Chapter 10 - ENERGY

Overview

Energy is a basic need of our society, but with most of it derived from scarce resources, effective planning for energy use and conservation is extremely important. Our transportation system relies on energy to propel the cars, trucks, and other vehicles that transport people and goods to, from, and throughout the community. Homes and businesses require energy to power appliances and machinery and to provide heat in the winter and cooling in the summer. Stamford has an energy coordinator and has taken some steps to promote conservation in municipal and school buildings, but much more can be done.

Act 174 and Enhanced Municipal Energy Planning

In 2016, the Vermont legislature approved Act 174 to enhance regional- and town-level energy planning and to create a way for municipalities to have input on the siting of electric generation facilities through land use planning. The Act established standards, which if met by a regional or municipal plan give their contents 'substantial deference' in proceedings of the Public Utility Commission regarding the siting of electric generation facilities. The standards require that plans include three broad components:

1. Analysis of current energy use and targets for future energy consumption;

2. Pathways, or implementation actions, to achieve future energy consumption targets; and

3. A mapping component with renewable energy resource maps and siting guidelines for renewable electric generation facilities.

Requirements for regional and local plans are based on statewide policies and goals outlined in the Vermont Comprehensive Energy Plan (CEP), updated in 2016. Two central goals of the CEP are reduction of total energy consumption in the state by a third by the year 2050, and the sourcing of 90% of remaining energy from renewable sources. Though the scope of these goals may seem ambitious, the inevitable and disruptive future price fluctuation in hydrocarbon-based fuels combined with the need to reduce energy costs of all Vermonters are powerful motivators to pursue these goals.

The Town Plan, including this energy element plus sections addressing land use, transportation, and housing are intended to meet the Act 174 standards for a municipal plan. The BCRC's comprehensive regional energy plan was issued a determination of compliance with state energy policy by the Public Service Department. Consequently, the BCRC is responsible for determining whether municipal plans meet those standards. The data, maps, and many of the strategies included in this energy element are derived from the regional energy plan and have been refined to be relevant to the unique conditions present in Stamford.

Current and Future Energy Use

To generate estimates of energy use across various sectors (transportation, heating, and electric) today and into the future, the BCRC collaborated with the Department of Public Service and the Vermont Energy Investment Corporation (VEIC). A computer modeling system called the Long-Range Energy Alternatives Planning (LEAP) model was used to explore various scenarios for achieving 90% renewables by 2050 ("90 x 2050). For the Bennington County Region as a whole, energy consumption will have to decrease by approximately 50% by 2050 to achieve that goal. Some of that reduction will result from a continuation of existing conservation and efficiency programs, but major building envelope improvements and changes to heating and transportation fuel choices will be required as well. Despite projected growth in electricity use, overall energy use will decline since electricity-based technologies such as heat pumps and electric vehicles are much more efficient than their fossil fuel counterparts.

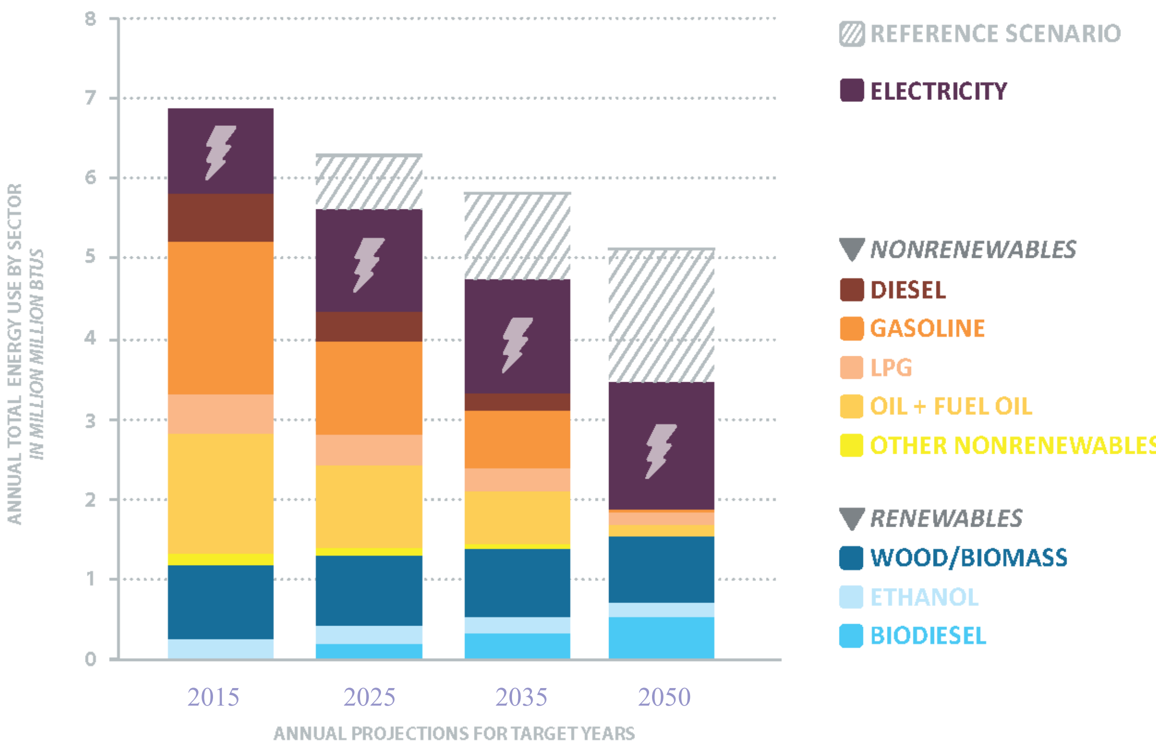


Figure 10-1. Bennington Region, Energy Use By Fuel Type, 2010-2050: LEAP model projections suggest that the Bennington region will have to decrease energy usage to about half of current levels by 2050 in order to achieve the 90X50 goal—an even greater rate of reduction than Vermont at large. Building weatherization, alternative heating systems and fuels, and improved efficiency in the transportation section, largely through greater reliance on electric vehicles, will drive those changes.

Estimated current energy consumption levels by fuel type for the Town of Stamford and projections for years 2025, 2035, and 2050—based on Vermont's 90 x 2050 goal—are displayed in Table 10-1. An increase in reliance on efficient renewably generated electricity and on solid and liquid biofuels can replace the vast majority of fossil fuel use in the town by the year 2050.

The greatest fuel transformation will occur in the transportation sector, where gasoline and diesel use will decline to less than 1.5% of current levels, replaced over time by EVs and biodiesel fuel use. Home heating oil and gas consumption will decrease significantly as high efficiency cold climate heat pumps are adopted to meet most residential and commercial space heating needs. Wood heating will continue to play a significant role in heating, and fortunately locally available wood is already used widely in Stamford as a renewable and efficient energy source for home heating.

Table 10-1. Total energy demand by fuel for the Town of Stamford, projected through 2050. Based on LEAP modeling for the Bennington Region and relative consumption levels inferred from population.

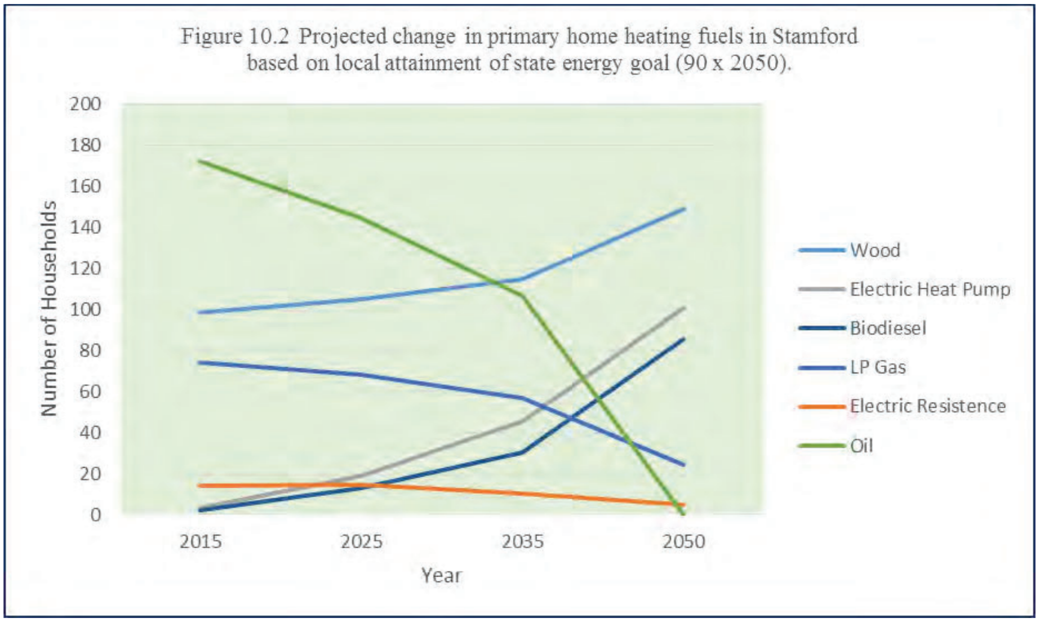
Fuels	2015	2025	2035	2050
Electricity (kWH)	7,722,743	9,298,066	10,294,549	11,591,442
Gasoline (gallons)	395,959	241,686	147,836	5,814
Kerosene (gallons)	13,519	9,259	5,556	-
Diesel (gallons)	108,489	66,693	40,525	1,272
Residual Fuel Oil (gallons)	72,817	53,277	39,916	19,707
LPG (gallons)	143,088	112,110	84,673	47,499
Oil (gallons)	193,355	129,388	77,051	4,725
Wood (tons)	144	138	133	129
Ethanol (gallons)	76,434	65,219	59,907	51,644
Solar Thermal (Th MMBtu)	-	0	0	0
Coal (short tons)	90	56	33	-
CNG (pounds)	16,121	17,361	17,361	18,601
Biodiesel (gallons)	1,176	39,970	66,029	105,999

Residential Energy Use

Stamford's households consume energy for space and water heating ("thermal" applications), for electric lighting, appliances, and equipment, and for transportation. According to US Census (American Community Survey) data from 2015, petroleum oil is used for heating by nearly half of the households in Stamford. Wood (cord wood and wood pellets) and LP gas also are commonly used for heating and another one-third are heated using LP gas. The transition to reduced energy use in this sector will rely on efficiency improvements to homes, heating systems, and appliances, and major changes in the fuel mix will be required to meet 2050 energy goals (Figure 10.2).

Forecasts for energy demand in the residential thermal sector all include significant efficiency gains, resulting in an overall decline in total energy consumption. Therefore, weatherization of existing homes will need to be a priority in Stamford since close to half of all residential structures in town are at least 50 years old and likely are not well air-sealed or insulated. To achieve efficiency targets based on this housing stock, 36 homes will need to undergo significant weatherization work by 2025, 111 by 2035, and 242 homes will need weatherization improvements by 2050.

The LEAP forecasts for residential energy use are also premised on an assumption that liquid biofuels will become genuinely renewable (i.e., their net energy yield will improve dramatically over time as technology advances) and will replace petroleum diesel



as a primary fuel for many home heating systems. If that assumption is not borne out by real developments over time, it is likely that, for the town to stay on target toward meeting goals, many of those homes will have to switch to either electric heat pumps, wood pellets, or cord wood for their primary source of heat.

Electricity demand projections in the residential sector are complicated by the widespread integration of heat pumps (an electricity-driven technology for space and water heating that is much more efficient than older electric resistance heating systems) and electric vehicles (with considerable charging of batteries expected to occur at home-based EV charging ports). Average annual electricity consumption for a household in Stamford is approximately 7,000 kWH (just under 600 kWH per month), an amount that has fallen somewhat over the past several years as a result of energy efficiency initiatives such as the lighting and appliance incentive programs offered through Efficiency Vermont.

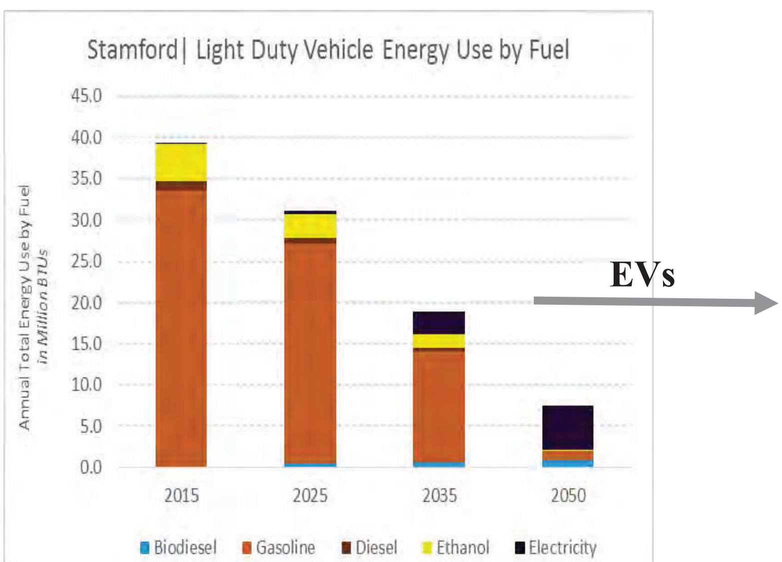
Those efficiency improvements will need to be continued into the future, since townwide electricity demand in the residential thermal sector is expected to more than double by 2050 due to adoption of residential heat pump systems, and electricity usage for residential vehicles is projected to grow from its current negligible amount to over 1.5 million kWH over that same timeframe. It is important to remember that even though electricity consumption will increase dramatically, total energy consumption (all sources) will decline even more dramatically due to a variety of conservation and efficiency measures, including the far greater efficiency of electricity-driven heat pumps and vehicle motors.

Residential Transportation

With transportation using more energy than any other sector, and the vast majority of that energy in form of nonrenewable petroleum fuels, it is clear that major changes must occur in the ways that people and goods are moved around the town and region. Reliance on personal light duty vehicles ("LDVs"- generally cars, pickup trucks, and SUVs) is widespread across the country and especially so in rural areas like southwestern Vermont. The independence and convenience provided by these vehicles has come to be considered essential by most people so a variety of changes in technology, alternative transportation modes, and even land use patterns will need to take place over time to maintain quality of life and economic vitality for residents. It is estimated that Stamford residents own over 680 vehicles and drive about 8.2 million miles per year (US Census ACS estimates). Job-related commuting alone accounts for approximately 19,000 miles per day of travel, consumes 160,000 gallons of gasoline per year, and costs residents over $400,000.

Fortunately, electric vehicle (EV) technologies have advanced significantly in recent years and these systems are expected to replace internal combustion engines at an increasing rate in coming decades. By steadily transitioning the town's light duty vehicle fleet, Stamford residents can improve transportation efficiency while keeping money in the local economy to support renewable electricity generation and other area businesses. According to the LEAP analysis, Stamford can reduce the amount of energy used for transportation to 20 percent of current levels by 2050 while maintaining the number of miles driven by residents at a constant level (Figure 10.3). Electrification of vehicles will account for much of this reduction in energy use through improved efficiency. By 2050, electric vehicles are expected to comprise close to 90 percent of the LDVs in Stamford (Figure 10.3), with biodiesel and ethanol fueling most of the rest of the cars and light trucks.

There are three main kinds of EVs: full electric vehicles, plug-in hybrid (petroleum and electric) vehicles that can be plugged in to charge, and hybrid vehicles (batteries provide an assist to the internal combustion energy and are charged while driving). Full EVs have larger batteries and do not rely at all on petroleum diesel; with increasing efficiency and driving range, it is expected that most vehicles will be full-electric by 2050. Electric vehicles of any type have a fuel efficiency significantly greater than that of internal combustion engine vehicles, leading to the significant efficiency gains projected over time.



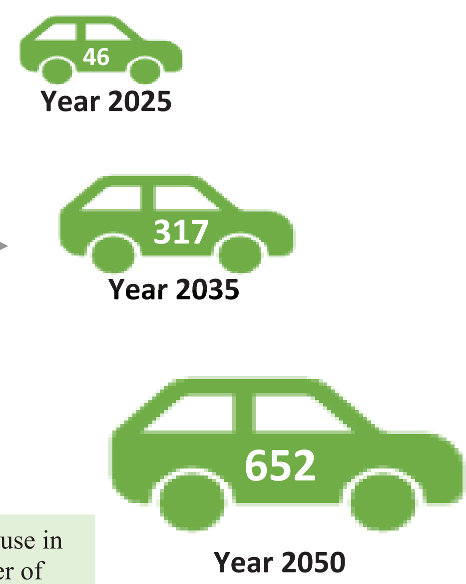
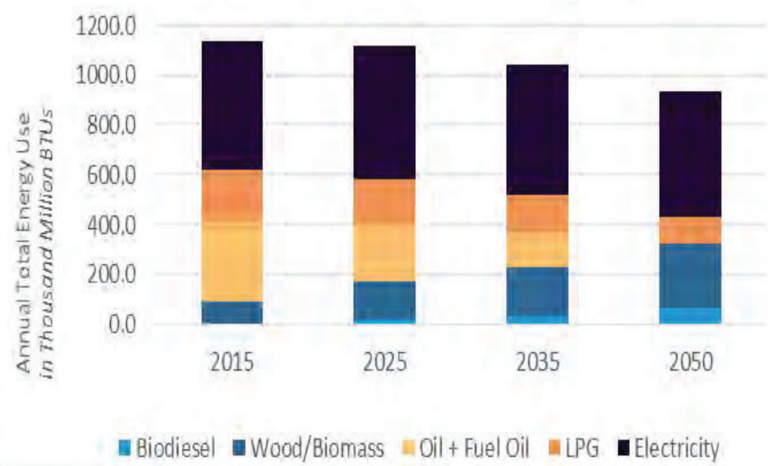


Figure 10.3. Electrification of the vehicle fleet can reduce total energy use in the transportation sector to 20% of its current level; by 2050 the number of electric vehicles (EVs) in Stamford is projected to rise to 652.

Although EVs certainly will play a major role in reducing energy use while allowing Stamford residents to continue to rely on personal vehicle travel, efficiency gains from EVs alone will not account for all the energy reduction needed to meet future transportation energy targets. Conservation through behavior changes such as carpooling, transit use, and increased reliance on walking and biking will be critical to reaching 2050 energy targets. Policies and programs that encourage compact mixed use development and implementation of bicycle and pedestrian friendly ("complete street") roadway design are necessary to shift the predominant transportation model to focus more on people and less on vehicles. As noted in the transportation section of this Plan, it would be beneficial to extend any local bus routes that run northward from North Adams, providing an efficient transportation alternative to the nearest commercial and job center as well as connections to intercity bus routes.

Commercial Energy Use

Figure 10.4. A slight reduction in commercial energy consumption is projected along with increased use of biofuels.



Stamford has a relatively small commercial sector, with heating and operations currently fueled primarily by electricity, oil, and LP Gas (Figure 10.4). Over time, electricity and liquid and solid biofuels are expected to replace most petroleum based fuels. Businesses can reduce energy consumption through building shell improvements and straightforward conservation practices such as using more efficient lighting and equipment. A comprehensive energy audit is an excellent first step that a business can take to identify steps that will yield significant energy and cost savings.

Some businesses also may be able to convert to woodchip or pellet based heating, add solar arrays, or include other renewable energy alternatives at their sites. Opportunities also exist to add EV-charging stations in parking lots for employees and/or customers.

Municipal Energy Use

The Town of Stamford and the School District rely on energy to heat the town offices, school, and fire station, and to operate municipal vehicles and equipment. While not being a large-scale user of energy itself, the town can, nonetheless, take actions to reduce the overall demand for energy and provide an example for energy efficiency and development. Transportation efficiency is supported by maintaining a land use plan that favors a compact development pattern and does not encourage residential sprawl into remote areas of the town. Those same land use policies and regulations also can encourage development that takes advantage of opportunities for passive solar heating and deployment of rooftop solar photovoltaic arrays.

For the most recent year, estimated energy consumption by the municipality and school resulted in total expenditures of $ 58,412.

- ⇒ Town Office Building and Fire Station: 4,000 gallons of oil, total cost $11,600
- ⇒ Stamford School: 6,000 gallons of oil, total cost $17,400
- ⇒ Municipal Vehicles and Equipment: 3,360 gallons of diesel, total cost of $10,486
- ⇒ Fire Department Vehicles: 363 gallons of diesel, total cost $1,134
- ⇒ School Electricity use: 88,750 kWH, total cost $14,200
- ⇒ Streetlighting: 22,450 kWH, total cost $3,592

The Town should have energy audits completed for its buildings and seek funding to implement the most cost-effective improvements. Weatherization improvements, maintenance and upgrades of heating and cooling equipment (potentially including conversions to wood chip or pellet based systems), net-metered solar energy, and use of LED lighting in public buildings, parking lots, and along streets all can have significant impacts on energy use and serve as a visible example of cost-saving investments for residents and businesses.

Local Renewable Energy Resources

The vast majority of energy used in Stamford is imported from outside the town (and generally from outside the state and nation) in the form of gasoline, oil, propane, and electricity. Some of the imported electricity is generated from renewable sources, primarily electricity obtained from hydroelectric generating facilities in Quebec and Labrador (via utility contracts with Hydro Quebec). Even imported renewable energy has environmental impacts, however, including damage to rivers and forests from hydroelectric projects in Canada. The impacts of local energy sources can be regulated more directly and the energy is more secure over the long-term.

A small amount of electricity generation occurs in Stamford, all of which is electricity generated from small-scale renewable solar photovoltaic arrays. The town should plan for some level of solar energy development to support local, regional and statewide targets for in-state renewable generation. An analysis based on both the quality of solar energy resources available in Stamford and the presence of environmental constraints to development indicates that it would be reasonable for the town to accommodate approximately 1.9 MW of solar generating capacity by the year 2050 (Figure 10-5). It can be assumed that up to 40 percent of that targeted amount may be developed on rooftops; the remaining capacity could be sited on approximately eight acres of land, which could be developed as one project or a combination of numerous smaller projects (residential and small-scale commercial projects). The town has identified four "preferred sites" for solar energy development, based on resource availability, local support, and landowner interest (Figure 10-5).

Wind energy also will be an important component of the region's future energy

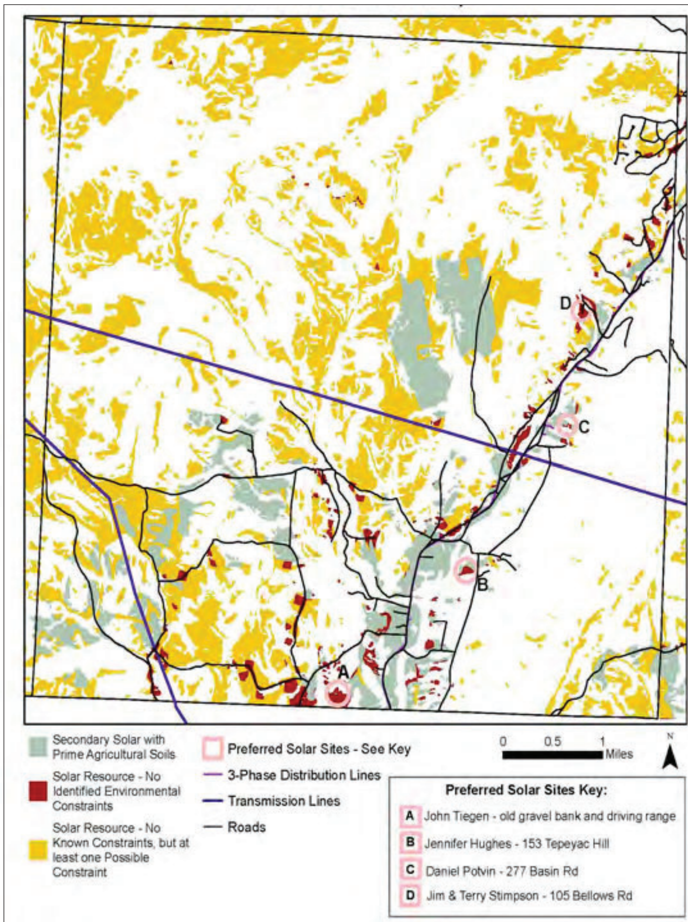


Figure 10-5. Solar energy development in Stamford is constrained by topographic conditions, access to electric distribution systems, and environmental resources. "Prime" sites have good access to solar energy and no identified environmental constraints, but still may be incompatible due to the presence of existing development or other factors, "Secondary" sites have good access to solar resources, but some potential environmental constraints that could complicate or prevent development.

The presence of any of these **most sensitive environmental resources** would prevent development on a site: vernal pools; river corridors and floodways; rare, threatened, and endangered species and state-mapped significant natural communities, federal wilderness areas, and Class 1 and 2 wetlands.

The presence of any of these **potential environmental constraints** might impact the development of a site and should be protected or mitigated to the extent possible: important agricultural soils, flood hazard (100-year floodplain) areas, conserved lands, deer wintering areas, "conservation design" forest blocks (important stands of unbroken forest), and hydric soils.

Despite these constraints, there is adequate potential in Stamford for the projected 1.9 MW of new capacity by 2050.

supply. The Bennington County Regional Energy Plan estimates that approximately 26 MW of new capacity from wind energy should be obtained from the region by 2050. While some of that supply can be realized through residential and small-scale commercial turbine generators (2.5 KW to 100 KW capacity), the only way to meet that target is to take advantage of higher and more consistent wind speeds along some of the area's ridgelines. Examples of such development are readily apparent in developments in nearby Searsburg, and in Monroe, Massachusetts. It is not surprising, then, that some of the best potential for future wind energy development in southwestern Vermont exists in Stamford (Figure 10-6).

Wind energy is a relatively efficient way to produce electricity from a renewable source, but it does have environmental impacts. The Town should consider all of the same environmental constraints identified for solar development and also recognize that large-scale wind projects need to be separated from residential development (a 1 kilometer buffer is illustrated in Figure 10-6). Because of their location on high elevation ridgelines, wind energy development often is highly visible - as is the case with the Hoosac Wind project, which while highly visible in Stamford, does not directly benefit the Town or its residents. Indeed, because of the high visibility and potential disturbance to this important ridgeline, the Town has determined that additional wind energy development on the Hoosac Range in Stamford is inappropriate and inconsistent with the Town Plan. However, responsible wind energy development on high value wind sites located in the northwestern part of

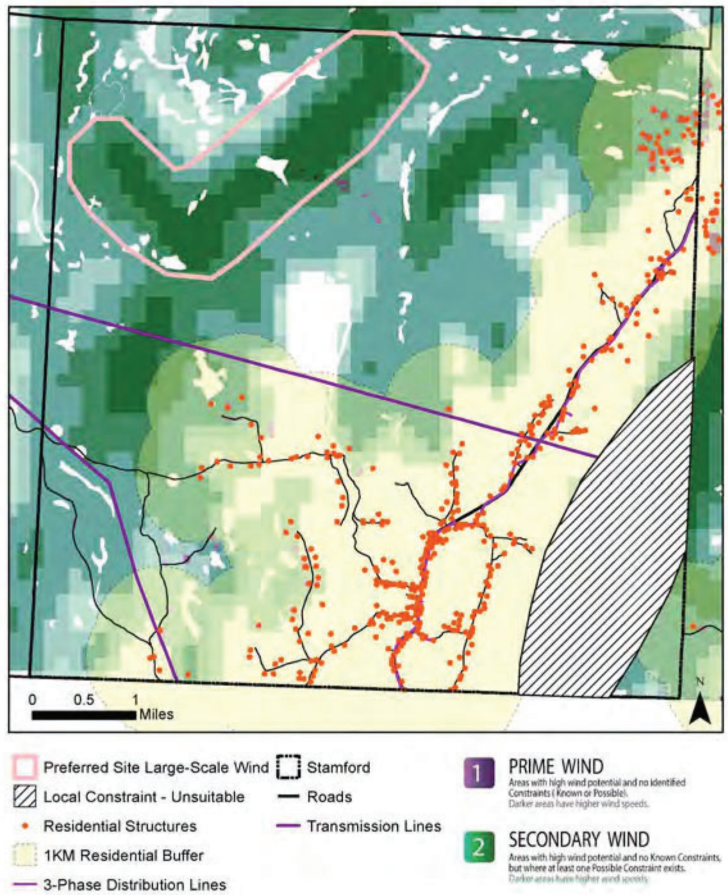


Figure 10-6. The Wind Energy Resource Map for Stamford illustrates that there is significant potential for wind energy development in Stamford due to topographic conditions and the fact that development is located relatively distant from potential wind energy facilities. Constraints to development are primarily associated with potential impacts to sections of remote forest land in these mountainous areas.

Special care must be taken to limit and mitigate environmental damage in these fragile upland areas.

The amount of development in Stamford should not exceed a reasonable contribution toward regional targets that are based on the LEAP model and state energy goals. Less than half of the 26 MW of future wind energy capacity should be located in Stamford.

The town should actively participate in any Section 248 reviews and require compensation if any site is located in Stamford.

Stamford is supported, and the Town considers this area to be a "preferred site" for commercial/utility scale wind energy development (Figure 10-6). If a new wind energy project were proposed on those high-value sites in the northwestern part of Stamford, the Town should receive significant financial compensation for hosting a large regional generation facility. If any project is proposed in Stamford, the Town should participate actively in the Section 248 siting process before the Public Utility Commission, and work cooperatively with the BCRC and the Vermont Public Service Department to ensure that impacts are minimized and that the town is fairly compensated.

It is not expected that all future wind generation for the Bennington County Region be sited in Stamford, as a few other prime sites exist in the area. Therefore, the total future generation capacity planned for Stamford should be limited to no more than 12 MW of capacity, equal to eight 1.5 MW turbines similar in size to those present on the Hoosac Range.

Stamford has limited potential for commercial-scale hydroelectric generation since existing dams would require extensive repair and upgrading and are located far from existing electric infrastructure. State and federal environmental regulations essentially prohibit new dam construction, so any hydroelectric generation is likely to be from a "microhydro" generator that would primarily provide electricity for use on site. Consideration should be given to removal of existing dams having no potential for electricity generation, in order to restore and enhance aquatic ecosystems.

For current renewable electricity generation sites and capacities in Stamford, refer to the Community Energy Dashboard:

https://www.vtenergydashboard.org/my-community/stamford/statistics.

Conservation, Efficiency, and Renewable Energy Strategies

Stamford should establish a municipal energy committee to work with the energy coordinator to support and oversee town-led energy conservation and efficiency efforts.

Land Use Planning and Regulation

The development pattern of the Town as a whole, and of individual development projects, can contribute to energy conservation.

- The municipal land use plan should continue to encourage development that is concentrated near the town's center, reducing the need for lengthy travel between destinations and allowing for an energy- and cost-efficient means of providing infrastructure.
- The town should encourage compact planned unit developments, building orientation to take advantage of solar gain for heating and natural lighting, proper use of vegetation, and energy-saving insulation and appliances to enhance conservation efforts.
- The Town should make all applicants for zoning permits aware of the state's energy efficiency codes, which require that new buildings meet Building Energy Standards.

Residential Sector Energy Efficiency Improvements

Owners of residential properties should take advantage of opportunities for energy efficiency improvements and use of renewable energy resources.

- Homeowners should consider having an energy audit completed to identify potential weatherization improvements together with the cost and expected energy (and dollar) savings of each.
- The town should ensure that information about audit/weatherization services such as those provided by NeighborWorks of Western Vermont, the Bennington Rutland Opportunity Council (BROC), and private contractors is readily available to residents.
- Rebate and incentive programs available through Efficiency Vermont can help homeowners who would like to invest in lighting and appliances, solar electric or small-scale wind generators, and/or water and space heating systems using solar energy, heat pumps, or wood (furnaces or stoves).

Commercial and Public Sector Energy Efficiency

Investments in energy conservation, efficiency, and renewable energy can help businesses and public and nonprofit organizations by reducing costs and increasing operational efficiency.

- New commercial and industrial construction should conform to the Vermont Guidelines for Energy Efficient Commercial Construction.

- The Town should encourage business and other organizations to conduct energy audits, make energy improvements, and install renewable energy systems when appropriate.
- Businesses, institutions, and other organizations should consider changes to their procedures and operations to conserve energy. Support for employee ride-share, public transportation use, and telecommuting should be considered. Whenever possible, local raw materials should be used and local markets identified for products.
- The Town should consider conducting a comprehensive municipal energy audit and make an effort to reduce fossil fuel use in its municipal facilities and operations:
    - ◊ Consider replacing streetlights and other outdoor lighting with LED fixtures.
    - ◊ Fuel efficiency should be an important consideration when the town replaces vehicles and heavy equipment.
    - ◊ Opportunities for employing renewable energy resources in municipal buildings and facilities should be pursued.
- The School should consider a wood biomass based heating system when replacing its current system. The Biomass Energy Resource Center should be contacted for technical assistance.

<u>Transportation Sector Energy Efficiency</u>

The design of the local transportation system can contribute significantly to energy conservation. Stamford can be a very bicycle and pedestrian friendly community and efforts to promote such human-powered transportation should be strongly supported.

- The village center sidewalk project and extensions to residential neighborhoods should be expanded over time, and safe and well-maintained road lanes and shoulders should be provided for horseback riding and bicycling.
- Safe roadway crossings, bicycle route signs, bicycle racks, and other amenities that encourage non-motorized travel around the town should be provided as part of roadway and other improvement projects whenever possible.
- The Town should periodically assess the demand for new public transportation, including new bus routes to North Adams and other employment and educational centers.

<u>Support for Local Food Systems</u>

Significant energy savings can be realized through production of local food: in backyard gardens, community supported agriculture (CSA) operations, and at area farms that sell their produce at local stores and farmer's markets.

- Continue to support the community garden at the municipal center property and support initiatives that encourage farming, value-added agricultural production and related businesses in Stamford.
- Support high intensity grazing and other agricultural and forestry practices that encourage carbon sequestration.

Electricity Supply and Generation

Much of the Town's energy is used in the form of electricity, and that demand is projected to grow significantly over time, so it is critical to assure an adequate supply from both generating sources and the capacity of transmission and distribution systems.

- The Town should support economically and environmentally sound development of local electricity generating capacity, improvements to the "Southern Loop" transmission system, and development of smart grid technology.
- Local electricity generation in Stamford should be consistent with local and regional needs, as identified in the Bennington County Regional Plan, and should not adversely affect the rural character of the community.
- Encourage solar photovoltaic generating systems, especially on rooftops and other developed surfaces. Small-scale projects at residences and commercial or public properties are appropriate throughout the town. Larger scale projects must be carefully sited to assure that important environmental resources, including those identified on the solar resource map (Figure 10-5) are protected, and that important locally identified resources and scenic vistas are preserved. The town may wish to develop a local ordinance to require screening that will mitigate visual impacts of solar projects.
- The Town should identify specific "preferred sites" for development of community scale and larger solar projects.
- Small-scale wind energy generators (no more than 100 KW capacity) are appropriate at most locations in Stamford, provided that noise levels meet state requirements and any tower is located further from the property line than the overall height of the tower plus blades.
- Larger-scale wind energy development (turbines exceeding 100 KW capacity) must be located at least 1 kilometer from any year-round residential building, adhere to all state environmental requirements, and provide direct benefits—in terms of electricity supply and/or financial contributions— to the town. Because Stamford is impacted by existing ridgeline wind energy development, no more than 12 MW of new generating capacity should be proposed, or sited, in Stamford.