POWER FOR THE PEOPLE

Chapter 5

The purpose of this Chapter is to help Warren residents to understand and plan for climate changes ahead and work to meet the State of Vermont's Comprehensive Energy Plan (CEP) goal of 90% renewable energy by 2050 through enhanced efficiency and greater use of renewable sources for electricity, heating and transportation.

Warren is located in the Green Mountains with long winters, cloudy and snowy weather, and a relatively dispersed population. The age of our housing and building stock along with the operations of Sugarbush Resort and associated recreational development make Warren an energy intensive town. Over 60% of Warren's approximately 2000 homes are occupied seasonally. Temperatures can 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.}

There is a growing recognition that the extraction, refining and burning of fossil fuels for energy is altering the earth's life sustaining ecosystem.

It is important that we create new and environmentally neutral ways to meet our energy needs. With forward thinking State and Local governments, and informed, motivated citizenry we can help meet Vermont's CEP energy goals.

Electrical Power Supply

Historical Supply

Warren's energy sources have varied over time. 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 primary 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. In 1910 four dams in Warren generated mechanical power for local industries (lumber, creamery, sawmill, and wheelwright).

The flood of 1927 took a great toll on Vermont's watermills. The Rural Electrification Act in the 40's and 50's permitted electricity to be generated at power plants many miles away from Warren and supported the construction of the power grid which distributed the newly generated electric power to Warren residents.

Prior to 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 introduction of the ski industry to Warren in the 1950s 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 Mad Bush substation's peak electrical demand has fluctuated from 3.4 mega watts (MVA) in 1966 to 16.73 mega watts in 2009 and 8.29 mega-watts in 2014.

Green Mtn Power Substation	# of Meters in Warren	Highest Recorded Peak	
		2009	2014
Madbush #38	997	16.73 MW	8.29 MW
Irasville #39	858	8.41 MW	7.21 MW
# of Meters	1855		

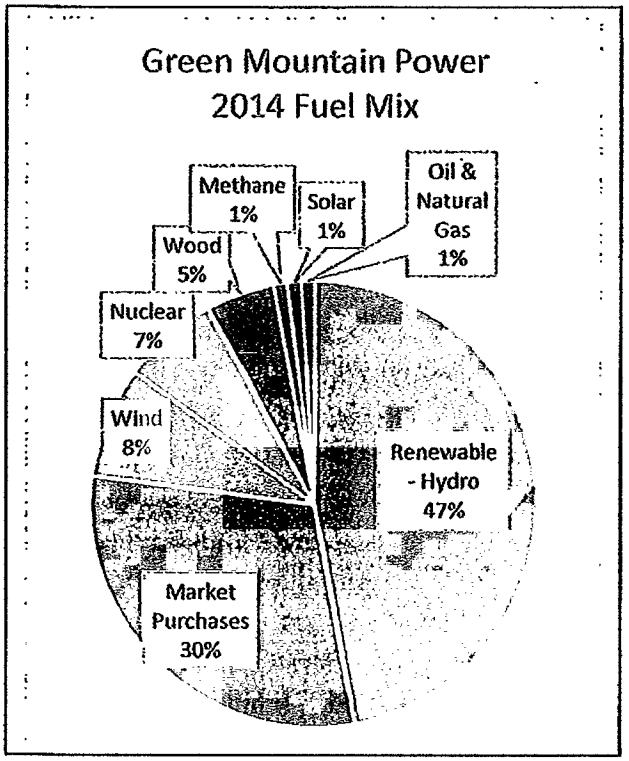
Electrical demands have remained fairly stable over the past decade. The decline and subsequent stabilization in the Valley's peak demand are due to the implementation of the comprehensive electrical load management plan developed by Sugarbush and Green Mountain Power in 1989. The management plan was designed to stabilize energy demand and implement a conservation program at the ski area. Not surprisingly, Sugarbush Resort creates the largest electrical power demand in Warren. Snowmaking requires substantial amounts of Green Mountain Power electrical current from its Mad Bush substation on German Flats Road. Large investments by the Resort and the Green Mountain Valley School in cooperation with Efficiency Vermont and the Vermont Energy Investment Corporation (VEIC) have provided snowmaking upgrades and increased efficiency; dramatically reducing their power requirements. In addition, Sugarbush has begun a series of environmental initiatives and upgrades that should help to further reduce its carbon footprint. The Town looks forward to the role of Sugarbush's leadership in this area.

Historically, there has been a relationship between energy costs, energy sources, location of development, and growth of the Town. First settled on its eastern upper plateau, where there was generally flat land suitable for farming, Warren began as a predominantly agricultural community. The dispersed farms had East Warren as their center where the common road intersects with Roxbury Mountain Road. Later the use of water power as an energy source concentrated mills and development along the river resulting in the establishment and growth of Warren Village. With the advent of the internal combustion engine, and the freedom afforded by it, the pattern of development became far more spread out. Houses, now, could be reached easily by car almost anywhere. Further, the automobile allowed easy construction of and access to winter recreation, the mainstay of our current economy.

Current Supply

Electricity is primarily supplied to the Valley by the Green Mountain Power Corporation. Green Mountain Power's sources of electricity are outlined in the chart below

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% of current load. Although adequate electrical capacity currently exists, past growth in Warren resulted in rapid increases in energy consumption.



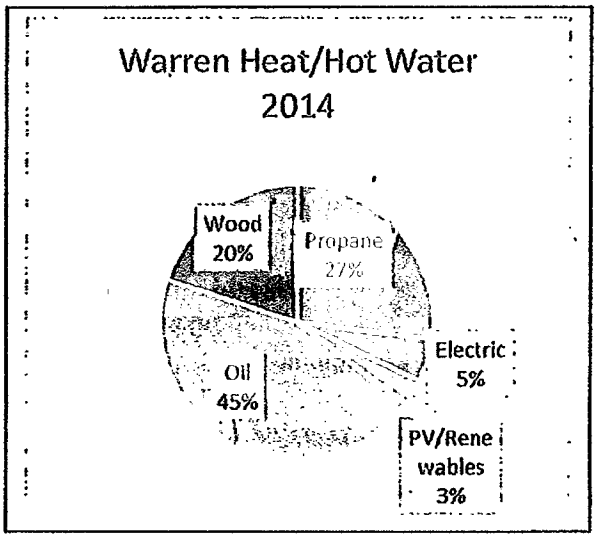
In 2010, GMP officials reported that no transmission and distribution improvements that would substantially increase the capacity of either the transmission lines feeding the area or the substations, Mad Bush and Irasville, are planned in the area over the next 5 years. Conservation and locally generated renewable power would make new capacity unnecessary.

Energy Demand

Residential

Household energy use represents approximately 40% 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. The chart below provides the 2014 breakdown of heating sources for occupied households in Warren.

In 2012, the most common sources of residential heat were oil, bottled/tank LP gas, or wood. There are a number of cord wood suppliers in the Valley, four oil and gas suppliers in Waitsfield and Northfield, and additional suppliers in Waterbury and Montpelier serve the Valley.



Transportation

In Warren it is estimated that more than 40% of our fossil fuel usage is for transportation. The national average energy consumption for transportation is 27%. 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%).

The size of our Town—40 square miles, minimal population of only 1731 residents, and the fact that all major shopping, banking, and entertainment opportunities existing outside of Warren, have created a community that needs, but cannot financially support, a public transportation system. The limited routes of the Mad Bus account for a very small part of total transportation. While Vermont invests in supporting excellent train connections to both sides of the state, getting to these locations can be challenging. During ski season, The Town of Warren and Sugarbush Resort only support limited routes of the Mad-Bus shuttle. 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.

Equally important is for the Town to encourage and develop electric charging stations to further encourage the use of EV and hybrid cars. Charging stations need to be centrally located in the village centers. Considering that the average life of an automobile in Warren is 11 years, there will be a complete turnover of vehicles before 2020 and several more before the 2050 mark. Because transportation accounts for more than 40% of fossil fuel usage, promoting the adoption of fuel efficient cars should be encouraged.

Future Energy Potential

Energy Efficiency and Conservation

Efficiency and conservation are key components to any reduction of fossil fuel use and are necessary if Warren is to meet renewable energy goals. Energy not used is a big step towards meeting these goals.

It is universally agreed that conservation and efficiency are the most cost-effective use of our energy dollars and can significantly reduce the investment necessary in renewable technologies while still achieving the same goals.

Solar Energy

The sun's energy can be used in three main areas to reduce energy consumption: hot water loads, heating and electrical production, and food supply. The amount of energy savings will depend upon site and economic constraints. New construction can and should utilize Vermont's "above-code" Energy Standards

The development of solar farms and group net metering projects for both residences and businesses/municipal facilities should be encouraged for Warren residents and businesses. Group net metering is critical to help Warren reach its goal of becoming a net-zero town, particularly as costs and efficiencies of solar technologies improve. For residents who live in less than ideal solar settings, this provides local residents the opportunity to not only "go solar" but permits the utility to increase its local renewable footprint without adding liability and complexity for the home or business owner.

Almost 60 years ago, Bell Labs scientists developed the photovoltaic cell. Two years later they began installing grid –tied PV panels. In 2003, Vermont enacted net metering laws to encourage small solar energy generation projects. Since then, Warren has seen both additional tracking and fixed installations of photovoltaics. With Federal, State and GMP incentives, this renewable energy resource is becoming more economically inviting. By mid-2014, Warren had 7 ground mounted grid-tied photovoltaic arrays, generating a total of 59kW and 18 roof-mounted, grid tied arrays, generating 86.56 kW. Completed in late 2014, the fixed, ground mounted array at the Warren Elementary School adds 165 more kW to the Town's solar portfolio.

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 can present safety and air quality issues; but these issues may be addressed using caution, proper maintenance and the latest in wood heat technology. Warren may be susceptible to air pollution due to its geographic location surrounded by mountains, however, with proper management burning wood may reduce overall greenhouse emissions. Done correctly, increasing usage of Warren renewable energy sources such as wood would save residents money and stimulate the local economy.

Wind Energy

Like most regions with ridgelines, the Town of Warren has potential for the development of wind energy generation facilities. While this potential has been mapped using computer models, very little actual wind testing has been done at this point. The computer modeled wind energy potential is mapped as part of the Renewable Energy Atlas of Vermont, and can be viewed at www.vtenergyatlas.com.

As a community, and as a municipality, the Town of Warren has always encouraged the use of renewable energy generation; and we see wind energy as an important part of the Town's efforts to meet the energy needs of the Town. In alignment with the State Comprehensive Energy Plan we hope to see 25% of our total electrical needs (currently about 25 Mw) met by Warren based renewable generation by the year 2025. Electricity generated by wind should be able to provide 20% of that goal or 5% of total electrical needs statewide.

The Town of Warren should continue to facilitate development of Warren based wind projects in order to achieve these renewable energy goals by means of community distributed and small-scale wind projects, particularly ones that can take advantage of net-metering.

The Town of Warren does not see large-scale or utility-scale wind generation as an appropriate fit for our town due to a variety of issues including a lack of adequate transmission facilities, and conflict with existing glider flight patterns along the Northfield Ridge.

Hydroelectric Energy

While hydro-electric drove much of the energy needs in Warren in the 19th and early 20th century, today much of our hydro-electric based energy comes from Hydro-Quebec. While there is a renewed interest in energy that is produced locally from renewable sources, hydro-electric generation facilities present challenges of scale, heath, land/resource use and aesthetics, just as all power sources pose. That said, hydro-electric power will continue to be a part of the State's energy portfolio and with proper planning small scale hydro could be part of Warren's energy portfolio.

In recent years, the Brooks Dam in Warren Village, by virtue of its continued existence, has been 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

Any hydro power development can impact aquatic life in rivers and streams. Impoundments can cause unnatural increases in water temperature, flood upstream shore lands, increase siltation, isolate fish populations, block fish passage and often destroy salmonid spawning areas. Technological developments in small- and micro-hydro may present opportunities for new hydro power generation in Warren without the impacts of requiring a new dam.

Clustering Development

The Town of Warren should continue to encourage more compact developments and development areas. Clustered development as opposed to conventional subdivisions preserve more land for open/recreational space, provide a better setting for community building, make possible local agriculture production, and ease

storm water management. Clustered development makes more ecological and economic sense.

The economic benefits of clustered development include having fewer roads, sewer/drainage, and electric/gas utility infrastructure to construct and maintain. Clustering development also reduces travel time for services and provides a better setting for public transportation, increased bicycle usage, and pedestrianism. This subsequently lessons petroleum usage, and reduces Co2 emissions

As petroleum prices rise over time, the cost of maintaining widely dispersed development will become increasingly difficult for both individuals and towns 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.

Energy Goals	
Goal 5.1	Foster quality growth and controlled development in Town.
Goal 5.2	Conserve renewable and nonrenewable energy.
Goal 5.3	Reduce direct and indirect transportation demands.
Goal 5.4	Encourage development of local renewable energy sources.

Objective 5.1. Foster quality growth and controlled development in Town by directing 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) Encourage Sugarbush to develop affordable employee housing appurtenant to the resort property

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

Objective 5.2. Conserve renewable and nonrenewable energy by establishing a strong and visible commitment to energy efficiency and conservation.

Implementation Strategies

a) Take corrective measures to reduce energy use in municipal buildings by implementing recommendations from 2008 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) Educate, and using a checklist as part of the building permit application process, encourage local residents to improve energy efficiency and conservation

e) Educate and encourage local residents to embrace more energy efficient transportation initiatives. Encourage reduced travel through car pools. Promote electric vehicle use.

Objective 5.3. Reduce direct and indirect transportation demands by creating 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) 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, Valley public transit).

e) Encourage additional coordination between Warren/Sugarbush and Waterbury with Amtrak schedules to encourage more mass transit use between Amtrak and the Valley.

f) 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.

Objective 5.4. Encourage the development of local renewable energy sources while bolstering the local economy and conserving forest lands as a renewable resource.

Implementation Strategies

a) Encourage the development of renewable energy projects (solar, wind) to enable town residents who do not have the appropriate landscape to take advantage of renewable energy initiatives at off-site locations (grid tied).

b) Amend the Land Use and Development Regulations to develop an ordinance regarding off-the grid energy generation specific to private wind type facilities.

c) Allow flexible standards in the Land Use and Development Regulations for

renewable energy generation and transmission facilities.

d) Develop siting guidelines for developers of wind and solar projects, to aid permit process uniformity and weigh community benefits and impacts

e) Develop site decommissioning plans for wind and solar projects to cover deconstruction and remediation upon permanent retirement of each turbine or solar array, where appropriate, as well as the entire site.

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

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

WARREN ENERGY COMMITTEE FIVE YEAR PLAN

AN ADDENDUM TO THE WARREN TOWN PLAN, CHAPTER 5

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