CHAPTER 5—Power for the People

Warren is located in the Green Mountains with long winters, cloudy and snowy weather, and a relatively dispersed population. Sugarbush Resort and associated recreational development make Warren an energy intensive town. Over 60% of Warren's approximately 2000 homes are occupied seasonally. Temperatures routinely drop to 20 and 30 degrees below zero, and winters with more than 8,000 heating degree days are common. A heating degree day is calculated based on the average of the high and low temperatures for each day. Every degree below 65 for the average of the high and low temperatures for the day is counted as a heating degree day.

Electrical Power Supply

Historical Supply

Warren's energy past has varied. Originally, the town was settled by farmers around a green at the Roxbury Gap Four Corners in East Warren. Subsistence agriculture and logging were the only economic activities. In the mid-1800s, the development of water-powered mills brought settlement to the present village, where power sites were abundant. Although farming was still a mainstay of the Town, the mills used timber resources to manufacture related products, often for export. The quiet green was replaced by the bustle of a town street with mills, company stores, and a more vibrant community life. Most resources and all energy still came from the immediate area. For example, in 1910 four dams in Warren generated power for local industries (lumber, creamery, sawmill, and wheelwright).

Until 1950, Vermont as a whole exported electricity to other states, and at that time, Warren had only begun to move away from its independent beginnings. Farming still played a key role in the Town's economic life. But the larger energy and economic picture had caused mills, stores, and other enterprises to relocate closer to major transportation routes and markets.

The advent of the ski industry in Warren brought economic vitality to the area along with the related infrastructure of the automobile era. People in Warren and elsewhere in Vermont began to rely heavily on petroleum products to run their cars, heat their homes and manufacture and transport the produce and products necessary for daily life.

The use of electricity increased rapidly as well. Figures from Green Mountain Power Corporation indicate that the Valley's peak electrical demand has risen from 3.4 mega watts (MVA) in 1966 to 23.0 mega watts in 2003 (an average annual increase of 24%). Electrical demands have remained fairly stable over the past decade. The decline and subsequent stabilization in the Valley's peak demand are due to the implementation of the comprehensive electrical load management plan developed by Sugarbush and Green Mountain Power in 1989. The management plan was designed to stabilize energy demand and implement a conservation program at the ski area. It established a schedule for increasing electrical efficiencies through the implementation of an interruptible load agreement with Green Mountain Power.

Historically, there has been a relationship between energy costs, energy sources, location of development, and growth of the Town. For example, agriculture meant settlement dispersed on farms and centralized community facilities to minimize transportation distances and costs. Later, water power concentrated development and growth along the river, and Warren Village started to grow.

Current Supply

Electricity is supplied to the Valley primarily by the Green Mountain Power Corporation. Green Mountain Power's sources of electricity include hydro (48.9%), nuclear (~~31~~42%), biomass (3.0%), premium renewables (wood, ~~hydro~~ methane, wind~~, 41.2%~~), oil and natural gas (0.8% ~~2.1%~~), ~~oil (2.0%),~~ and market purchases (5.0% ~~23.9%~~). Local distribution is provided by a 34.5 kilo volt (kV) transmission line and 12.47 kV distribution systems which comprise a looped line with sources in Montpelier and Middlesex. The capacity of the two substations, Irasville (#39) and Mad Bush (#38), serving the Valley was expanded in the late 1980s and has 10 MVA reserved capacity or about 45 ~~50~~% of current load. Although adequate electrical capacity currently exists, past growth in Warren resulted in rapid increases in energy consumption.

The 3310 line that feeds the #39 and #38 Substations has 24.43 MVA of capacity left, however this includes more than the Mad River Valley. Based on load data gathered from 1999 to 2009, the existing capacity at the #39 Irasville Substation is 2.5 MVA (this is 23.8% of the available capacity) and at the #38 Mad Bush is 4.5 MVA (this is 22.5% of the available capacity). This capacity is based on load being applied directly at the substation. This does not account for individual circuit loading, i.e. it would probably not be possible to put 4.5 MVA of load at the end of one of the Mad Bush circuits, but the substation transformer would be able to handle that amount of load.

In ~~late~~ 2010 ~~03~~, GMP officials reported that no transmission and distribution improvements that would substantially increase the capacity of either the transmission lines feeding the area or the substations, Mad Bush and Irasville, are planned in the area over the next 5 years.

Energy Demand

Residential

As of ~~2003~~ 2008, household energy use represents approximately ~~30%~~ 40.79 % of total statewide energy consumption. Almost 80% of domestic demand is for space heating and domestic hot water. The remaining 20% runs miscellaneous appliances, lighting, cooking, drying and air conditioning. Space heating and hot water heating are affected by building design and construction. Other energy uses are affected primarily by personal choices and habits. Table 5.2 provides the 2000 breakdown of heating sources for occupied households in Warren.

The most common sources of heat are bottled/tank LP gas, oil/kerosene or wood. There are a number of cord wood suppliers in the Valley. Two oil and gas suppliers are based in Waitsfield, and additional suppliers in Waterbury and Montpelier serve the Valley. Since the 1990 Census many of the older seasonal properties have converted from wood and electric heat to propane.

Transportation

According to the Vermont Agency of Natural Resources, approximately 43% of the energy used in Vermont is used for transportation. The national average energy consumption for transportation is 27% (US DOE 1990). Almost half of the VT transportation energy is consumed by commuters, shoppers, recreationists and others traveling in private automobiles. Public transit represents a very small portion (3%) of the energy used for transportation in Vermont. In Warren, the limited routes of the MadBus account for a very small part of total transportation. Valley trails or bike lanes are also limited and not well integrated with the region. According to 2000 Census data, 85% of Warren residents drove vehicles to work, and only 9% of residents carpooled.

When petroleum prices rise, the cost of maintaining dispersed development will become increasingly difficult for both individuals and the town to support. Costs associated with school buses, road and utility maintenance, and other transportation will increase. Clustering development is an important tool for cutting down on energy usage, as is establishing commercial activities and jobs near residential areas.

Future Energy Potential

Energy Conservation

Energy conservation measures such as increased user control, weather-stripping, insulation, caulking, etc., can reduce heat loss in buildings by 25-50%.

Solar Orientation

The orientation and degree of slope determine the amount of solar radiation hitting a particular site. Southern slopes receive more radiation; northern slopes receive less, especially during the winter when sun angles are low on the horizon. Eastern slopes receive early morning sun; western slopes receive afternoon sun. Orientation affects such factors as ground temperature, shadow length, date of a snow melt, desirability for outdoor activity, and building heat loss. Careful site planning can have a positive impact on the town's total energy requirements.

Solar Energy

The sun can be utilized in three main areas to reduce energy consumption: hot water loads; heating and electrical production ~~requirements~~; and food supply. The amount of energy savings will depend upon site and economic constraints. New construction can and should utilize such techniques.

Wood Energy

Wood is a plentiful resource and, with wise management, could supply an even more significant share of Warren's energy needs. It is important to note that wood burning may present safety and air quality issues. These issues may be addressed using caution, proper maintenance and the latest in wood heat ~~stove~~ technology. Warren may be susceptible to air pollution due to its geographic location surrounded by mountains. However, burning wood instead of gas will reduce greenhouse emissions. Done correctly, u~~U~~sing local renewable energy sources such as wood would save residents money and stimulate the local economy.

Wind Energy

The Lincoln Ridge is among the best wind sites in New England. However, most of this property is national forest. ~~Green Mountain National Forest has a policy against developing wind turbines on National Forest Land. Therefore, it is unlikely a large scale wind farm will be established in Warren.~~ Small scale wind generation in the Valley is possible in certain areas ~~but would have a small impact on overall generation and would require more detailed investigation of specific sites.~~ and various projects have been proposed. Given the ever rising costs of continued reliance on fossil fuels, there is likely to be increased interest in developing wind projects in the Valley. While Warren encourages the use of solar and small scale wind, a delicate balance must be sought in deciding the placement of solar and wind energy equipment.

Hydroelectric Energy

~~At present,~~ In recent years, the Brooks Dam in Warren Village ~~is~~ was viewed as the only feasible site in Warren for hydro power generation. In the past, it generated electricity which was sold to Green Mountain Power. ~~Discussions are now underway regarding the future of the dam. Its removal would leave no viable location to generate hydroelectric energy.~~

~~It should be noted that developing available sources of hydro power is not without costs~~. ~~The adverse impact of~~ Large-scale hydro power development can ~~be~~ severely ~~on~~ impact aquatic life in rivers and streams. Impoundments cause unnatural increases in water temperature, flood upstream shore lands, cause siltation, isolate fish populations, block fish passage and often destroy salmonid spawning areas. Other negative aspects of large-scale hydro power development include the aesthetic implications of dams and impoundments as well as the possible impact on popular recreational pursuits, such as canoeing and fishing. However, dams have played a significant role in Warren's history and remains of such dams add to the cultural heritage of the community and provide swimming opportunities. Technological developments in small- and micro-hydro may present opportunities for new hydro power generation in Warren without the negative impacts of larger scale projects.

Clustering Development

The density of development can affect energy consumption. As the population is dispersed across the town, more energy is consumed for transportation. There is also a transmission loss over the long power lines required to service dispersed development.

Energy Goals

Goal 5.A Foster quality growth and controlled development in Town.

Goal 5.B Conserve renewable and nonrenewable energy.

Goal 5.C Reduce direct and indirect transportation demands.

Objective 5.1. To direct growth to specified centers served by energy infrastructure. Limit growth in areas of town not served presently.

Implementation Strategies

a) Continue to limit the types of land use and allowable density in areas outside the designated growth centers and in the least accessible areas of town, including the Forest Reserve (FR) District (see Chapter 10).

b) Through Land Use and Development Regulations, encourage clustered and multi-family housing in new residential developments (see Chapter 10) and provide opportunities for appropriate home occupations and larger home-based businesses to minimize commuting to work (see Chapter 9).

c) Amend the Land Use and Development Regulations to encourage innovation in energy conservation and energy efficiency by providing incentives for concentrating development in appropriate locations (e.g., grant density bonuses to developments employing solar design and energy efficiency).

d) Encourage clustered or concentrated patterns in the Land Use and Development Regulations to minimize land consumption and excessive curb cuts, to enable pedestrian and bicycle travel, and to avoid strip or linear development (see Chapter 10).

e) Through the Memorandum of Understanding administered by the MRVPD, continue to ensure that expansion and development activities at Sugarbush do not exceed the current or planned capacity of local electrical supplies.

f) Continue ongoing contact with Green Mountain Power regarding growth and future electrical capacity issues.

Objective 5.2. To establish a strong and visible commitment to energy efficiency.

Implementation Strategies

a) Take corrective measures to reduce energy use in municipal buildings by implementing recommendations from 2008~~3~~ Energy Audit.

b) Encourage maximum conservation of electricity and promote its use in applications where it functions most efficiently, such as lighting, motor operation, and certain industrial processes.

c) Educate citizens about the need for sustainable energy practices. For example, provide technical information to builders and developers, make new public buildings models of energy efficiency, and/or integrate local energy issues into education curricula.

d) Allow flexible standards in the Land Use and Development Regulations for renewable energy generation and transmission facilities.

Objective 5.3. To conserve forest lands as a renewable resource.

Implementation Strategies

a) Encourage sustainable forest management to ensure wood supply for the future; implement all relevant forest land conservation policies of this Plan.

b) Maintain the Forest Reserve (FR) District (see Chapter 10).

Objective 5.4. To create opportunities for walking, cycling and other energy efficient alternatives to the automobile.

Implementation Strategies

a) Complete a recreation and pedestrian path network plan for Warren. Encourage through regulatory and non-regulatory methods, the donation or provision of path easements from developers to enable creation of paths. Seek similar easements from owners of lands not proposed for development.

b) Continue to support state and regional public transportation systems, including the valley transit system. Ensure continued service to Warren Village.

c) ~~Implement recommendations in the 2004 Warren Village Pedestrian Enhancement Plan and~~ Improve pedestrian access in the Lincoln Peak/Sugarbush Village growth center.

d) Encourage employers to provide incentives to promote energy efficient commuting (e.g. ride sharing, bicycling, use of Valley transit).

Table 5.1
Total customers served by the Madbush and Irasville substations - 2009

Substation	Number of Meters	Highest Recorded Peak
Mad Bush #38	1,311	16.73 MW
Irasville #39	2,984	8.41 MW
Total for area served by these stations	**4,295**	
Source: 2010 Green Mountain Power		

Table 5.2 Heating Source by Occupied Households in Warren

Fuel Type	1990		2000	
	Total Units	% of Units	Total Units	% of Units
Wood	180	35%	104	14%
Electricity	118	23%	53	7%
Bottled/Tank or LP Gas	114	22%	392	53%
Oil/Kerosene	96	18%	169	23%
Utility Gas	4	1%	19	3%
Coal or coke	3	1%	3	<1%
Solar	0	0%	0	0
Other	0	0%	2	<1%

Source: 1990 & 2000 US Census