Town of Starksboro | ENHANCED ENERGY PLAN

Introduction

INTENT OF THIS ENERGY PLAN

The Town of Starksboro recognizes our individual and collective responsibility to help reduce and conserve the energy we all use. Starksboro believes it serves its citizen's interests by conserving energy, reducing our consumption of non-renewable energy and shifting our usage to carbon free or carbon neutral renewable energy sources. Starksboro also believes that the Starksboro Town Plan must create a vision and clear policy statements for the Town to follow concerning energy conservation, reduced consumption and renewable generation within the Town. By this Plan Starksboro intends to exercise more control over the types of energy choices made within the Town.

One of the principal ways for Starksboro to gain more control over its energy usage and consumption is to create policies to meet the municipal determination standards for enhanced energy planning enabled in 24 V.S.A. 4352. By pursuing enhanced energy planning Starksboro agrees that its energy plan will further regional and state energy goals, including the goal of having 90% of the energy used in Vermont obtained through renewable sources by 2050 ('90 x 50') and the following:

- Vermont's greenhouse gas reduction goals under 10 V.S.A. § 578(a);
- Vermont's 25 by 25 goal for renewable energy under 10 V.S.A. § 580;
- Vermont's building efficiency goals under 10 V.S.A. § 581;
- State energy policy under 30 V.S.A. § 202a and the recommendations for regional and municipal energy planning pertaining to the efficient use of energy and the siting and development of renewable energy resources contained in the State energy plans adopted pursuant to 30 V.S.A. §§ 202 and 202b (State energy plans); and the distributed renewable generation and energy transformation categories of resources to meet the requirements of the Renewable Energy Standard under 30 V.S.A. §§ 8004 and 8005;

To receive a positive determination of energy compliance, an enhanced energy plan must be duly adopted, regionally approved, and must contain the following information:

An analysis of current energy resources, needs, scarcities, costs, and problems.
Targets for future energy use and generation.
"Pathways," or implementation actions, to help the municipality achieve the established targets.
Mapping to help guide the conversation about the siting of renewables.

A positive determination of compliance with the requirements of enhanced energy planning will enable Starksboro's Plan to achieve "substantial deference" from the Public Utilities Commission in Section 248 applications for energy generation facilities (ex. wind facilities, solar facilities, hydro facilities, etc.) under Criteria (b)(1) – Orderly Development of the criteria the Public Utilities Commission uses to evaluate proposed generation and transmission projects seeking Certificates of Public Good authorizing the construction of the proposed project. Substantial deference increases the respect the Public Utilities Commission will need to provide to clearly articulated policies in this plan (The current standard is "due consideration").

This chapter includes the required analysis, targets, "pathways," and associated mapping. Topics covered include energy conservation, reduction, and generation as it relates to thermal and electrical energy usage, transportation,

and land use planning. The plan also includes energy generation and siting standards. In addition to satisfying the above noted required criteria, this plan also contains a number of goals, objectives, and policies which describe actions Starksboro will undertake to achieve the described targets through implementation of conservation and appropriate generation strategies and as a part of the Town's efforts to meet the State's larger renewable goals.

STARKSBORO ENERGY COMMITTEE

The Town of Starksboro has recently formed an energy committee to consider, discuss, and address energy efficiency and renewable energy opportunities in Starksboro. Its mission is to work with residents, businesses and the Town to ensure our community's long-term energy future and energy independence by changing the way we use, produce and relate to energy.

OUTLINE OF HOW TO READ THIS PLAN

This plan breaks Starksboro's energy usage into the following four chapters, followed by a mapping section and associated appendix:

1. Thermal Use: This Chapter focuses mostly on Energy used for space heating.
2. Electrical Use: This Chapter focuses mostly on energy use within buildings for other end uses than space heating, for operating equipment, and is predicted to expand significantly to include transportation and heating loads.
3. Transportation Use: This Chapter focuses on energy used for transportation.
4. Land Use Generation and Transmission: This Chapter focuses on strategies for land use planning aimed at identifying appropriate siting opportunities for energy generation and transmission resources.
5. Mapping: This Chapter includes an analysis of the mapping of Starksboro's energy resources and constraints and a siting policy for new generation.
6. Appendix - Maps

Each chapter noted is broken into three sub-sections.

USE ANALYSIS: This sub-section providess current usage data in Starksboro for each of the four energy sectors. It includes charts of usage and a narrative describing the usage data.

TARGETS: The second sub-section will look at future projections of energy usage in the Town assuming Starksboro intends to meet the State goals of using 90% renewables by 2050. This subsection contains projections of usage targets. In 2016 through collaboration of the Addison County Regional Planning Commission worked with the Vermont Energy Investment Corporation (VEIC), and the Vermont Department of Public Service to develop regional targets for future energy use and generation. The intent of these targets is to meet the State of Vermont's 90 x 50 goal. The targets represent one scenario of what meeting this goal may look like. However, there could be numerous other ways for Vermont to achieve the 90 x 50 goal. For more information about the regional targets, please see the Addison County Regional Energy Plan (www.acrpc.com).

PATHWAYS: The third sub-section in each chapter provides goals, objectives, and policies for implementing the plan.

Additionally, the Land Use, Generation and Transmission chapter includes a mapping analysis of Starksboro's energy resources and constraints and a siting policy for new generation.

Thermal Use Analysis

THERMAL USE

An estimate of current residential thermal energy demand in Starksboro, based on data from the American Community Survey (2011-2015), is shown in Table 1. The data shows that the largest number of residences in Starksboro currently heat with fuel oil, (about 42%), followed by wood (41%) and propane (14%). Together these three heating sources account for about 97% of residential thermal heating fuel usage in Starksboro.

TABLE 1. CURRENT MUNICIPAL RESIDENTIAL HEATING ENERGY USE

Fuel Source	Municipal Households (ACS 2011-2015)	Municipal % of Households	Municipal Square Footage Heated	Municipal BTU (in Billions)
Natural Gas	0	0.0%	0	0
Propane	94	14.4%	168,839	10
Electricity	5	0.8%	10,360	1
Fuel Oil	272	41.6%	530,366	32
Coal	3	0.5	6216	0
Wood	269	41.1%	547,598	33
Solar	0	0.0%	0	0
Other	2	0.3%	4,144	0
No Fuel	3	0.5%	6,216	0
Total	654	100.0%	1,285,721	77

Wood constitutes a carbon neutral renewable resource. It is also currently abundant in much of Starksboro. Both fuel oil and propane gas are non-renewable fossil fuels. In order to meet State targets, their use will need to be largely eliminated by 2050. Making homes more thermally efficient is one way to reduce fossil fuel use. Another is to improve the heating and hot water equipment to make it work more efficiently. The third, and over the long-term best solution is to replace the fuel source with technology using an alternative, renewable fuel source, like electricity produced through renewable generation or wood. There are numerous barriers to efficiency adoption, including the higher first cost of new equipment. While the Town of Starksboro has little control over the costs of energy or equipment, it can work to encourage conservation, efficiency and lower local generation costs to help residents overcome some of the major barriers to adopting cost-effective efficiency improvements.

Estimates for commercial and industrial thermal energy use are more difficult to calculate. An estimate of total commercial energy use (thermal and electricity) is provided in Table 2 and based on data from the Vermont Department of Labor (VT DOL) and the Vermont Department of Public Service (VT DPS).

TABLE 2. CURRENT MUNICIPAL COMMERCIAL THERMAL ENERGY USE

Column1	Commercial Establishments in Municipality (VT DOL)	Estimated Thermal Energy BTUs by Commercial Establishments in Municipality (in Billions)
Municipal Commercial Energy Use	21	15

As the table immediately above shows, Starksboro has a very limited number of commercial establishments. Sugaring, however, should be noted as a commercial agricultural use as Starksboro does now have approximately 300,000 taps in the Town and which represents approximately four billion BTUs of thermal energy usage for boiling, not including

electrical use for pumps and motors. Most of the thermal energy changes that will need to take place in Starksboro to meet the targets will need to be done by individual home owners.

Energy conservation is the most cost-effective way to reduce energy costs in Vermont. A wide variety of state and federal subsidies and rebates are currently available for Vermont residents to conserve energy. Efficiency Vermont, the nation's only efficiency utility, has an informative home page at Efficiencyvermont.com. Visit it to learn about their current programs, including energy audits, incentives for Home Performance with Energy Star, information on appliances and LED bulbs, building an Energy Star home, home heating help, rebate information, and Efficiency Vermont's reference library.

Vermont also has residential energy standards. Officially called the "Residential Building Energy Standards" (RBES), the Residential Energy Code is a minimum standard of energy efficiency for all new residential construction in Vermont. The Vermont Residential Energy Code Handbook edition 4.1 March 1, 2015. REBS encompasses two requirements:

1. a technical requirement that includes minimum standards for energy-efficient building components and construction practices, and
2. a certification requirement for reporting compliance. Upon completion state law requires every Vermont builder to self-certify that the home complies with the Code as built. The builder must complete and sign a certificate and submit it to the Town Clerk for filing. This should be on record before the Zoning Administrator issues a Certificate of Occupancy.

THERMAL TARGETS

Thermal targets for Starksboro include increasing weatherization of homes, increase in new efficient wood heat systems and switching to efficient heat pump systems. See tables below for one example of targeted changes necessary to meet the 90 x 50 State goal.

TABLE 3. THERMAL EFFICIENCY TARGETS	2025	2035	2050
Residential - Increased Efficiency and Conservation (% of municipal households to be weatherized)	2%	9%	47%
Commercial - Increased Efficiency and Conservation (% of commercial establishments to be weatherized)	17%	18%	51%
Fuel Source Migration			
New Efficient Wood Heat Systems (in units)	1	3	24
New Heat Pumps (in units)	68	162	321

To hit the goal of 90% renewable energy use in Starksboro, targets have been established for each of the three major strategies to reduce or change the type of fuel used for space-heating. In order to hit the targets, by 2050 property owners in Starksboro will need to have made significant improvements to their homes and businesses. Approximately half of the houses and businesses in Starksboro will need to have been weatherized to conserve energy by using it more efficiently to heat those spaces. Additionally, a number of homes currently using wood as a heating source will need to invest in new technology to burn that wood more efficiently. Lastly, nearly all of the houses currently heating with oil or propane will need to have switched fuel sources to cleanly generated electrical heat by installing efficient electric heat pumps.

Thermal Pathways to Implementation - Goals, Policies and Recommended Actions

Given the significant enhancements noted above, Starksboro promotes the following Goals, Objectives and Policies for itself and its citizens.

Goals

1. Reduce annual energy needs and fuel usage for heating structures and space conditioning to foster the transition from non-renewable fuel sources to renewable fuel sources for residential, commercial, and municipal buildings and facilities in the Town of Starksboro.

Objectives

1. Support energy conservation efforts for all buildings.
2. Promote improved efficiency for all types of building systems and increased use of renewable fuels in all buildings, especially new ones.
3. Support the migration from non-renewable fuel sources to renewable fuel sources (i.e. oil and propane heating to efficient wood heating or electric heat pump systems)
4. Conserve forest land as a renewable local energy resource, tempered by the responsible use of wood for biomass energy production.

Policies

1. Coordinate with ACRPC, Efficiency Vermont, and other efficiency resources and service providers to encourage Starksboro residents to participate in weatherization programs.
2. Promote the residential and commercial building energy standards by asking the Zoning Administrator to distribute information about Vermont's Energy Codes to permit applicants, explaining options for energy efficiency and requiring a code certificate prior to issuing any certificate of occupancy.
3. Conduct energy audits of municipal and school buildings to identify efficiency retrofits and incorporate the recommendations into the municipal and school capital budgets.
4. Explore the funding opportunities and implementation possibilities to upgrade the efficiency of all town buildings including the school, town hall, library, town garage, volunteer fire department building, and town offices.

Electrical Use Analysis

An estimate of current electricity use in Starksboro is shown in Table 4. This data is from 2015 and is available from Efficiency Vermont and Green Mountain Power, ("GMP") the electric utility that serves the majority of the Town of Starksboro. Vermont Electric Coop serves a portion of the town but the data was not available. Residential structures consume 10 times as much electrical energy as the commercial entities within the Town.

TABLE 4. CURRENT ELECTRICITY USE	
Use Sector	Current Electricity Use (Efficiency Vermont)
Residential (kWh)	6,228,749
Commercial and Industrial (kWh)	652,079
Total (kWh)	6,880,828

Electrical Targets

Like the thermal targets noted above, Starksboro will need to focus on efficiency and conservation to positively affect the amount of electricity it uses. Since most of the electrical consumption in Starksboro is by residents, rather than commercial entities, the targets will largely require individual homeowners to improve the thermal efficiencies of their structures, as noted in the previous chapter, and increase the efficiency of the electrical fixtures, motors and bulbs used in their homes and appliances.

However, even with significant efficiency steps taken by businesses and residents, Starksboro's electrical usage is predicted to increase, largely because many of the new technologies needed to reduce fossil fuel consumption, like heat pumps and electric cars, increase Starksboro's consumption of electricity. This strategy only works to reduce greenhouse gases if one assumes the electricity is generated from renewable generation. Table 5, below, shows that Starksboro must increase its efficiency and conservation by nearly 60% by 2050 to meet the proposed targets. Technology advances, like better fuel or motor efficiency, will drive this change. However, this plan anticipates that Starksboro and its residents will also need to make significant conservation and efficiency improvements to meet the targets.

Table 5. Electricity Efficiency Targets	2025	2035	2050
Increase Efficiency and Conservation	10.8%	37.2%	59.2%

Electrical Pathways to Implementation - Goals, Objectives, and Policies

Starksboro promotes the following Goals, Objectives and Policies for itself and its citizens to meet the electrical targets above:

Goals

1. Conserve renewable and nonrenewable energy resources
2. Reduce reliance on nonrenewable fossil fuel energy sources, such as oil and gas, and shift reliance to renewable energy sources by encouraging conversion to electric heat pumps and electric vehicles.
3. Reduce emissions of greenhouse gases and substances that cause acid rain by switching from non-renewable resources to renewable electric resources.
4. Plan for increased electric demand with the support of Green Mountain Power, Vermont Electric Coop, and Efficiency Vermont.

Objectives

1. Support energy conservation efforts and the efficient use of energy in all our municipal buildings and encouraging the installation of efficient equipment in non-municipal buildings
2. Promote energy efficiency in all buildings, especially new ones.
3. Support the conversion from non-renewable heating systems (i.e. oil, gas and propane) to efficient renewably fueled systems (i.e. more efficient wood heating, electric heat pumps systems, etc.).
4. Discourage the use of "always-on" street lamps and other outdoor lighting.
5. Encourage the transition to renewable and lower-emission electrical energy sources for transportation.

Policies

1. Promote the use of the residential and commercial building energy standards by distributing code information to permit applicants and working closely with the Zoning Administrator.
    a. Encourage conversion to electrical systems (i.e. heat pumps and electric cars)
2. Plan for and install electric vehicle charging infrastructure on municipal property.
3. Investigate installation of community-based renewable energy project(s) to allow Starksboro's citizens to participate in the economic benefits of local energy production.
4. Explore the funding opportunities and implementation possibilities to upgrade the efficiencies in all town buildings including the school, town hall, library, town garage, volunteer fire department building, and town offices.
5. Incorporate EV ready standards into building code. (Ex. As simple as 220v outlet in garages)

Transportation Use Analysis

More than any other sector, the transportation costs borne by Starksboro's residential vehicle use demonstrate the scope of the change that will need to take place in Starksboro to meet the State's energy goals. Based upon the number of registered vehicles in Starksboro, assumed average vehicle miles travelled, gas mileage per vehicle, and assumed gas prices at their current level, Table 6 shows Starksboro residents spend over $1.8 million dollars per year on residential vehicle trips. While some money will go to local gas stations, the majority of the cost per gallon leaves the local economy. Reducing vehicle miles by transforming local infrastructure to provide for choices and opportunities other than single family vehicles will promote fuel conservation and monetary savings for individuals. Converting to different, locally produced energy generation sources for transportation could help reinvest some of this money locally. Table 6, below, depicts Starksboro's fuel usage for passenger vehicles (It does not include heavy trucks or farm vehicles).

TABLE 6. CURRENT MUNICIPAL TRANSPORTATION ENERGY USE	
Transportation Data	**Municipal Data**
Total # of Vehicles (ACS 2011-2015)	1,338
Average Miles per Vehicle (Vtrans)	11,356
Total Miles Traveled	15,194,328
Realized MPG (2013 - VTrans 2015 Energy Profile)	18.6
Total Gallons Use per Year	816,899
Transportation BTUs (Billion)	98
Average Cost per Gallon of Gasoline (RPC)	$2.31
Gasoline Cost per Year	$1,887,037

Breaking the numbers down further, since we know Starksboro has 654 households, this shows that on average, Starksboro's citizens average just fewer than two cars per household. If we divide the $1.8 million dollars spent by the number of households, it shows the average household spends, with two cars, approximately $2,885 per year on gasoline, not including other expenses associated with owning a vehicle. When one includes maintenance and depreciation on the vehicle, AAA estimated that in 2014 the cost per year of owning a single vehicle was nearly $9,000. Since the average household has two cars, that adds up to an average of $18,000 per household, per year.

Transportation Targets

Table 7, below, shows proposed Transportation Targets for the Town of Starksboro.

TABLE 7. TRANSPORTATION TARGETS	2025	2035	2050
Renewable Energy Use - Transportation	2.7%	18.2%	83.5%
Fuel Source Migration - Transportation			
Electric Vehicles	117	800	1559
Biodiesel Vehicles	26	44	63

As the Table 7 shows, to meet the proposed targets by 2050, over 83% (more than 4 out of 5) of vehicles in Starksboro will need to run on renewably generated electricity. Additionally, most commercial vehicles and farm equipment will need to switch from diesel to bio-diesel or electricity.

Transportation Pathways to Implementation - Goals, Objectives and Policies

To meet these targets Starksboro promotes the following Goals, Objectives, and Policies for itself and its citizens:

Goals

1. Reduce reliance on nonrenewable energy sources such as diesel and gas and shift reliance to renewable energy sources.
2. Reduce emissions of greenhouse gases and substances that cause acid rain.
3. Hold vehicle miles traveled per capita to 2011 levels through reducing the amount of single occupancy vehicle (SOV) commuter trips, increasing the amount of pedestrian and bicycle commute trips, and increasing public transit ridership.

Objectives

1. Support the reduction of transportation energy demand, reduction of single-occupancy vehicle use, and the transition to renewable and lower-emission energy sources for transportation.
2. Support regional efforts to increase access to safe every day walking and cycling within and across municipal borders.
3. Provide walking and biking paths in large developments.
4. Support state and regional public transportation programs serving Starksboro and ask major employers wishing to construct or expand businesses in the region to promote energy efficient commuting.
5. Support use of the Park and Ride in Starksboro at the Town Office and encourage Starksboro residents to consider using ride-sharing programs in order to reduce use of fossil fuels.
6. Support actions to encourage switching to electric vehicles (ideally powered by renewables).

Policies

1. Work with ACTR to understand ways in which service to Starksboro could be improved.
2. Plan for and install electric vehicle charging infrastructure on municipal property.
3. Review municipal road standards to ensure that they reflect all “complete streets” principles applicable to our rural roads.
4. Nominate a Starksboro representative to sit on the Walk-Bike Council of Addison County to foster safe and accessible opportunities for walking and cycling as an alternative SOV.
5. Incorporate EV ready standards into building code. (as simple as 220v outlet in garages)

Land Use, Generation and Transmission Analysis

LAND USE ANALYSIS

Starksboro currently constitutes a largely rural, agricultural town with some density of vacation and year-round homes, a small village center which includes town offices, municipal facilities and an elementary school. Because of its existing settlement patterns and a lack of significant numbers of commercial and industrial facilities, Starksboro residents are probably more dependent on their cars than many Vermont towns. While Starksboro desires to retain its rural feel, it can adopt land use policies that encourage more densely settled areas that have the capacity to allow for more transportation alternatives within those areas, while also potentially saving energy and promoting healthier options, like walking or biking. As with other conservation type goals, conserving energy by reducing the need for cars can be more cost effective for Starksboro's citizens than migrating to electric vehicles as discussed in the previous chapter. Therefore, the Land Use Section of this Plan promotes greater density and housing options in Starksboro's village areas. Other Land Use policies to limit energy use are listed in the Policy Section below.

GENERATION

Existing Renewable Generation: Current Energy Generation

Starksboro's energy supply is largely consistent with statewide patterns. For example, Starksboro does have a number of alternative energy installations that provide energy utilizing local renewable energy resources. A growing number of homes have photovoltaic systems that supply a portion of their electrical energy. Thanks to Vermont's net-metering law, owners of these systems can sell excess power back to the grid during periods of high solar production, and purchase grid power when needed. Thus, the grid serves as a kind of storage system for solar-produced electrical energy. Since 2015 these numbers have continued to increase and a couple of other homes now have solar domestic hot water systems. Table 8 depicts Starksboro's existing renewable generation resources as of 2015 for GMP and 2018 for VEC.

TABLE 8. EXISTING RENEWABLE GENERATION (2015 GMP & 2018 VEC)	Sites	MWh
Solar	70	683
Wind	1	2.5
Hydro	0	0.00
Biomass	0	0.00
Other	0	0.00
Total Existing Generation	71	685.5

As Table 8, demonstrates, 71 different sites generate renewable energy from solar within the Town of Starksboro. The discussion below encompasses all of the types of renewable generation potentially available to Starksboro's residents and how they might harness it to meet statewide generation targets for the community.

TYPES OF RENEWABLE GENERATION POTENTIAL

Solar Energy

Starksboro's location and climate mean our share of solar energy is less than average. Nevertheless, the rate of solar energy input to Starksboro ranges from about 500 kilowatts per acre in January to 900 kilowatts per acre in June; these are for solar collectors tilted at an angle equal to our latitude, 44°. (National Renewable Energy Laboratory, Solar Radiation Data Manual for Flat-Plate and Concentrating Collectors)

For comparison, our January figure is just over half that of Albuquerque, New Mexico—an excellent place for solar energy—and our June figure is more than three-quarters that of Albuquerque. Given our total energy consumption rate of 10,500 kWh per annual average household consumption, this means that even in January Starksboro could, in principle, meet our average energy demand with solar energy, using just 30 of our town's 13,952 acres. Inefficiencies would raise this figure many times over, as would our increased energy consumption in January. Nevertheless, it's clear that the solar resource at Starksboro is theoretically more than adequate for our energy needs.

While the technology exists to convert solar energy into heat and electricity to supply all of Starksboro's energy with in-town solar installations, the current costs are prohibitive. However, use of solar energy for electricity and/or heat in individual homes and for charging electric vehicles is technologically feasible and ranges from solidly economical to marginally so. Solar energy facilities ranging from 150 kW to 5MW are starting to be constructed in neighboring Addison County towns with varying visual and other impacts. Table 8 describes some of our town's current solar installations.

As noted earlier, Starksboro supports renewable energy generation installations sized, sited, and constructed pursuant to the community Siting Standards contained later in this section. Starksboro believes the best commercial/industrial solar sites in the Town would be in the area Starksboro has zoned for industrial use.

Biomass

Trees' leaves act as solar collectors, storing solar energy through the process of photosynthesis. Although the efficiency is low, Vermont's large areas of forest make for a substantial rate of solar energy storage in the form of tree biomass. Biomass can be burned for heat or to generate electricity. Many homes in Starksboro use wood either as the primary heating fuel or to supplement another heat source, usually oil but sometimes solar or geothermal. As Table 1 shows, about 41% of Starksboro's households burn wood for heat, generating approximately 33 Billion BTUs. Burning wood for heat in Starksboro certainly makes a significant dent in our town's oil consumption.

Local foresters agree that each acre of Addison County forest might sustainably yield about one-third of a cord of firewood each year. Given that the majority of Starksboro is generally wooded, if we assumed that 10,000 of Starksboro's approximately 16,800 acres were sustainably harvested for firewood, that could yield nearly 3,300 cords per year, a little more than 4 cords per household.

Starksboro also has significant land area devoted to farming. While not currently economical, biomass crops, for both space heating and as a liquid alternative to diesel fuel could support Starksboro's farming economy in the future.

Accordingly, Starksboro supports the use of biomass for residential and small commercial heating applications within town, and as a renewable biodiesel alternative to diesel fuel. As a cautionary note, widespread use of wood and other biomass materials as a heat-producing or energy producing fuel might result in unacceptable levels of air-born particulates and other forms of air pollution. Therefore, while supportive, Starksboro should consider biomass in the context of public health impacts in addition to whether supplies are sustainable and effective to meet short and long term demands for renewable heat source energy.

Biogas

Biogas can be derived from methane capture in a digester from manure on farms, the capped landfill or sewage treatment plants and can be burned to generate heat or electricity.

Wind

Mapping of New England wind resources by the National Renewable Energy Laboratory (TrueWind Solutions, "Wind Energy Resource Map of New England," available through Massachusetts Technology Collaborative www.mtpc.org/rebates/green_power/NE_spd100m.pdf) shows that most of Starksboro has average winds in the

Class 1 category (speeds below 12 miles per hour). This is the lowest class, which is unsuitable for commercial-scale wind power.

A small portion of Starksboro–probably the ridge on the northern end of town West side of Big Hollow Road and north of Shaker Hill Road–appears to have class 3 winds (around 12 miles/hour at 100 meters above the ground), considered marginally suitable for larger-scale wind installations. However, all of Starksboro is likely capable of producing significant wind energy at the smaller scale of individual- or multiple-home wind turbines. Experience with wind installations in Starksboro and surrounding communities confirms this; see the section "Alternative Energy in Starksboro," below.

Starksboro supports residential and community scale wind projects that are also able to meet its siting standards contained later in this chapter. Residential scale wind consists of a single tower less than 120 feet high generating less than 15kW of energy. Community scale wind consists of 1 or more towers all less than 200 feet high (so as not to require night lighting) and producing less than 1 MW of electricity. Industrial wind projects that have towers over 200 feet or generate over 1 MW of power are prohibited.

Geothermal Energy

Due to geothermal and solar input the upper layer soil temperatures in Vermont average around 45°F to 50°F year-round. This temperature is too low for direct heating, although it can help with summer cooling. Nevertheless, the constant ground temperature represents a significant energy resource, and with appropriate technology it can be used as a heat source.

To date, no one has used geo-thermal systems relying on heat pump technology in Starksboro. However, the technology is potentially viable and therefore included above.

Hydropower

Historic hydro sites in Starksboro include Baldwin Pond, the Great Falls on Lewis Creek (States Prison Hollow Road) and Lewis Creek near lower Ireland Road, among others. While this has historically been a viable energy source, it isn't currently, but could be again at some point in the future.

Energy Storage

Should Starksboro permit large-scale generation in its jurisdiction, it may also want to include some type of storage facility to supplement the power generated to improve its short-term resiliency. Battery storage, while expensive, is decreasing in price, is commercially available to support homeowners and may work well with generation assets. Other options for storage are in development as well. Storage would not necessarily need to be sited with intermittent renewable generation but may be desirable to increase the value of the system. As a result, Starksboro may want to be supportive of co-siting of renewable generation and storage.

The following chapter describes mapping that was done of the Town of Starksboro and the resulting maps are included at the end of this section. As an outcome of the mapping exercise, ACRPC calculated the amount of renewable generation potential in Starksboro. These calculations were based on the maps and some assumed values for the amount of land needed to produce specified amounts of solar and wind energy. The results of this analysis are depicted below in Table 9, Renewable Generation Potential. As the table demonstrates, the amount of renewable generation potential is substantial, especially when compared to the numbers of actual generation that currently exists in Starksboro, contained in Table 8.

Renewable Generation – Potential and Targets

Renewable Generation Constraints

As part of the mapping exercise described below, ACRPC created maps identifying potential renewable generation sites in Starksboro. The first map, Map 1, "Known Constraints" shown on page 16, depicts natural resource layers that will preclude renewable energy development. These "Known Constraints" depict places where natural resource characteristics would be prohibitive to securing a permit for energy development. Map 2, entitled "possible constraints" depicts places where natural resources exist, but may not prohibit development. Prime agricultural soils would be an example of a possible constraint. A lot of prime agricultural resources exist within Starksboro. However, depending on how a development is proposed and/or sited, it may or may not prevent wind or solar development.

The next set of maps show the location of where solar wind and biomass resources exist in quantities that would support generation. These maps are depicted below as Map 4. Solar Resources, Map 5. Wind Resources and Map 6. Biomass Resources. While these maps depict where resources exist, they depict baseline resources, not necessarily the "best" resources in the area. For example, the Wind Resource Map depicts where the wind blows at the minimum velocity necessary to support wind power. As noted in the wind discussion above, while many places may meet the minimum criteria for wind development, the best area for wind in Starksboro is probably the Shaker Mountain ridge. This area is identified as having class 3 winds (around 12 miles/hour at 100 meters above the ground). This is considered marginally suitable for larger-scale wind installations. Accordingly, users are cautioned to read the maps in this context.

Mapping

Mapping Methodology

Spatial data showing the location of potential energy resources (solar, wind, hydro, and biomass) formed the basis of the maps developed by ACRPC.

This Appendix includes maps provided to the Town of Starksboro by ACRPC. These maps show data as required by the Department of Public Service Determination Standards, including access to energy resources, and constraints to renewable development, and are a required element of enhanced energy planning.

The maps show areas that are potentially appropriate or inappropriate locations for future renewable generation facilities. The maps are a planning tool only and may not precisely indicate locations where siting a facility is acceptable. When a generation facility is proposed, the presence of all natural resources and other specific characteristics of the site shall be verified as a part of the application.

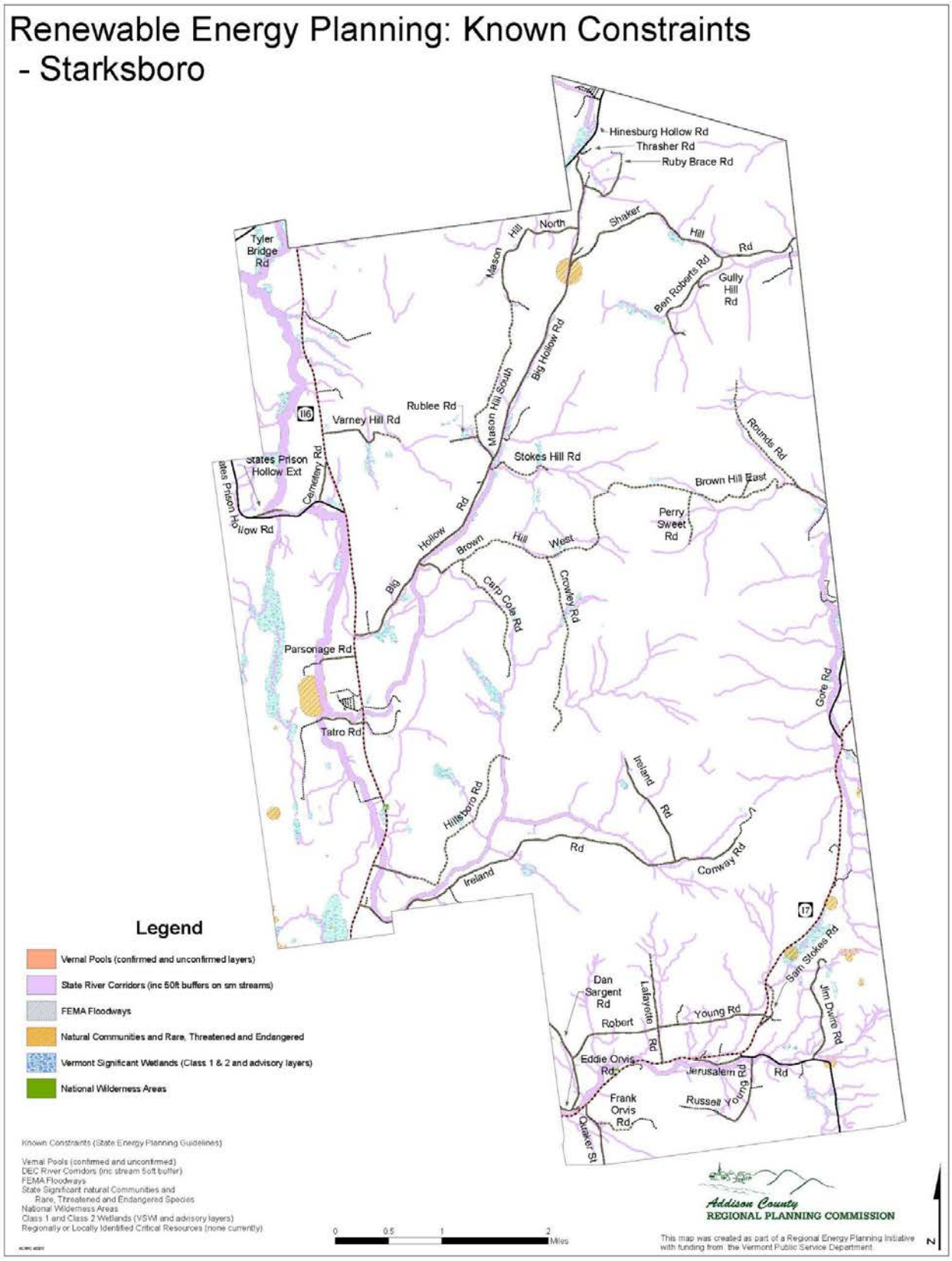
Energy Resources and Constraints

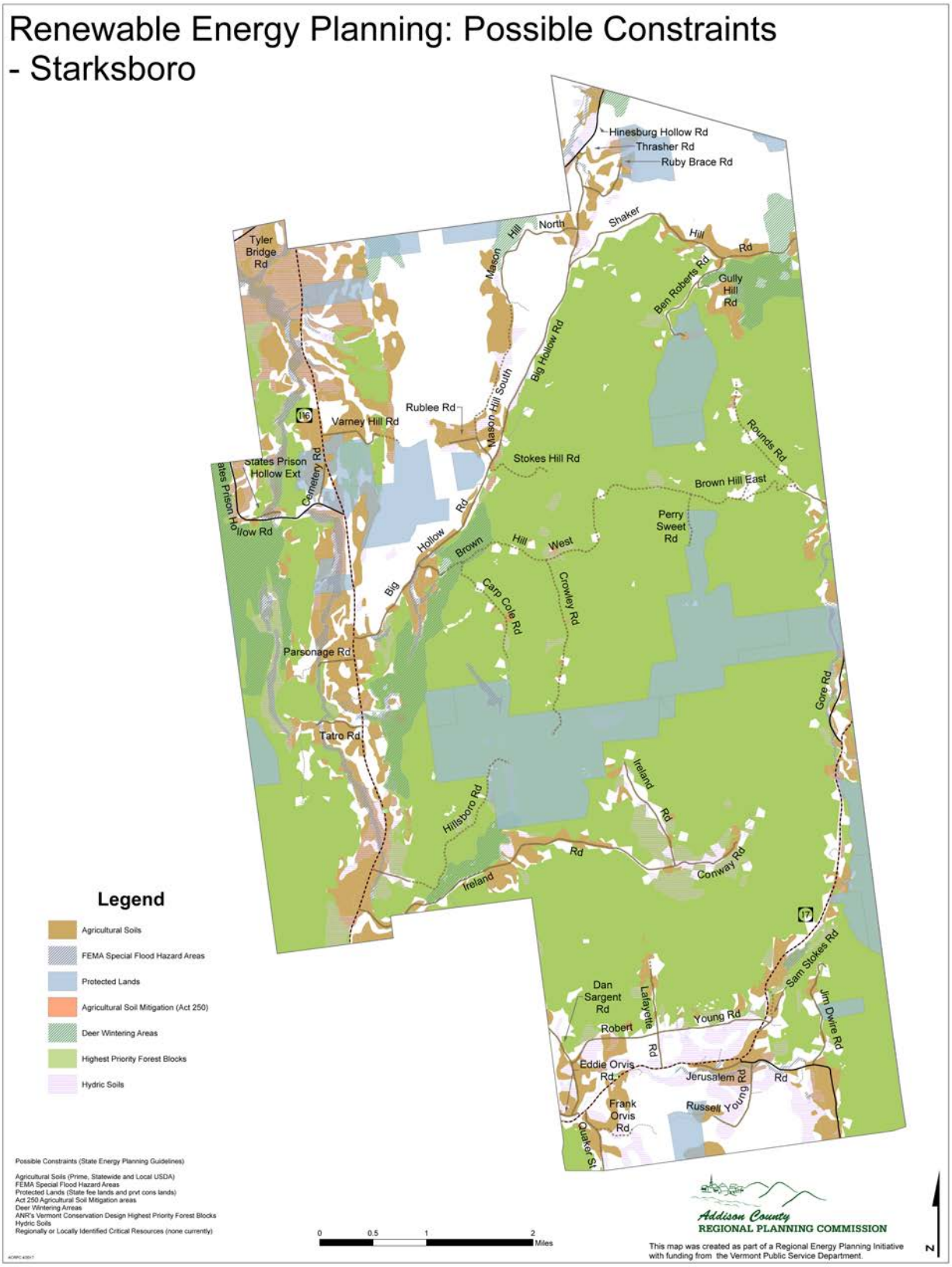
"Known" and "possible" constraints were subsequently identified on the maps. Known constraints are conservation resources that shall be protected from all future development of renewable generation facilities. Possible constraints are conservation resources that shall be protected, to some extent, from the development of renewable generation facilities. The presence of possible constraints on land does not necessarily impede the siting of renewable generation facilities on a site. Siting in these locations could occur if impacts to the affected possible constraints are mitigated, preferably on-site.

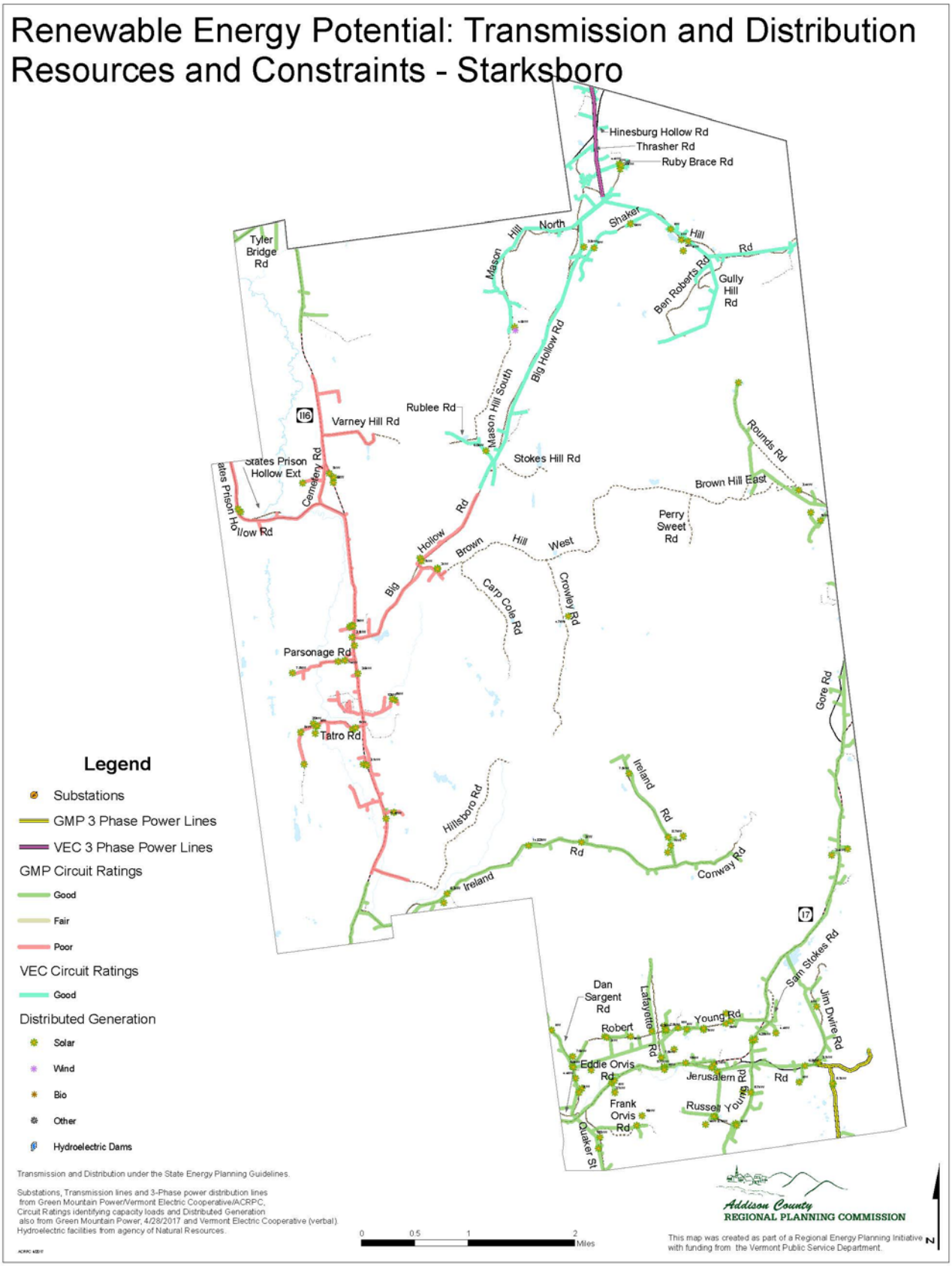
A full list of known and possible constraints included on the maps is located in Table 9. The known constraints and possible constraints used to create the maps include constraints that are required per the State Determination Standards from the Department of Public Service and constraints that were selected by ACRPC.

TABLE 9 – MAPPING CONSTRAINTS		
SOLAR, WIND AND BIOMASS MAPS - KNOWN CONSTRAINTS		
CONSTRAINT	DESCRIPTION	SOURCE
Confirmed and unconfirmed vernal pools	There is a 600-foot buffer around confirmed or unconfirmed vernal pools.	ANR
State Significant Natural Communities and Rare, Threatened, and Endangered Species	Rankings S1 through S3 were used as constraints. These include all of the rare and uncommon rankings within the file. For more information on the specific rankings, explore the methodology for the shapefile.	VCGI
River corridors	Only mapped River Corridors were mapped. Does not include 50 foot buffer for streams with a drainage area less than 2 square miles.	VCGI
National wilderness areas		VCGI
FEMA Floodways		VCGI/ACRPC
Class 1 and Class 2 Wetlands		VCGI
Designated Village Centers	These areas are the center of dense, traditional development in the region. This constraint does not apply to roof-mounted solar within such designated areas. The inclusion of this resource as a regional constraint is consistent with goals and policies of the Addison County Regional Plan.	ACRPC
FEMA Flood Insurance Rate Map (FIRM) special flood hazard areas	Special flood hazard areas as digitized by the ACRPC were used (just the 100-year flood plain -500-year floodplain not mapped). The inclusion of this resource as a regional constraint is consistent with goals and policies of the Addison County Regional Plan.	ACRPC
Ground and surface waters drinking protection areas	Buffered Source Protection Areas (SPAs) are designated by the Vermont Department of Environmental Conservation (DEC). SPA boundaries are approximate but are conservative enough to capture the areas most susceptible to contamination. The inclusion of this resource as a regional constraint is consistent with goals and policies of the Addison County Regional Plan.	ANR
Vermont Conservation Design Highest Priority Forest Blocks	The lands and waters identified here are the areas of the state that are of highest priority for maintaining ecological integrity. Together, these lands comprise a connected landscape of large and intact forested habitat, healthy aquatic and riparian systems, and a full range of physical features (bedrock, soils, elevation, slope, and aspect) on which plant and animal natural communities depend. The inclusion of this resource as a regional constraint is consistent with goals and policies of the Addison County Regional Plan. (Source: ANR)	ANR
Public water sources	A 200-foot buffer is used around public drinking water wellheads. The inclusion of this resource as a regional constraint is consistent with goals and policies of the Addison County Regional Plan.	ANR
Municipal Conservation Land Use Areas	Conservation Land Use Districts, as designated in municipal plans, that include strict language that strongly deters or prohibits development have been included as a regional known constraint. The inclusion of this resource as a regional constraint is consistent with the goals and policies of the Addison County Regional Plan.	ACRPC

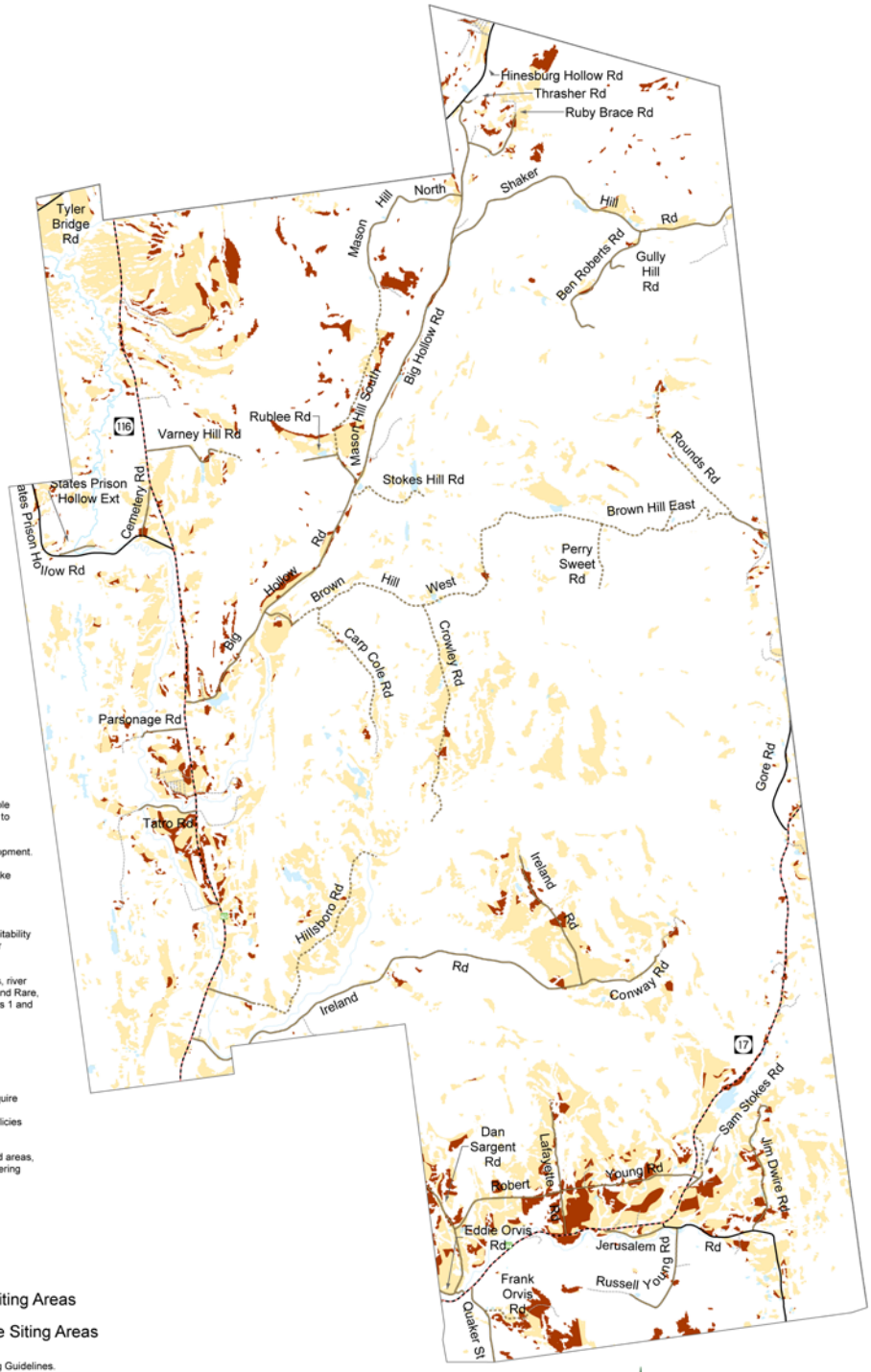
SOLAR, WIND AND BIOMASS MAPS - POSSIBLE CONSTRAINTS (TABLE 9 CON'T)		
Constraint	**Description**	**Source**
Protected lands	This constraint includes public lands held by agencies with conservation or natural resource oriented missions, municipal natural resource holdings (ex. Town forests), public boating and fishing access areas, public and private educational institution holdings with natural resource uses and protections, publicly owned rights on private lands, parcels owned in fee by non-profit organizations dedicated to conserving land or resources, and private parcels with conservation easements held by non-profit organizations.	VCGI
Deer wintering areas	Deer wintering habitat as identified by the Vermont Agency of Natural Resources.	ANR
Hydric soils	Hydric soils as identified by the US Department of Agriculture.	VCGI
Agricultural soils	Local, statewide, and prime agricultural soils are considered.	VCGI
Act 250 Agricultural Soil Mitigation Areas	Sites conserved as a condition of an Act 250 permit.	VCGI
Class 3 wetlands	Class 3 wetlands in the region have been identified have been included as a Regional Possible Constraint. The inclusion of this resource as a regional constraint is consistent with goals and policies of the Addison County Regional Plan.	ANR
Municipal Conservation Land Use Areas	Conservation Land Use Districts, as designated in municipal plans, that include strict language that deters, but does not prohibit development, have been included as a regional possible constraint. Specific municipal land use districts included are outlined in Section D. The Forest/Conservation District was included in this category.	ACRPC


Renewable Energy Planning: Known Constraints
- Starksboro
Hinesburg Hollow Rd
Thrasher Rd
Ruby Brace Rd
Tyler Bridge Rd
Mason Hill North
Shaker Hill Rd
Ben Roberts Rd
Gully Hill Rd
Big Hollow Rd
Mason Hill South
Rublee Rd
Varney Hill Rd
116
Rounds Rd
States Prison Hollow Ext
Cemetery Rd
States Prison Hollow Rd
Stokes Hill Rd
Brown Hill East
Perry Sweet Rd
Big Hollow Rd
Brown Hill West
Carp Cole Rd
Crowley Rd
Parsonage Rd
Gore Rd
Tatro Rd
Hillsboro Rd
Ireland Rd
Ireland Rd
Conway Rd
17
Sam Stokes Rd
Jim Dwire Rd
Dan Sargent Rd
Lafayette Rd
Young Rd
Robert
Eddie Orvis Rd
Jerusalem Rd
Rd
Frank Orvis Rd
Russell Young Rd
Quaker St
Legend
Vernal Pools (confirmed and unconfirmed layers)
State River Corridors (inc 50ft buffers on sm streams)
FEMA Floodways
Natural Communities and Rare, Threatened and Endangered
Vermont Significant Wetlands (Class 1 & 2 and advisory layers)
National Wilderness Areas
Known Constraints (State Energy Planning Guidelines)
Vernal Pools (confirmed and unconfirmed)
DEC River Corridors (inc stream 50ft buffer)
FEMA Floodways
State Significant natural Communities and
Rare, Threatened and Endangered Species
National Wilderness Areas
Class 1 and Class 2 Wetlands (VSWI and advisory layers)
Regionally or Locally Identified Critical Resources (none currently)
0 0.5 1 2 Miles
Addison County
REGIONAL PLANNING COMMISSION
This map was created as part of a Regional Energy Planning Initiative with funding from the Vermont Public Service Department.
N


Renewable Energy Planning: Possible Constraints
- Starksboro
Hinesburg Hollow Rd
Thrasher Rd
Ruby Brace Rd
Shaker Hill Rd
North Hill
Tyler Bridge Rd
Mason Hill
Ben Roberts Rd
Gully Hill Rd
Big Hollow Rd
Rublee Rd
Mason Hill South
Varney Hill Rd
Rounds Rd
States Prison Hollow Ext
Cemetery Rd
States Prison Hollow Rd
Stokes Hill Rd
Brown Hill East
Perry Sweet Rd
Big Hollow Rd
Brown Hill West
Carp Cole Rd
Crowley Rd
Parsonage Rd
Gore Rd
Tatro Rd
Ireland Rd
Hillsboro Rd
Ireland Rd
Conway Rd
Sam Stokes Rd
Jim Dwire Rd
Dan Sargent Rd
Lafayette Rd
Young Rd
Robert
Eddie Orvis Rd
Jerusalem Rd
Russell Young Rd
Frank Orvis Rd
Quaker St
Legend
Agricultural Soils
FEMA Special Flood Hazard Areas
Protected Lands
Agricultural Soil Mitigation (Act 250)
Deer Wintering Areas
Highest Priority Forest Blocks
Hydric Soils
Possible Constraints (State Energy Planning Guidelines)
Agricultural Soils (Prime, Statewide and Local USDA)
FEMA Special Flood Hazard Areas
Protected Lands (State fee lands and prvt cons lands)
Act 250 Agricultural Soil Mitigation areas
Deer Wintering Areas
ANR's Vermont Conservation Design Highest Priority Forest Blocks
Hydric Soils
Regionally or Locally Identified Critical Resources (none currently)
0 0.5 1 2 Miles
Addison County
REGIONAL PLANNING COMMISSION
This map was created as part of a Regional Energy Planning Initiative with funding from the Vermont Public Service Department.
N


Renewable Energy Potential: Transmission and Distribution Resources and Constraints - Starksboro
Hinesburg Hollow Rd
Thrasher Rd
Ruby Brace Rd
Tyler Bridge Rd
Mason Hill North
Shaker Hill Rd
Ben Roberts Rd
Gully Hill Rd
Big Hollow Rd
Mason Hill South
Rublee Rd
Varney Hill Rd
116
Stokes Hill Rd
Rounds Rd
States Prison Hollow Ext
Cemetery Rd
States Prison Hollow Rd
Brown Hill East
Perry Sweet Rd
Big Hollow Rd
Brown Hill West
Carp Cole Rd
Crowley Rd
Parsonage Rd
Gore Rd
Tatro Rd
Ireland Rd
Hillsboro Rd
Ireland Rd
Conway Rd
17
Sam Stokes Rd
Jim Dwire Rd
Dan Sargent Rd
Lafayette Rd
Young Rd
Robert
Eddie Orvis Rd
Jerusalem Rd
Rd
Frank Orvis Rd
Russell Young Rd
Quaker St
Legend
Substations
GMP 3 Phase Power Lines
VEC 3 Phase Power Lines
GMP Circuit Ratings
Good
Fair
Poor
VEC Circuit Ratings
Good
Distributed Generation
Solar
Wind
Bio
Other
Hydroelectric Dams
Transmission and Distribution under the State Energy Planning Guidelines.
Substations, Transmission lines and 3-Phase power distribution lines from Green Mountain Power/Vermont Electric Cooperative/ACRPC, Circuit Ratings identifying capacity loads and Distributed Generation also from Green Mountain Power, 4/28/2017 and Vermont Electric Cooperative (verbal). Hydroelectric facilities from agency of Natural Resources.
0 0.5 1 2 Miles
Addison County
REGIONAL PLANNING COMMISSION
This map was created as part of a Regional Energy Planning Initiative with funding from the Vermont Public Service Department.
N

Renewable Energy: Potential Solar Resource Siting Areas - Starksboro



Dept of Public Service Methodology

This map shows areas of resource potential for renewable energy generation from solar, i.e. locations where renewable energy generation would likely be most feasible according to the natural conditions of an area. This map also considers various other conditions, such as natural resource areas, that may impact the feasibility of renewable energy development. These conditions are referred to as constraints. Areas of prime solar potential exist where the natural conditions make development feasible and no constraints exist.

Known Constraints

Known Constraints signal likely, though not absolute, unsuitability for development based on statewide or local regulations or designated critical resources.

Known Constraints include: Vernal pools, FEMA floodways, river corridors,Federal wilderness areas,Natural Communities and Rare, Threatened and Endangered Species, and wetlands (class 1 and 2) and wetland advisory layers.

These areas have been removed and are not shown on this map.

Possible Constraints

Possible Constraints signal conditions that would likely require mitigation, and which may prove a site unsuitable after site-specific study, based on statewide or regional/local policies that are currently adopted or in effect.

Possible Constraints include: Agricultural soils, FEMA flood areas, Protected Lands, ACT 250 soil mitigation areas, Deer wintering areas, Highest Priority Forest Blocks, and Hydric soils.

These areas are shown on the map where they coincide with areas of renewable solar potential identified in the solar analysis.

Legend

Primary Solar Resource Siting Areas

Secondary Solar Resource Siting Areas

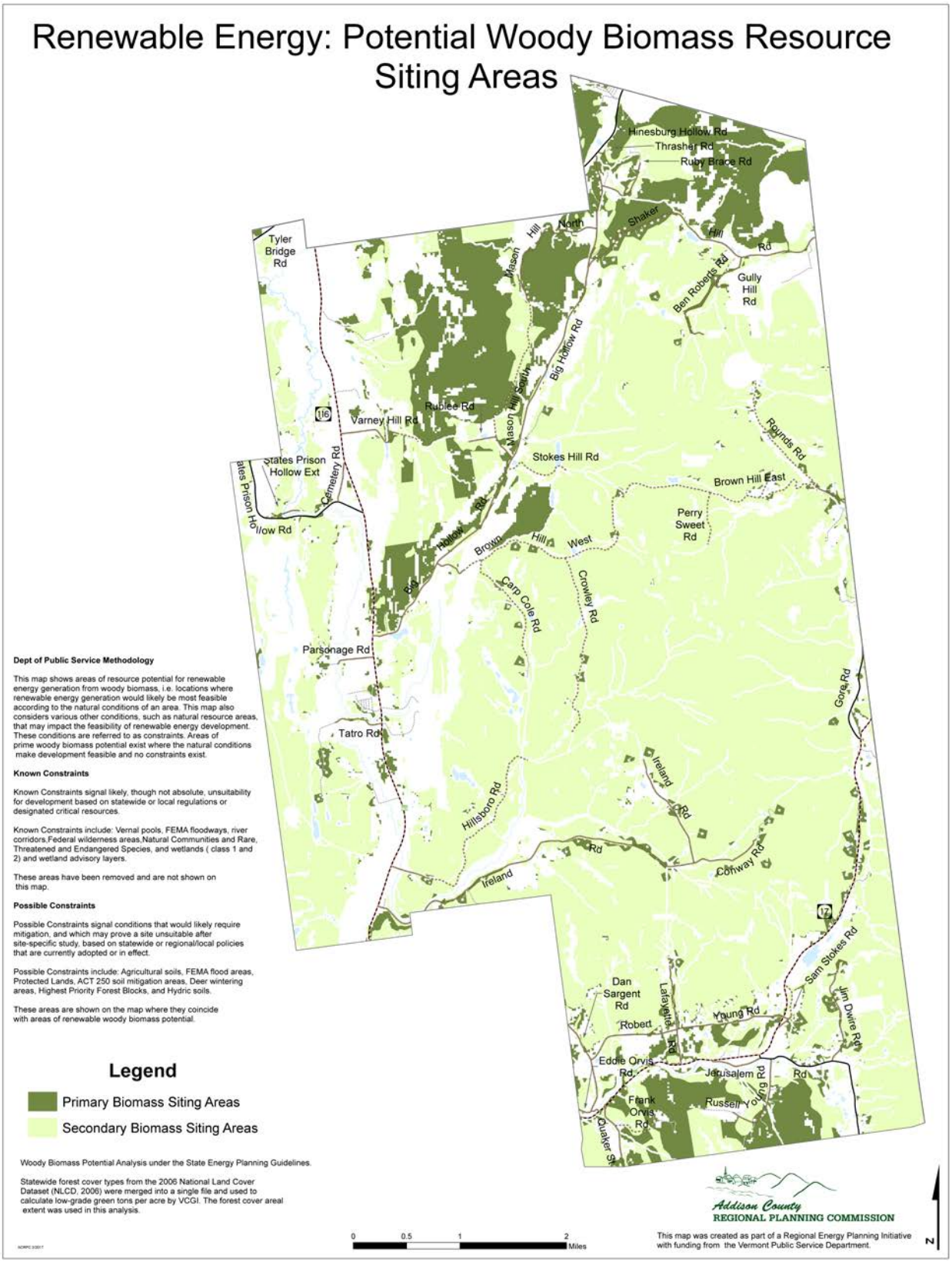
Solar Potential Analysis under the State Energy Planning Guidelines.

Statewide ground based (30m USGS DEM) solar potential layer created with ESRI solar analyst by VCGI. Filtered by SLOPE (<= 14%), ASPECT (90-270 degrees) and values >= 1,000 kWh/sq meter.

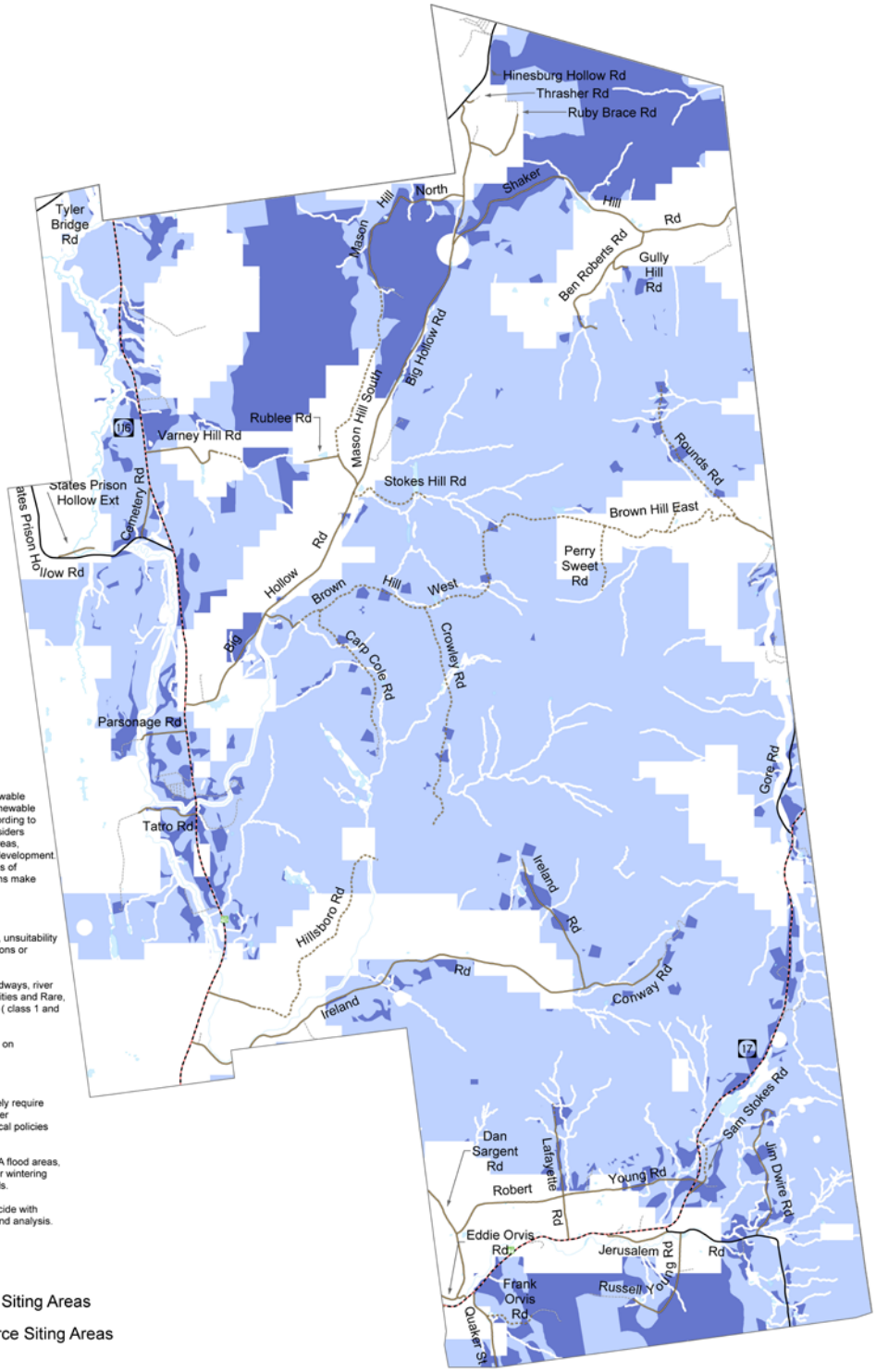
ACRPC 4/2017

Addison County REGIONAL PLANNING COMMISSION

This map was created as part of a Regional Energy Planning Initiative with funding from the Vermont Public Service Department.


Renewable Energy: Potential Woody Biomass Resource Siting Areas
Hinesburg Hollow Rd
Thrasher Rd
Ruby Brace Rd
Shaker
Hill
Rd
Tyler Bridge Rd
Mason Hill North
Ben Roberts Rd
Gully Hill Rd
Big Hollow Rd
Mason Hill South
Rublee Rd
Varney Hill Rd
116
States Prison Hollow Ext
Cemetery Rd
States Prison Hollow Rd
Stokes Hill Rd
Rounds Rd
Brown Hill East
Perry Sweet Rd
Big Hollow Rd
Brown Hill West
Carp Cole Rd
Crowley Rd
Parsonage Rd
Gore Rd
Tatro Rd
Ireland Rd
Hillsboro Rd
Ireland Rd
Conway Rd
17
Sam Stokes Rd
Jim Dwire Rd
Dan Sargent Rd
Lafayette Rd
Young Rd
Robert
Eddie Orvis Rd
Jerusalem Rd
Russell Young Rd
Frank Orvis Rd
Quaker St
Dept of Public Service Methodology
This map shows areas of resource potential for renewable energy generation from woody biomass, i.e. locations where renewable energy generation would likely be most feasible according to the natural conditions of an area. This map also considers various other conditions, such as natural resource areas, that may impact the feasibility of renewable energy development. These conditions are referred to as constraints. Areas of prime woody biomass potential exist where the natural conditions make development feasible and no constraints exist.
Known Constraints
Known Constraints signal likely, though not absolute, unsuitability for development based on statewide or local regulations or designated critical resources.
Known Constraints include: Vernal pools, FEMA floodways, river corridors,Federal wilderness areas,Natural Communities and Rare, Threatened and Endangered Species, and wetlands (class 1 and 2) and wetland advisory layers.
These areas have been removed and are not shown on this map.
Possible Constraints
Possible Constraints signal conditions that would likely require mitigation, and which may prove a site unsuitable after site-specific study, based on statewide or regional/local policies that are currently adopted or in effect.
Possible Constraints include: Agricultural soils, FEMA flood areas, Protected Lands, ACT 250 soil mitigation areas, Deer wintering areas, Highest Priority Forest Blocks, and Hydric soils.
These areas are shown on the map where they coincide with areas of renewable woody biomass potential.
Legend
Primary Biomass Siting Areas
Secondary Biomass Siting Areas
Woody Biomass Potential Analysis under the State Energy Planning Guidelines.
Statewide forest cover types from the 2006 National Land Cover Dataset (NLCD, 2006) were merged into a single file and used to calculate low-grade green tons per acre by VCGI. The forest cover areal extent was used in this analysis.
0 0.5 1 2 Miles
Addison County
REGIONAL PLANNING COMMISSION
This map was created as part of a Regional Energy Planning Initiative with funding from the Vermont Public Service Department.
N

Renewable Energy: Potential Wind Resource Siting Areas - Starksboro



Dept of Public Service Methodology

This map shows areas of resource potential for renewable energy generation from wind, i.e. locations where renewable energy generation would likely be most feasible according to the natural conditions of an area. This map also considers various other conditions, such as natural resource areas, that may impact the feasibility of renewable energy development. These conditions are referred to as constraints. Areas of prime wind potential exist where the natural conditions make development feasible and no constraints exist.

Known Constraints

Known Constraints signal likely, though not absolute, unsuitability for development based on statewide or local regulations or designated critical resources.

Known Constraints include: Vernal pools, FEMA floodways, river corridors,Federal wilderness areas,Natural Communities and Rare, Threatened and Endangered Species, and wetlands (class 1 and 2) and wetland advisory layers.

These areas have been removed and are not shown on this map.

Possible Constraints

Possible Constraints signal conditions that would likely require mitigation, and which may prove a site unsuitable after site-specific study, based on statewide or regional/local policies that are currently adopted or in effect.

Possible Constraints include: Agricultural soils, FEMA flood areas, Protected Lands, ACT 250 soil mitigation areas, Deer wintering areas, Highest Priority Forest Blocks, and Hydric soils.

These areas are shown on the map where they coincide with areas of renewable wind potential identified in the wind analysis.

Legend

Primary Wind Resource Siting Areas

Secondary Wind Resource Siting Areas

Wind Potential Analysis under the State Energy Planning Guidelines.

Statewide 30m, 50m, and 70m wind speed layers from Mass.Tech Collaborative wiere filtered for minimum wind speed, then merged into a single file by VCGI.

ACRPC 2/2017

0 0.5 1 2 Miles

Addison County REGIONAL PLANNING COMMISSION

This map was created as part of a Regional Energy Planning Initiative with funding from the Vermont Public Service Department.

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At the end of the mapping exercise, ACRPC calculated the amount of renewable resource generation possible in Starksboro based upon the maps and some assumed values for the amount of land it took to produce specified amounts of solar and wind energy. The results of this analysis are depicted in Table 10, Renewable Generation Potential. As the table demonstrates, the amount of renewable generation potential is substantial, especially when compared to the numbers of actual generation that currently exists in Starksboro, contained in Table 8.

TABLE 10. RENEWABLE GENERATION POTENTIAL	MW	MWh
Rooftop Solar	1.2	1,461
Ground-mounted Solar	504	618,106
Wind	9407	28,841,096
Hydro	N/A	Potential to be determined
Biomass and Methane	N/A	Large biomass potential but depends on technology - cogeneration (electricity + heat) is ideal. There is also agricultural biomass potential, and maybe methane from Town dump.
Other	N/A	N/A
Total Renewable Generation Potential	9,912	29,469,662

Renewable Generation Targets

As part of the same exercise, DPS also provided Renewable generation targets that all municipalities would need to meet in the context of the State meeting its goal of producing half of its energy within the State. Those goals for Starksboro, shown in Table 11 below, are based upon a combination of Starksboro's population (correlated to its potential use) and to the amount of potential resources available in Starksboro.

When one compares the goals in Table 11 with the potential in table 10, it is readily clear that, at least theoretically, Starksboro's resource potential dwarfs its generation goals.

TABLE 11. RENEWABLE GENERATION TARGETS	2025	2035	2050
Total Renewable Generation Target (in MWh)	25,817.1	51,634.2	78,233.7

Starksboro has chosen to use the following community land use standards to help guide energy projects to locate in areas it deems acceptable and to prohibit them in other areas.

Community Standards for Siting and Decommissioning Energy Projects

Starksboro recognizes that financial considerations require large solar and wind projects be located in close proximity to electric power lines capable of transmitting the load proposed to be generated and with easy access to major transportation networks for construction. However, Starksboro also desires to maintain the working and open landscapes, adopted conservation and habitat protection measures, scenic rural views

important to its economy and to the rural cultural aesthetic and quality of life. All commercial or community scale generation projects must meet the policies and standards set forth in this energy plan.

A. **Siting.** Where a project is placed on the landscape constitutes the most critical element in the siting of a project. Poor siting cannot be adequately mitigated. Accordingly, all renewable energy projects must evaluate and address the proposed site's aesthetic, environmental and cultural impact on the surrounding landscape and significant viewsheds.

Preferred Sites:
Systems sited within Starksboro's Industrial Use Planning Area shall be considered "preferred sites"

Good sites have one or more of the following characteristics:

- Roof-mounted systems;
- Systems located in close proximity to existing larger scale, commercial, industrial or agricultural buildings;
- Proximity to existing hedgerows or other topographical features that naturally screen the proposed array from view from at least two sides;
- Systems fit the scale and context of their location.
- Reuse of former brownfields or otherwise impacted property.
- Glare and noise are minimized to the extent possible.

Poor Sites have one or more of the following characteristics:

- No natural screening;
- Topography that causes the arrays to dominate the skyline from common vantage points like roads or neighborhoods (recognizing that this is more difficult for wind towers);
- Locations in floodways or mapped river corridors;
- A location in proximity to and interfering with a significant viewshed
- The removal of productive agricultural land from agriculture use; and
- Sites that require public investment in transmission and distribution infrastructure in order to function properly.

B. **Mass and Scale**. The historical working landscape and other open lands, rural residential development, and rolling hills set against the backdrop of the Green Mountains define Starksboro. Starksboro desires to preserve these types of viewsheds. Rural structures like barns fit into the landscape because their scale and mass generally do not impact large tracts of otherwise open land. When houses are added to Starksboro's landscape, sensitive siting and appropriate screening are required whenever possible. Renewable energy systems shall also be limited in mass and scale, or have their mass and scale broken by screening, to fit in with the landscape. Systems of 150 kW and less (which comprise 1.5 acres or less) should fairly easily conform to these standards given the smaller size. All commercial scale solar arrays (i.e. above 15kW) shall also be limited in mass and scale, and/or have their mass and scale broken by screening to fit in with the landscape. Commercial solar projects larger than 1 MW are only allowed if, adequately screened or otherwise mitigated visually.

Projects which on the balance are found to have poor siting characteristics pursuant to the community standards contained above or in other parts of Starksboro's Town Plan violate Starksboro's Plan regarding orderly development.

Mitigation methods.

A. *Solar Installations*: In addition to properly siting a project according to the criteria set forth above, solar developers must take the following action to mitigate all project sites:

- Locate the structures on the site to keep them from dominating the skyline above the horizon from public vantage points;
- Shorter panels may be more appropriate in certain spaces than taller panels to keep the project lower on the landscape.
- At a minimum, all solar arrays must observe the setback restrictions contained in Act 56 governing solar installations. However, developers are encouraged to increase setbacks to at least those listed in Starksboro's Zoning Regulations within the Zoning District in Municipality in which the array lays.
- Use the existing topography, development or vegetation on the site to screen and/or break the mass of the array;
- In the absence of existing natural vegetation, the commercial development must be screened by native plantings beneficial to wildlife and pollinators that will grow to a sufficient height and depth to provide effective screening within a period of 5 years. Partial screening to break the mass of the site and to protect public and private views may be appropriate.
- Practice a "good neighbor policy". The siting of the array should be done in such a manner that the array creates no greater burden on neighboring property owners or public infrastructure than it does on the property on which it is sited. As an example, a landowner may not site an array on his or her property in a location calculated to diminish the visual impact of the array from his or her residence, but places the array immediately within their neighbor's or the public's viewshed.
- Use black or earth tone materials (panels, supports, fences) that blend into the landscape instead of metallic or other brighter colors), and take all possible steps to eliminate or reduce reflection on affected properties or views from the public roads.
- Allow wildlife passage through fencing or using the solar site as wildlife habitat

B. *Wind*: The actual footprint of a wind turbine tends to be small but its surrounding impact is more substantial than the footprint area. Wind turbines (particularly wind farms) are likely to have scenic or aesthetic impacts, sometimes quite dramatic. Scale and landscape context are important considerations in siting wind installations. In addition to the relevant goals, policies and standards set forth above, the following additional criteria will be used to evaluate whether on the balance potential wind installations meet or violate Starksboro's Town Plan:

- Glare and noise will be considered in locations that are adjacent to residential or recreational properties. Lower gloss paint or darker color blades may be required where reflective characteristics could present an annoyance.

- Wind turbines are likely to be most appropriate within agricultural, commercial or industrial contexts and should be sited, where practical, near other structures.
- In landscapes valued for natural or scenic features, particularly the views around siting will be evaluated for potential visual impacts on scenic views and the experience of a natural landscape.
- Impact on the flight and migration patterns of birds.
- No wind towers requiring night lighting shall be allowed within the Town of Starksboro (Generally, turbines with a total height greater than 200 ft.)

C. Transmission lines and infrastructure: Transmission infrastructure, including sub-transmission lines, or any lines equal to or greater than 45kW and substations can also have a substantial impact on the environment around them. In fact, one of the reasons to support distributed generation is to reduce the need for expensive transmission line upgrades. If any transmission lines are proposed within the Town of Starksboro shall meet the following mitigation guidelines:

- Substations shall be screened in a manner similar to solar sites as noted above.
- Lines shall be located at the edge of fields, not through the middle of the field;
- Lines shall not rise above the level of the treeline (Presumed to be 60 feet);
- Where lines cross distribution lines, the distribution lines shall be buried to reduce the height of the transmission lines.
- Plantings shall be used to screen transmission infrastructure form residences or prominent communal viewpoints.

Decommissioning and Restoration. All projects shall be decommissioned at the end of their useful life. This means equipment shall be removed, landscaping kept and disturbed areas restored. Developers of all projects 100 kW and greater shall provide the municipality with appropriate assurances to guarantee funding exists to decommission the project. In keeping with Starksboro's desire to retain its agricultural land base, a solar array's useful life shall be deemed to be at the end of its useful life when the array(s) are taken off line.

Land Use, Renewable Generation and Transmission - Goals, Objectives, and Policies

Given the generation targets, noted above, to meet statewide targets, Starksboro promotes the following for itself and its citizens.

Goals

1. Conserve renewable and nonrenewable energy resources
2. Reduce reliance on nonrenewable energy sources such as oil and gas, and shift reliance to renewable energy sources.
3. Reduce emissions of greenhouse gases and substances that cause acid rain
4. Support responsibility sited and responsibly developed renewable energy projects, which includes such structures as solar panels, wind turbines and all supporting infrastructure

5. Plan for increased electric demand with the support of Green Mountain Power, Vermont Electric Coop, and Efficiency Vermont.
6. Lead by example. Encourage the use of alternative means for energy production in town buildings, the school and residences such as geothermal and solar.
7. Conserve forest land as a renewable energy resource, tempered by the responsible use of wood for biomass energy production.

Objectives

Land use

1. Encourage settlement patterns that reduce travel requirements for work, services, and recreation.
2. Encourage development of compact neighborhoods.
3. Concentrate development within our residential-agricultural-commercial districts which results in the conservation of natural resources, land, energy used and infrastructure demands.
4. Allow general stores and other businesses in village areas.
5. Allow infilling of existing large-lot development if higher density development is desirable and appropriate.
6. Provide opportunities for appropriate home occupations.
7. Support local farms and local food system which decrease energy demands of trucking and shipping and gives value and purpose to our open agricultural lands.

Generation

1. Support the development and siting of renewable energy resources in the Town that are in conformance with the goals, strategies, and mapping outlined in this energy plan.
2. Development of generation utilities shall be favored in identified preferred locations over the development of other sites.
3. Support production of energy from methane for on -farm use only as a desirable agricultural practice
4. Encourage the use of wind energy with due regard to aesthetic and environmental considerations, especially in high and medium density residential areas.

Transmission

1. Plan for improving the infrastructure to accommodate the increased electric demand with the support of Green Mountain Power, Vermont Electric Co-op, and Efficiency Vermont.

Policies

1. The Starksboro Energy Committee will continue to work closely with the Starksboro Planning Commission, DRB and Zoning Administrator on any proposed energy development projects within Starksboro.
2. Investigate the installation of municipal solar and/or wind net-metering facilities to off-set municipal electric use.
3. Investigate installation of community-owner renewable energy project(s) to allow Starksboro's citizens to participate in the clean energy and economic benefits of local energy production.