Change

1. Greenhouse Gases

Almost 200 years ago, a mathematician and physicist by the name of Jean-Baptiste Fourier discovered that the Earth's atmosphere could trap heat from sunlight. This process is now commonly referred to as the 'greenhouse effect'. Fossil fuels (oil, gas, and coal) have been burned to power more than 150 years of industrial activities. A significant byproduct from burning fossil fuels is carbon dioxide, which has been identified as one of the three major greenhouse gases (GHG) with methane and ozone being the other two. While some greenhouse gases are necessary for the earth's atmosphere to keep temperatures at habitable levels; excess amounts reduce the amount of heat loss into space and have a net effect of global warming.

2. Global Warming

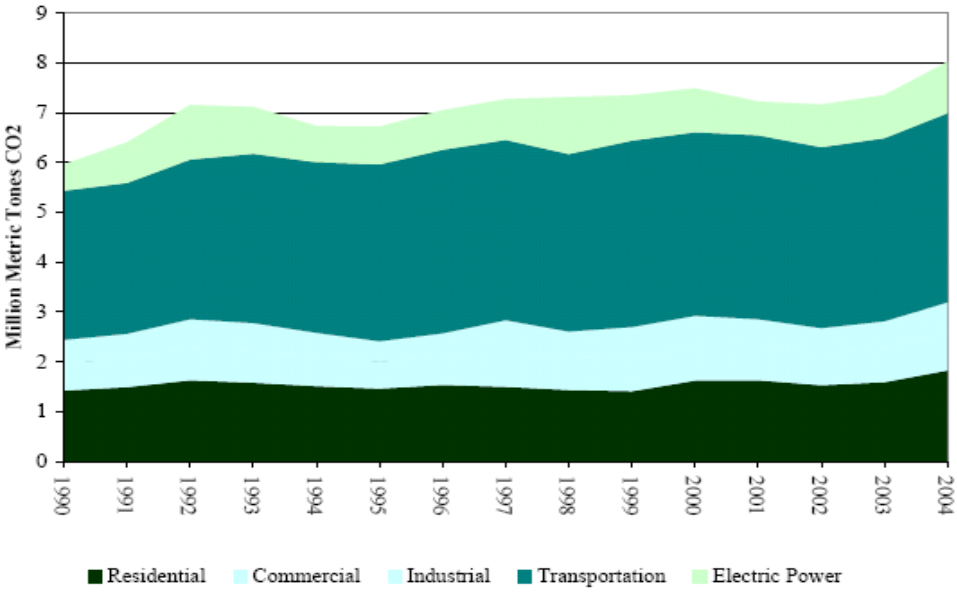
In 1988, the United Nations Environmental Programme and the World Meteorological Organization formed a scientific body composed of hundreds of scientists from around the world known as the Intergovernmental Panel on Climate Change (IPCC) (www.ipcc.ch/). The IPCC provides an objective source of climate change information based on scientific evidence. According to the IPCC, climate change is defined as:

> *Climate change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use.*

In 2007, the IPCC concluded "with at least 90% certainty, global warming is man-made and will continue for centuries, and that rising temperatures will cause sea levels to rise, floods and mass famine." In December 2007, both the IPCC's work and Al Gore were awarded the Nobel Peace Prize "for their efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such change."

In 1998, the Kyoto Protocol, an international agreement, was created with the purpose of reducing global GHG emissions. Since then, 178 countries, not including the United States, and other governmental agencies have signed and ratified the agreement. Despite the United States' reluctance to act on the federal level, twenty-six states, including Vermont, have forged ahead with tackling carbon and global warming issues. In 2001, Vermont, along with neighboring states' governors and Canadian premiers, signed the Climate Action Plan, which calls for the reduction of GHGs to 10% below 1990 levels by 2020, and 75 - 85% reductions by 2050. Vermont's GHG emission reduction goals are to reduce GHG emissions by 25% from 1990 levels by 2012, 50% by 2028, and, if practicable, 75% by 2050.

While Vermont's 8 million metric tons of annual carbon emissions are relatively minute compared to the world's 28 billion, its emissions though have been steadily increasing since 1990 (see **Fig. 8.2**). With its heavy reliance on single occupancy vehicles to travel, Vermont's transportation sector accounts for almost half of its emissions. Reducing and meeting the emissions goals of the Climate Action Plan will be a challenge, and one that will need to address many contributing aspects including legislature, policies, infrastructure, land use planning, transportation systems management, alternative fuels, cleaner vehicles and overall public awareness.



Source: Vermont Public Service Department

Figure 8.2 Vermont's Carbon Dioxide Emissions from Fossil Fuel Consumption

C. Energy Consumption in the Region

According to the Vermont Public Service Department (VPSD), three sectors consumed most of Vermont's energy demand in 2005: heating (27%), electric (40%) and transportation (33%) (see **Fig. 8.3**). By 2010, VPSD predicts energy consumption to increase by 46%, while population is projected to change by only 5%. Such prediction clearly demonstrates the need for a change in consumption behaviors.

In May, 2008, the VPSD released a public draft of its third Energy Plan whose policy priorities include affordability, environment and reliability. The Energy Plan focuses on the State's efforts to transition from fossil fuels to cleaner energy supplies in a way that protects Vermont's economic and environmental future.

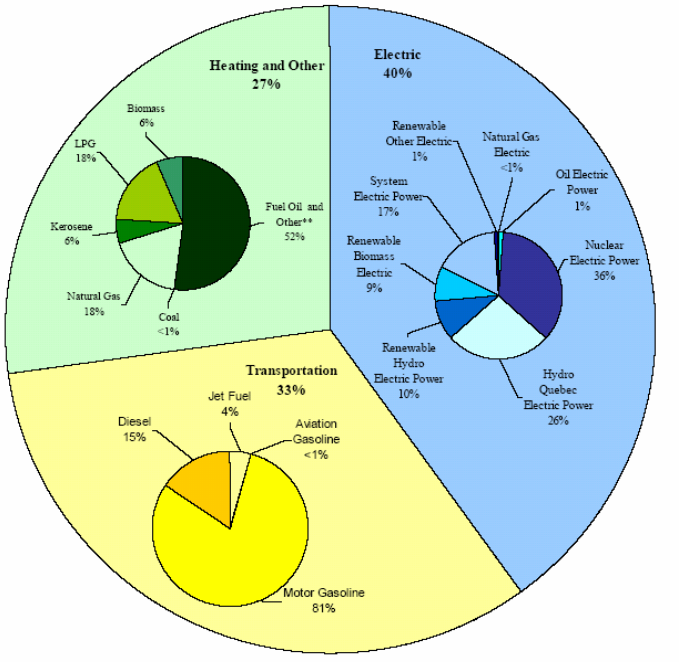


Fig. 8.3 Vermont's Energy Supply 2005 (% of Total Energy Consumed)

1. Electricity

Vermont uses more than a third of its total energy consumed in electricity. Two thirds of Vermont's electric supply is provided by Hydro-Quebec and Vermont Yankee Nuclear Plant (Vermont Yankee) and the rest by in-state hydro, biomass, and other renewables. Of the twenty separate electric companies providing electricity to homes and businesses, Central Vermont Public Service is the Region's sole electric provider with the exception of Ludlow Electric Light Department which serves Ludlow, Cavendish, Proctorsville, Mount Holly and Plymouth. See the Community Utilities and Facilities chapter for more information.

Customer type is an important factor when planning for future consumption needs. Residential needs differ significantly from commercial and industrial needs. According to VPSD, a typical Vermont household uses 600 kilowatt hours (kWh) per month with an average electricity bill of $80.00. While it's difficult to estimate the commercial/industrial sector's usage, its rate charge per kWh is $.08 as opposed to the residential rate of $.13.

Another factor not to be overlooked when considering future energy options is consumer choice. Often cleaner and healthier alternative energy choices involve start-up investment costs which will initially increase rates. Over time, however, savings will be seen as a decrease in energy usage will ultimately result in lower electricity bills. Capacity and willingness are also important aspects, since it is the consumer who will make the final energy decisions based on his/her individual circumstances and needs.

a. Hydro-Power

Vermont-based hydro power generates approximately 10% of the State's electricity production (30% when combined with Hydro Quebec). The State is considering improving efficiency at its 78 existing facilities to generate additional power. In January 2008, the ANR reported that additional opportunities exist for in-state hydroelectric capacity, and identified the following findings concerning Vermont's hydro potential and recommendations concerning permitting: 1) develop a comprehensive guide and low impact standards for development ; 2) retain and streamline present permitting process and prefeasibility assessments; 3) investigate increasing production at existing facilities; 4) retain existing conservation flow procedures; 5) and remove useless dams to restore stream and river connectivity to help balance cumulative impact of new hydroelectric development. (ANR, "The Development of Small Hydroelectric Projects in Vermont; A Report to the Vermont General Assembly," January 9, 2008.)

Vermont utilities obtain a third of their electricity supply from Hydro Quebec. As such, a pressing matter that is currently being addressed is the fact that Vermont's contract with Hydro Quebec will begin to expire in 2012. Vermont is also considering other hydro projects such as Lower Churchill Development. It is being developed by Newfoundland and Labrador Hydro with a completion date sometime in 2015. They are presently exploring options available for bringing the power to the New England markets. While the amount of hydroelectric power from New York has been significantly reduced since the 1950s, its price still makes it an attractive contributor to Vermont's electricity portfolio.

While there are clear benefits to developing a local renewable electric resource such as hydroelectric power, such benefits should be weighed against any negative environmental impacts. Power generated from a stream must not compromise the minimum stream flow necessary to support aquatic life forms. Adverse impacts to water ecosystems, and water quality should be avoided.

b. Nuclear

As one of the lowest carbon-emitting sources of energy, nuclear power has the greatest potential in helping to reduce regional carbon emissions associated with fossil fuel generated electricity. Roughly 35% of the electricity consumed in Vermont is provided by Vermont Yankee, a nuclear plant located in Windham County in the southeastern town of Vernon, which has been operating since 1971. In 2002, Vermont Yankee was sold to a subsidiary of Entergy Corporation of New Orleans, the second largest nuclear plant operator in the nation. With greater resources and expertise available to the facility, the subsequent increase in output was then sold into the New England market. Vermont Yankee is currently in the process of renewing its operating license which is due to expire in 2012.

While many view nuclear power as a source of abundant, clean, renewable energy, others argue that operations are not safe and pose a significant threat to public health, safety and welfare. Nuclear fission will always have levels of risks, including mining issues, waste disposal, and safety issues surrounding the decommissioning of a nuclear plant. Risks as well as benefits should be carefully weighed when considering nuclear energy.

c. Biomass

Biomass refers to living and recently dead biological material that can be used as fuel or for industrial production. Most commonly, biomass refers to plant matter grown to generate electricity or produce biofuel, but it also includes plant or animal matter used for production of fibers, chemicals or heat. Biomass may also include biodegradable wastes that can be burnt as fuel.

Converting municipal solid waste, farm waste and other biodegradable waste streams to energy could reduce global warming as well as reduce pollution and waste stream management problems. Landfill sites generate gases such as methane. Capturing this methane and using it as a fuel source can also reduce emissions of greenhouse gases. Waste may not meet all of our energy requirements, but not utilizing this energy source has a negative impact. The University of New Hampshire is the first university in the country to use landfill gas a primary energy source (www.grenvalhalla.com).

Vermont has been a national leader in wood biomass energy for over 20 years. According to the Biomass Energy Resource Center (www.biomasscenter.org), with the exception of methane recovery systems, biomass systems are usually fueled by waste wood, from logging operations, forest thinning, low-grade wood, and/or sawmill residues. These systems create a commercial market for wood whose extraction benefits forest health while also boosting the forest-product economy. Rather than depleting the forest resource, biomass energy, when sustainably supplied, helps it to grow. According to the June, 2007 *Vermont Wood Fuel Supply Study*, based on USDA Forest Service information, Vermont and the surrounding counties in New York, Massachusetts, and New Hampshire have:

- 9.3 million acres of forested land area designated as "timberland";
- 1.1 billion tons of above-ground biomass inventory on timberland;
- 24.8 million tons of net growth of new wood annually on timberland;
- 4.8 million tons of average annual harvesting to supply all current wood product market demand (includes saw logs, pulp, firewood, and biomass); and
- 20 million tons of under-utilized wood grown annually.

Current consumption of low-grade wood for fuel and fiber represents a significant demand on the region's forest; however, the study also found that forests are growing wood much faster than the current rate of harvesting. While biomass offers an alternative energy source, **Table 8.1** illustrates some of the pros and cons of biomass.

Table 8.1 Pros and Cons of Biomass

PROS		CONS	
Carbon Neutral	burning plant material releases the same amount of carbon dioxide originally taken out of the environment while growing	Start-Up Costs	Extra costs of installing technology to process and recycle wastes
Renewable	plants can be grown and people will continue to generate rubbish	Proximity	Biomass usually has to be harvested close to the station to be economical
Positive Side-Effect	collecting biomass to generate electricity also helps get rid of rubbish	Materials	Expensive to collect, harvest and store raw materials

Source: Meridian Energy Limited 2006

d. Other Sources

In addition to the sources listed above, there are other sources of electricity generation for both residential and commercial applications including photovoltaics, solar, and wind (discussed in Section E. Alternative Energy below), Cow Power (http://www.cvps.com/cowpower/; capturing methane gas in cow manure to generate electricity), geothermal (harnessing heat energy present underneath the Earth's surface), and tidal power (using water turbines to turn electrical turbines).

2. Heating

As illustrated in **Table 8.2** below, the Region uses various fuel sources for residential heating. Fuel oil and kerosene are the most frequently used fuel sources to heat residential homes (and water), with wood being the second most popular. With recent technology, wood biomass energy systems are now providing a sustainable and renewable source of heat for schools, state institutions and industrial applications.

Table 8.2 - House Heating Fuels By Town (%) – 2000								
FUEL	Utility Gas	Bottled, tank, or LP gas	Electricity	Fuel oil, Kerosene, etc.	Coal or coke	Wood	Solar Energy	Other
Andover	.00	14.60	1.77	61.95	.00	21.68	.00	.00
Baltimore	.00	14.28	2.86	51.43	.00	31.43	.00	.00
Cavendish	.33	11.59	2.81	67.89	.00	17.05	.00	.33
Chester	.39	16.20	3.24	68.21	.00	11.27	.00	.69
Ludlow	1.89	9.15	4.62	75.75	.28	7.74	.00	.57
Reading	.71	13.33	1.40	62.45	.00	22.10	.00	.00
Springfield	1.44	11.40	5.43	74.39	.30	6.40	.00	.64
Weathersfield	.43	10.63	1.20	73.69	.00	14.05	.00	.00
West Windsor	.44	21.05	3.73	60.52	.00	13.16	1.10	.00
Windsor	.00	13.29	3.80	78.90	.00	3.51	.00	.50

Source: 2000 U.S. Census

a. Fossil Fuels

Petroleum-based fuels meet roughly half of Vermont's energy demands – 31% in transportation (gasoline and diesel); 20% by distillate, residual, propane and kerosene. Fuel oil is the primary source of energy for heating homes in the Region. Volatility in the countries supplying oil to the U.S., combined with increased world-wide demand, has contributed to unprecedented oil prices. Adding to this unstable market is the heightened concern for greenhouse gases and global warming. Burning of fossil fuels is not only the largest contributor of GHGs, but is also directly linked to the acidification of rivers, lakes and soil, and an increase in air particulates that adversely affect air quality. These factors will hopefully bring about a public awareness to cleaner, healthier choices provided by alternative energy resources.

b. Biomass

Biomass is organic, renewable and comes in various forms. Biomass is an attractive source of energy for Vermont especially since forest lands comprise of 77% of its land area. According to the Vermont 2005 Appliance Saturation Survey, 11% of Vermonters use wood as their primary source of heating. As more efficient wood-burning appliances (wood, pellet stoves) are added to homes, wood has great potential for replacing fossil fuels. At $180 per ton of wood pellets, the cost to heat with a wood pellet stove in Vermont during the 2007 heating season was less than that of every other fuel. According to the VDPS' November, 2007 Vermont Fuel Price Report, made from biomass such as sawdust are another form of heating and cost 50% less than oil ($13.64/mBTU, far below fuel oil versus $26.85/mBTU and even natural gas at $21.38/mBTU). Pellet-burning appliance sales have increased by almost 400% since 2000. With these increases, the cost of supplying the fuel wood is rising and availability is poor. Maintaining this fuel source to consumers without Vermont forests paying the price is a concern.

According to VDPS estimates, additional wood could be harvested for biomass fuel if more private land was carefully managed. When grown and harvested in conjunction with effective forest management plans, wood production for energy use adds no additional CO_2 to the atmosphere and does not degrade the forest resource. The use of biomass fuels can replace or reduce the use of non-renewable resources. In addition, jobs related to biomass energy are available to local residents. New biomass technologies exist which have the

potential to provide 90% efficiency and reduce emissions, a vast improvement over highly polluting fossil fuels. Locally, biomass energy is currently being utilized by 33 Vermont schools including Springfield High School and Weathersfield School which heat with wood chip systems.

c. Other Heating Sources

Other feasible heating sources are available, but are currently underutilized in Vermont. These heating sources include solar hot water heating systems and geothermal heat pumps. Passive solar construction techniques can significantly reduce the heating demands of structures. (See Section E. Alternative Energy below for more information.)

3. Transportation

The transportation sector accounts for 33% of the total energy consumed in Vermont, and is the largest source (44%) of GHG emissions. Gasoline use has grown at a rate of 1.4% annually, while diesel use has risen 2.7% suggesting an even more rapid growth in freight movement within or through the State. With its rural character, dispersed settlement patterns, and reliance on single occupancy vehicle travel, Vermonters have a difficult challenge to face in reducing its consumption in transportation fuels. While there are some strategies that can be implemented to gain some ground in this area, they will need to be implemented on state, regional and local levels.

In June, 2008, VTrans came out with a Climate Change Action Plan which has three major focus areas: reducing GHG emissions; protecting Vermont's transportation infrastructure from the effects of climate change; and reducing its own operational impacts. In reducing GHG emissions, VTrans is taking a three-pronged approach in promoting the development, availability, and use of cleaner burning bio-fuels; increasing vehicle efficiency; and increasing the efficiency of the transportation system.

On a more regional and local level, towns should promote alternative transportation options, such as ride-share programs, van-pooling, public transportation, flex-time, and bicycling which can not only help achieve a reduction in traffic and transportation fuels, but also helps to keep road maintenance costs down. Settlement patterns that are more concentrated and require less travel should be encouraged in order to take advantage of such alternative transportation options. This is especially the case in the winter season where due to the Region's rural characteristics, winter travel options are extremely limited. Municipalities should look into utilizing biodiesel to fuel town vehicles such as school buses. RPC should work with VTrans to explore alternative funding sources for transportation, as the above alternative options would have the net result of reducing state and federal fuel tax revenues.

D. Energy Conservation

While it is necessary to look into alternative energy resources, it is equally as important to conserve the resources that are already being used and will continue to be used until alternatives are available. Benefits of energy conservation include reducing electricity demands, reduction in air pollutants, increasing efficiencies and reducing overall use of resources which in turn lead to lower utility and heating bills.

In 1999, the State of Vermont established the Vermont Energy Efficiency Utility Fund (VEEUF) to fund ten core statewide energy efficiency programs, which were subsequently condensed into eight programs in 2003. These programs include: business existing facilities; business new construction; customer credit; business initiatives; energy efficiency products; residential new construction; residential existing buildings; and residential initiatives. Pursuant to 30 V.S.A. §209, the Vermont Public Service Board (VPSB) established a volumetric charge to customers, the Energy Efficiency Charge (EEC), for the support of energy efficiency programs. Currently, there are twenty (20) distribution utilities assessing these charges and utilizing the programs.

Vermont continues to invest more per capita in energy-efficiency programs than any other state in the U.S. Most recently, on March 19, 2008, Governor Douglas signed into law Senate Bill 209 -The Vermont Energy Efficiency and Affordability Act. The following is a list of some of the more important aspects of the act that will increase the state's use of renewable energy:

- Raises the cap on net metering to 250kW, expands the number of net metering systems allowed (from 1% to 2%), allows for full group net metering and improves aesthetic review of wind turbines;
- Establishes a new and simplified permitting process for meteorological stations used to measure wind resources;
- Strengthens the existing SPEED (Sustainably Priced Energy Enterprise Development) Program and existing Renewable Portfolio Standard;
- Establishes a formula for calculating the fair market value of new commercial-scale renewable energy plants for the purpose of setting the statewide educational property tax;
- Requires studies on increasing the use of biodiesel by state government and on reaching the goal of meeting 25% of our total energy from farm- and forest-based resources by 2025; and
- Creates a new heating energy-efficiency program for Vermont.

1. Local Energy Initiatives

Vermont Energy & Climate Action Network (VECAN) in partnership with the Alliance for Climate Action, New England Grassroots Environment Fund, Sustainable Energy Resource Group, Vermont Energy Invest Corporation and Vermont Natural Resources Council, work together to "plan and implement energy-saving, greenhouse-gas emission reduction strategies at the local level." VECAN developed a Town Energy and Climate Action Guide that provides communities with the necessary tools and resources to form their own volunteer energy and climate action committees. Under 24 V.S.A. §113, town selectboards are enabled to appoint an energy coordinator. Towns should consider not only energy coordinators but also Energy Committees in addressing a town's energy decisions. Go to http://www.vnrc.org/article/view/14458/1/625 to get a copy *The Town Energy and Climate Action Guide* by VECAN.

2. Efficiency Strategies

Vermont is the first state in the nation to have a non-profit organization that provides energy efficiency services to its residents under a contract with the Vermont Public Service

Board. Efficiency Vermont provides "technical assistance and financial incentives to Vermont households and businesses, to help them reduce their energy costs with energy-efficient equipment and lighting and with energy-efficient approaches to construction and renovation."

The Sustainable Energy Resource Group (SERG) is another Vermont based organization that promotes energy conservation, efficiency and renewables through the formation of town energy committees to help residents, businesses and municipalities reduce energy consumption, save money, increase the sustainable use of renewables, strengthen the local economy and improve the environment. Energy saving tips from SERG can be found at www.serg-info.org.

The following topics are areas in which towns are encouraged to look at when addressing energy efficiency:

- Efficient Buildings – energy audits and renovations (www.effiencyvermont.org);
- Work Options – telecommuting; 4-day work week; flex time;
- Baseline Buildings' Energy – using an easy on-line tool created by the Environmental Protection Agency, towns can benchmark their buildings' performances and compare them to similar public buildings (http:www.epa.gov/Region1/eco/energy/energy-challenge.html);
- New Developments – 'greening' town plans, zoning/subdivision bylaws; compact land use patterns;
- Biodiesel – Biodiesel for school buses;
- Educational Outreach – distribute Vermont energy standards to developers applying for building permits (Energy Code Assistance Center 1-888-373-2255);
- Change a Light Campaign – raise awareness and create cost-effective electricity by swapping out incandescent bulbs with compact fluorescent light (CFLs) bulbs. CFLs use roughly 1/3 less energy, have a $40-$70 electric savings, and release over 1/3 less carbon emissions.
- Public Campaigns – no idling; bike or walk to work; and
- Energy Section in Town Libraries – materials providing energy saving tips, residential and business emissions calculators, books and DVDs, etc.

3. Resources

See **Appendix B** for a listing of Energy Resources.

E. Alternative Energy

1. Wind

Wind is a clean, efficient and a sustainable source of energy for both commercial and residential energy production. Between 1996 and 2004, wind power production in the United States has increased four fold. Wind energy can save as much as 50-90% on electric bills and cost from $6,000-$22,000 to install. The investment pays for itself in around 6 – 15

years, with electric bills roughly $8-$15 for up to nine months of the year. New technologies have made it possible to utilize wind power more efficiently thus making it a viable alternative source of energy. While wind energy produces zero pollution and is a relatively secure fuel source, there still exists controversy over the siting of wind turbines with respect to noise, aesthetics and effects to wildlife.

a. Specifications

Wind turbine towers are mostly lattice or monopole construction made from steel. The blades are made of fiberglass-reinforced polyester or wood-epoxy. Commercial wind turbines range in size with the largest rotor diameters measuring 90 meters and with a total height of 135 meters (442 feet). Small turbines for residential or small businesses are much smaller with rotor diameters of 8 meters or less and mounted on towers 40 meters (131 feet) high. In Vermont, ridgelines are seen as ideal locations for wind generation facilities due to wind patterns and elevation (2,000 – 3,500 feet above sea level) conditions. Other factors that are considered for siting include proximity to transmission lines and substations, and meeting lighting requirements set by the Federal Aviation Administration for towers over 200 feet tall. Generally, an annual average wind speed greater than 9mph is required for small wind electric turbines (less for water pumping operations). Information regarding wind availability around Vermont is available through the American Wind Energy Association at www.awea.org.

b. Output

Energy output depends on the turbine's size and the wind's speed through the rotor. At a site that has an average wind speed of 12 miles per hour, a 10-kW wind turbine can generate about 10,000 kWh annually or enough power for a typical household. Using a 53,000 square foot school, a 250 kW turbine provides an average of 350,000 kWh of electricity per year which is more than this building would need. The excess energy could be fed back into the local utility system.

c. Land Use Implications

Since wind power relies on wind speed and power density to generate energy, it can be assumed that there will be proposals to site wind turbines in areas that have relatively constant strong winds for maximum benefit. Wind potential is rated in classes on a scale of 1 through 7, with 4 being suitable for utility-scale power generation. Andover, Ludlow and West Windsor are the only areas in the Region with Class 4 or higher ratings. Since most of the suitable areas are either privately owned or state-owned forest lands, the regional plan encourages development criteria to address environmental and community concerns. The following items should be considered when developing such criteria:

- Aesthetics – sensitive landscapes; scenic and historic resources;
- Noise – levels and affected persons living in a prescribed proximity;
- Wildlife habitats – protecting physical and ecological relationships;
- Surrounding Infrastructure – access to site; transmission lines; and
- Decommissioning – removal and restoration of land to its original state.

A residential wind siting handbook, *Siting a Wind Turbine on Your Property*, can be found at http://publicservice.vermont.gov/energy-efficiency/ee_renewables.html. The American Wind Association also provides a wind siting handbook at www.awea.org/sitinghandbook/

d. Permitting Requirements

Wind generation facilities are land uses and may be subject to local or state permitting requirements. Under 30 V.S.A. §248, the Vermont Public Service Board (Board) must issue a Certificate of Public Good prior to the construction of any power generation facility (wind, hydro, etc.) including net-metered residential wind turbines. It also provides for a review process whereby the Board looks at how a project will affect environmental, economic, and social impacts. Section 248 also provides that the Board give consideration to the recommendations of municipal and regional planning commissions and their respective plans. This is important to note as wind power facilities needing Board approval under Section 248 are preempted from municipal review. In addition, large-scale wind generating projects with the purpose of utility consumption are not subject to local zoning or subdivision regulations. Residential wind turbines; however, are subject to such regulations and considered accessory uses or structures subordinate to a primary use. Local zoning height restrictions often unintentionally prohibit the construction of wind turbines.

2. Solar

The power of the sun has great potential to supply electricity and provide heating in Vermont since the "fuel" is free. According to Vermont Public Service, enough sun hits the average residential roof in Vermont to supply 10 times the electricity used by the average homeowner. In addition, with today's window and insulation technologies, passive solar and daylight techniques can provide 30 – 50% of a buildings heating and lighting needs. Passive solar optimizes the amount of energy that can be derived directly from the sun and used for heating and lighting. It relies heavily on the design of the building, siting (southern exposure), and materials used (see **Fig. 9.4**).

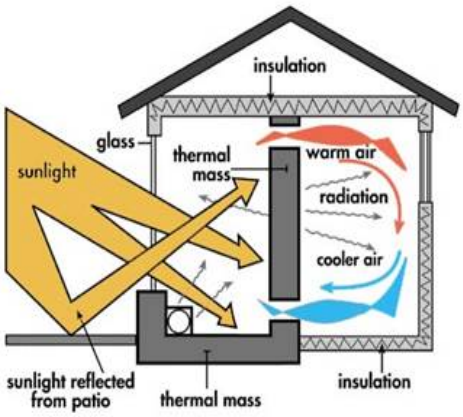


Fig. 9.4 Passive Solar Energy

Photovoltaics (PV's) and thermal collectors are used to capture the sun's energy. PV's can convert sunlight into electricity (such as seen with traffic signals), and thermal collectors heat water or air for residential or commercial uses. As part of the federal "Million Solar Roofs Initiative," Vermont has committed to 1,000 new solar installations by the year 2010. In order to reach that goal, VDPS is encouraging residents to install "net metered" renewable energy systems. Net metering was approved in 1998 and requires electric utilities to permit customers to reduce their electric bills by generating their own power using small-scale renewable energy systems. The excess power they generate can be fed back to their utilities. All equipment purchased to construct and install a net metered renewable energy system is exempt from the state's 6% sales tax.

While solar is one of the cleanest forms of alternative energy, comparatively, it is the most expensive since costs are front-loaded. These costs, however, should decline with the increase in technology which presently is in its infancy. In addition to initial investment costs, capacity to utilize solar energy can also be affected by siting and the lack of technical knowledge. Despite these constraints, its positive attributes make it an energy source that policies should encourage. Information regarding solar energy in Vermont can be found at http://publicservice.vermont.gov/energy-efficiency/ee_vtsolarguide.html.

3. Micro-hydro

Micro-hydro systems are those hydro-electric generating systems with a rated capacity of approximately 300 kW which is the maximum size for most stand alone hydro systems not connected to the grid, and suitable for "run-of-the-river" installations. "Run-of-the-river" refers to a type of hydroelectric generation where the natural flow and elevation drop of a river are used to generate electricity. This generation has a minimal environmental impact on the local ecosystem since the water runs straight through the generator and back into the stream.

Advantages to micro-hydro include:

- small amount of flow or a drop as low as two feet to generate electricity to a site up to a mile away;
- continuous supply of electrical supply compared to other renewable energies;
- cost run from $1,000 - $20,000 depending on site requirements and location;
- low maintenance fees; and
- ability to supplement with intake from existing power grid or other alternative systems if needed.

Disadvantages to micro-hydro include:

- suitable site characteristics (flow rate, output and drop);
- low power in summer months; and
- ecological impact (while small, still needs to be considered).

4. Vermont Incentives for Renewables and Efficiency

Vermont has many incentives for utilizing renewables and becoming energy efficient. Such incentives include sales tax exemptions, the solar and small wind state rebate program, corporate tax credits for solar, and several loan and grant programs. More information on state incentives can be found at the Database of State Incentives for Renewables & Efficiency's website http://www.dsireusa.org.

5. Alternative Energy Facilities

While the RPC supports and encourages the development of alternative energy facilities in the Region, it also believes that they should not come at a cost to the Region's natural resources. In that respect, the following guidelines shall be observed:

(a) developers should first define the character of the proposed site to determine how well the proposed facility will conform to the existing landscape including

scenic quality (focal points, viewer sensitivity, topographic diversity, prominence/dominance, order of landscapes and patterns of development);

(b) proposed projects should meet the aesthetic test set forth under Criterion 8 of Act 250;

(c) site selection should also consider access, site clearing, onsite power lines, substations, lighting and off-site power lines. Minimal disturbance of the site shall be a planning objective;

(d) reasonable measures shall be taken to mitigate possible destruction or impairment of habitats existing in a project area; and

(e) facilities deemed to be abandoned or unused should be removed by the owner/operator(s) within a reasonable time from cessation of operations, as well as restoring and/or enhancing the site back to its natural state.

F. Planning Implications

While energy decisions can seem like an uphill battle, every resident can make a difference. Small changes add up and sound regional and local planning can play a positive and effective role in guiding energy decisions. By promoting appropriate land use patterns, participating in energy development decisions, facilitating alternative transportation options, and encouraging energy conservation strategies; municipalities can provide leadership toward a position of sustainable energy use which will not only help to maintain a healthy environment, but will also build a foundation for economic health and stability.

Local planning and zoning bylaws also play an important role in promoting energy efficient development. Planning efforts should be cognizant of settlement patterns less dependent on single occupant vehicle transportation models, land uses and policies that encourage energy conservation and efficient uses of energy resources. In addition, when implementing town plans, municipalities should consider zoning bylaws and subdivision regulations in the development of alternative energy structures/systems where feasible. Furthermore, there needs to be some flexibility in zoning bylaws to allow for an increase in the use of emerging technological advancements in energy resources such as solar and wind.

ENERGY GOALS

1. To improve conservation and efficiency in the use of existing energy resources, and to facilitate the transition to cleaner energy resources in order to protect the environment.

2. To reduce demand for fossil fuels by promoting public transportation, ride-share programs and other programs that lessens the dependence on single occupancy vehicles.

3. To encourage land use patterns and development in the Region that use energy more efficiently.

4. To increase the awareness of residents and municipalities of energy conservation practices and programs through educational programs.

ENERGY POLICIES

1. Member towns and residents are encouraged to pursue the transition from the use of fossil fuels to renewable energy sources.

2. Promote the feasibility of alternative energy options for commercial and industrial uses.

3. No new dams or major improvements to existing dams should be encouraged, or permitted, without full consideration of its social, economic, and environmental impacts, and are in conformance with local and regional plans.
   (a) run-of-the-river projects are preferred over projects which require impoundments with low or minimum flows;
   (b) recreation and fisheries are high priorities for river uses and should not be significantly diminished by hydropower development; and
   (c) water quality and minimum flows to sustain aquatic life must be maintained.

4. Promote alternative transportation practices that promote energy efficiency such as: expanding existing park-n-ride commuter parking lots, bicycle paths to lessen the dependency on single occupancy travel

5. Where it is demonstrated that the costs of providing energy services and facilities clearly is outweighed by a public benefit to the areas or region and the land use settlement patterns resulting from the development or subdivisions are in conformance with this Plan and relevant local plans, such services and facilities should be permitted.

6. Prior to the construction of additional or upgraded transmission or distribution lines or related facilities, utilities should demonstrate that such public investments have maximized demand management, increase energy efficiency and promote energy conservation.

7. Where development and construction of alternative energy facilities and electric power generation facilities are proposed for public use, plans must consider placement of such facilities in locations where aesthetic and wildlife impact is minimal or reasonable measures have been employed to mitigate adverse impacts.

8. Capital investments of public utilities and services are encouraged within built-up centers to support the high intensities of use.

ENERGY RECOMMENDATIONS

1. Encourage the development of a transportation system that reduces the use of single-occupancy vehicles, and enables increased non-motorized vehicle and pedestrian traffic. Emphasize links between schools, stores, work and home, and coordinate these with the development of “greenway" segments.

2. Help towns to ensure that the design, location and maintenance of existing and future transportation systems are consistent with Smart Growth and Growth Center Planning.

3. Developers should examine alternative energy resources in the design and construction phases of new development, and promote the energy efficiency standards recommended by the Vermont Department of Public Service and Efficiency Vermont.

4. Encourage the concentration of energy-intensive facilities, housing and other uses to prevent the expense of distributing energy over large geographic areas.

5. Educate residents and local officials in the Region about the progress of utility restructuring and facilitate the transition when restructuring takes effect.

6. Local planning commissions, selectboards, citizens, and members of the energy industry should work cooperatively to identify ways to reduce the cost of energy to consumers, and to promote efficiency in energy use and conservation.

7. Local planning commissions should employ, as part of the review and approval process, all practical energy conservation measures to maximize energy efficiency in siting, design, and construction. Standards recommended by the Department of Public Service and Efficiency Vermont may serve as a basis for the development of such conservation measures.

8. The Commission supports the implementation of the Least Cost Integrated Planning, as identified in Vermont's Twenty Year Electric Plan and the Vermont Comprehensive Energy Plan and recommends that due consideration be given to the benefits of utilizing local energy resources in all LCIP project analysis.