Waltham, Vermont Enhanced Energy Plan

Approved by Addison County Regional Planning Commission
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Waltham Enhanced Energy Plan

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Section I. Introduction

Background and History

The State of Vermont has officially recognized the destructive impact of rising levels of greenhouse gas pollution. Vermont also has acknowledged that it has the highest level of greenhouse gas emissions per capita in the Northeast and is the only state in New England whose emissions have increased in the last 30 years.[1] To address this destruction and to reverse this trend, Vermont established a goal to reduce pollution from greenhouse gas emissions by obtaining 90% of its energy from renewable resources by 2050 and reducing energy use by more than one-third by that same time. Waltham is committed to participate in both of these programs to help the State reduce its reliance on greenhouse gas producing fossil fuels. This background history is meant to give context to Waltham's renewed effort and commitment to adopt an enhanced energy plan. Waltham's intent with this Energy Plan is to adopt the State and regional energy mandates allocated to Waltham and to meet the goals and targets set forth herein.

Energy Plan Assumptions

This plan is based on the assumptions that:

a. The price of fossil fuels has been historically volatile compared to other sources of energy, fossil fuels may not be abundant or cheap in the future, and disruptions in extraction and distribution of these fuels occurs repeatedly, all of which create energy security risks;
b. The full social, environmental, and economic costs of energy are not reflected in present market prices,[2]
c. Conserving energy, reducing consumption of non-renewable energy, and shifting reliance to local renewable energy improves human health by reducing air and other pollution, provides economic benefits by lowering the costs of energy, expands job opportunities in the renewable energy sector, and protects the

[1] Vermont Department of Environmental Conservation, Vermont Greenhouse Gas Emissions Inventory and Forecast: Brief 1990 – 2016. See: https://dec.vermont.gov/sites/dec/files/aqc/climate-change/documents/_Vermont_Greenhouse_Gas_Emissions_Inventory_and_Forecast_1990-2016.pdf

[2] According to an International Monetary Fund study, US pre-and post-tax fossil fuel subsidies in 2015 that constitute market price distortions amounted to about $650 billion. This figure includes the receipt by fossil fuel companies of direct subsidies and the fact that fossil fuel prices do not reflect the costs of the consequences of greenhouse gas and other pollution. These latter figures include things like the medical costs of treating lung and other illnesses caused by exposure to fossil fuel pollution and chemicals. Neither do these subsidy costs include other items such as the approximately $81 billion/year that the US military spends on protecting oil supplies or the costs of the wars fought over the security of Persian Gulf oil. All of these costs are borne by the US public and are not reflected in the price of these fuels. See: https://www.imf.org/en/Publications/WP/Issues/2019/05/02/Global-Fossil-Fuel-Subsidies-Remain-Large-An-Update-Based-on-Country-Level-Estimates-46509 and https://www.americansecurityproject.org/wp-content/uploads/2019/05/US-Oil-Dependence.pdf.

environment by reducing the consequences of greenhouse gas pollution.

d. For our own benefit and for the common good, each town must play a role in shaping and implementing policies and actions that promote wise and clean energy use.

Intent of Energy Plan

The intent of this Waltham Energy Plan is to adopt the goals of Vermont's Comprehensive Energy Plan[3] and take advantage of the 2016 passage of Act 174, which gives communities the opportunity to revise their municipal plans in order to obtain a "Determination of Energy Compliance." Receiving a Determination of Energy Compliance will give the Waltham Enhanced Energy Plan "**substantial deference**" before the Public Utilities Commission's (PUC) Section 248 permitting process, instead of "due consideration" in Section 248 applications for energy generation facilities (ex. wind facilities, solar facilities, etc.) under Criterion (b)(1)-Orderly Development.[4] Section 248 (30 V.S.A. § 248) is a Vermont law that requires an approval from the PUC for, among other things, energy generation facilities. In order for these facilities to receive a Certificate of Public Good from the PUC, the specifications in the Waltham Energy Plan will be considered under the **"substantial deference"** standard. Increasing the Town's control over the siting of renewable energy projects is the main goal that prompted the creation of this Energy Plan.

The other two main goals to be achieved by this energy plan, generating local renewable energy and reducing the overall use of energy, will benefit Waltham in other significant ways. Producing our own renewable energy will make Waltham much less reliant on outside sources of energy. Reducing our overall use of energy, after initial investments in weatherization and efficiency, will lower our overall cost of energy.

These are the reasons that the Town of Waltham supports Vermont's comprehensive energy goals. Waltham believes it serves its citizens' interests by conserving energy, reducing our consumption of non-renewable energy, and shifting our usage to carbon free or carbon neutral renewable energy sources.

By this Plan, Waltham intends also to exercise more control over the types of energy choices made within the Town. Specifically, in order for Waltham to gain more control over its energy policies, the Town needs to meet the **municipal determination standards** for

[3] https://publicservice.vermont.gov/publications-resources/publications/energy_plan

[4] "Substantial deference as defined by Act 174, and used in the Section 248 process, provides towns and regions a strong voice in determining where energy projects should, and should not, be sited. The Act defines substantial deference as: "a land conservation measure or specific policy **shall** be applied in accordance with its terms unless there is a clear and convincing demonstration that other factors affecting the general good of the State outweigh the application of the measure or policy."

enhanced energy planning enabled in 24 V.S.A. 4352. By pursuing enhanced energy planning, Waltham 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 goal 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);
- 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 by Waltham, regionally approved, and must contain the following information:

A. An analysis of current energy resources, needs, scarcities, costs, and problems.

   "Use Analysis" will analyze baseline usage data in Waltham for each of the four energy sectors. It includes charts of usage and a discussion concerning the usage data.

B. Targets for future energy use and generation.

   "Targets" will look at future projections of usage if Waltham is to meet the State goal of using 90% renewables by 2050. This sub-section contains projections of usage targets corresponding to one scenario that would **theoretically** meet that goal. In 2016, Addison County Regional Planning Commission (ACRPC) worked with the Vermont Energy Investment Corporation (VEIC) and the Vermont Department of Public Service (PSD) to develop regional targets for future energy use and generation that met the State of Vermont's 90 x 50 goal. However, there are numerous ways for Vermont to achieve the 90 x 50 goal. The Target Scenario included in this plan represents Waltham's participation in the Region's goals. It also represents an approach that appears reasonable and economic given current technology and

understanding of probable technological advance prior to 2050. More information about the regional targets is provided in the Addison County Regional Energy Plan (https://acrpc.org/regional-programs/energy/).

C. Pathways, or implementation actions, to help the municipality achieve the established targets.

   "Pathways to Implementation" provides goals, policies and recommended actions to implement the plan

D. Mapping to help guide the conversation about the siting of renewables.

   The mapping section (which includes maps and text descriptions) allows Waltham to visually identify where renewable energy generation is most suitable. This section combines resource information with specific known and possible constraints to the development of renewable energy generation. The mapping section also allows the opportunity to identify preferred locations for renewable energy development and areas unsuitable for development of any kind. In addition, the maps identify existing infrastructure to support renewable energy development.

This plan includes the required analysis, target data, the goals, policies and implementation actions, and associated mapping necessary to meet the standards for an Enhanced Energy Plan. Topics covered include energy conservation and efficiency as it relates to thermal and electrical energy usage, transportation, and land use planning. The plan also includes energy generation and siting standards and policies proclaiming the type, size, and suitable locations for energy generation facilities in Waltham. Lastly, it specifies the goals, policies and actions Waltham will undertake to help implement conservation and efficiency policies to help meet the State's larger renewable goals.

In writing this plan, Waltham recognizes that the identified goals and policies will impact residents differently based on their life situation. Financial burden is a top concern when evaluating the impacts of a policy. Energy burden is calculated as the amount a household spends on energy in a year divided by annual income, and can be broken down by sector (thermal, transportation, electricity). According to the 2019 Efficiency Vermont Energy Burden Report, the energy burden in Waltham (Figure 1) is equal to 8.7% of the median annual income in the town with the greatest share of the burden coming from transportation costs. While this is an average, it illustrates the opportunity to reduce financial burdens for residents through energy efficiency.

The policies and goals of this plan have been crafted to reduce the energy burden for all Waltham residents. For example, this plan promotes electric vehicles and public transportation to reduce the costs of transportation for residents. Similarly, switching from fossil fuels to wood or electric heating systems would reduce the costs of heating for residents. Leading the community in electric efficiency in municipal buildings will allow tax dollars to be put towards more valuable community services that benefit all residents. In addition to the financial benefits, the development of this plan gives Waltham residents greater decision-making power around the siting of new generation along with an opportunity to own and benefit from locally produced power.

Although the policies and goals of this plan are intended to benefit all residents, some opportunities promoted will not be accessible to all. Changes like weatherization upgrades, fuel switching, and electric vehicles, are often too costly for many households to pursue and are unavailable to renters. This creates inequity as some households are not able to take advantage of long-term benefits due to short term costs. This plan seeks to minimize that inequity through the promotion of free and reduced-cost services, available through Champlain Valley Office of Economic Opportunity, Neighborworks of Western VT, Efficiency VT and others.

Figure 1 - Waltham Energy Burden[5]		
Median Household Income	$71,250	
Sector	Average Spending	Burden
Electricity	$1,421	2.0%
Thermal	$1,977	2.8%
Transportation	$2,772	3.9%
Total	**$6,170**	**8.7%**

Figure 1: Waltham Energy Burden

[5] https://www.efficiencyvermont.com/news-blog/whitepapers/vermont-energy-burden

Outline of How to Read this Plan

This plan breaks Waltham's above-described energy usage, targets, pathways, and future projections and projects into the following Sections:

Section II, Thermal Use: This Section focuses mostly on energy used for space heating and cooling.

Section **III**, Transportation Use: This Section focuses on energy used for transportation.

Section IV, Electrical Use: This Section focuses mostly on energy used for operating equipment, but electrical use is predicted to expand significantly to include transportation and heating and cooling equipment as indicated in the 2nd and 3rd Sections.

Section V, Land Use, Generation and Transmission: This Section focuses on land use planning as it relates to energy conservation (e.g. reduction of vehicle trips), and siting of new energy generation and transmission resources. Additionally, this Section includes a mapping analysis of energy resources and constraints.

Section VI, Standards for Siting and Installation of Energy Projects: This Section focuses on siting and visual mitigation standards for new energy generation facilities that reflect the land use policies of Waltham.

Glossary, this Section defines terms and abbreviations used in the Plan.

Section II. Thermal Use

Thermal Use analysis

Table 1 shows the most recent estimate of residential thermal energy demand in Waltham. based on data from the American Community Survey ("ACS"), a product of the United States Census (2019). The data shows that Waltham is relying on three of the most polluting sources of thermal energy. Fuel oil is the most common primary heating source used by Waltham residents (53.6%). Fuel oil is followed by wood, serving about 26.3% of households, with propane serving nearly all of the remaining households (about 15.5%). Note: This solar data generated by ACS may not be totally accurate since some Waltham households were likely using electricity from photovoltaic panels for space heating and cooling equipment and solar powered hot water heaters after this time period. Also, there has likely been a shift toward electricity as households switch to cold climate heat pumps.

Table 1: Municipal Current Residential Thermal Energy Use				
Fuel Source	**Waltham Households (ACS 2019)**	**Waltham % of Households**	**Waltham Residential Heating square ft**	**Waltham BTU (in Billions)**
Fuel Oil	104	53.6%	195,604	12
Wood	51	26.3%	92,602	6
Propane	30	15.5%	55,386	3
Electricity	5	2.6%	8,004	0
Natural Gas	3	1.5%	5760	0
Solar	1	0.5%	1,928	0
Coal	0	0.0%	0	0
Other	0	0.0%	0	0
No Fuel	0	0.0%	0	0
Total	194	100.0%	359,284	22

Table 1: Municipal Current Residential Thermal Energy Use[6]

[6] https://data.census.gov/cedsci/table?q=Heating&t=Heating%20and%20Air%20Conditioning%20%28HVAC%29%3AOwner%2FRenter%20%28Householder%29%20Characteristics%3AOwner%2FRenter%20%28Tenure%29%3APhysical%20Characteristics&g=0500000US50001_0600000US5000176075&tid=ACSDT5Y2019.B25117

Since many Waltham residents use wood to heat their homes, wood burning considerations deserve attention in this energy plan. Heating with wood, while relatively low in cost, is not as efficient as electricity. Wood smoke is also unhealthy since it pollutes indoor and outdoor air.[7] Since one major goal of any Vermont Enhanced Energy Plan is to reduce air pollution from the use of fossil fuels, it would be counterproductive if the plan encouraged switching to more wood burning, thereby increasing air pollution from wood smoke. Statistics compiled by the US Environmental Protection Agency (EPA) show that residential wood stoves in Vermont in 2015 emitted just over 22 pounds of pollutants per person, almost double that of Minnesota, the No. 2 state.[8] Burning wood can also lead to a long-term loss of the carbon sequestering effect that forests provide.[9] To some extent, replacing older inefficient and polluting stoves, fireplaces, and outdoor hydronic heaters with new EPA certified wood burning equipment can offset these problems. After start- up, a properly installed, correctly used EPA certified wood stove should be smoke free. The other benefits of the new wood stoves and fireplaces are that they:

- save money, fuel, time, and resources
- are up to 50% more energy efficient
- use 1/3 less wood for the same heat
- cut creosote build-up in chimneys that helps reduce the risk of fire
- reduce indoor and outdoor particle pollution by 70%
- reduce the incidence of asthma attacks and other respiratory problems

All of these factors need to be considered in reaching the goal of transitioning to renewable forms of clean energy.

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[7] Along with most other environmental health experts, Vermont has determined that wood smoke in any form is a potential human health problem. https://dec.vermont.gov/air-quality/compliance/owb/health-and-environment. The worst pollution comes from uncertified outdoor hydronic heaters due to the poor combustion and the large amounts of smoke emitted. The pollutants in wood smoke include carbon dioxide, carbon monoxide, fine particulates that reach the deep lungs, nitrogen oxides, sulfur oxides, volatile organic compounds (such as benzene and formaldehyde), acrolein, dioxins, and furans. In older homes, up to 70% of wood stove smoke can re-enter the home. Breathing air containing wood smoke can cause a number of serious respiratory and cardiovascular health problems. Those at greatest health risk from wood smoke include infants, children, pregnant women, the elderly, and those suffering from allergies, asthma, bronchitis, emphysema, pneumonia, or any other heart or lung disease. See: https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/2020-01/r-ard-17-01.pdf and https://www.epa.gov/burnwise/wood-smoke-and-your-health

[8] https://www.burlingtonfreepress.com/story/news/local/2015/03/14/vermont-per-capita-wood-stove-emissions/24784007/ See Also, https://www.epa.gov/sites/production/files/documents/strategies.pdf

[9] When wood is burned, it releases carbon dioxide in the wood smoke. According to a study by Massachusetts Institute of Technology, the time it takes to offset that CO_2 release with an equal amount of carbon sequestration from new trees ranges from 44-104 years after clear-cut, depending on forest type — assuming the land remains forest. Selective cutting would produce the same qualitative gap but with different recovery times. Reference: Sterman JD, Siegel L, and Rooney-Varga JN. Does replacing coal with wood lower CO_2 emissions? Dynamic lifecycle analysis of wood bioenergy. Environmental Research Letters, 13:1, 2108. https://iopscience.iop.org/article/10.1088/1748-9326/aaa512/meta.

In addition to switching to more renewable sources of energy, Waltham can work to encourage conservation of energy. For instance, Waltham needs to do more to encourage its citizens to work with local providers of services promoting weatherization and efficiency. Services available that promote weatherization and efficiency include:

- The Champlain Valley Office of Economic Opportunity (CVOEO) provides fuel assistance to income-qualified residents either on a seasonal basis (call CVOEO at 800-479-6151) or on a crisis basis (call CVOEO Addison Community Action at 802-388-2285). The CVOEO website, https://www.CVOEO.org, describes additional fuel assistance programs available to Vermont residents. CVOEO also provides free weatherization services to income-qualified Addison County households.
- Efficiency Vermont, the nation's only efficiency utility, has many programs to improve energy efficiency. Information and descriptions can be found on its home page at https://www.efficiencyvermont.com, including energy audits, incentives for Home Performance with Energy Star, information on appliances, compact fluorescent and LED bulbs, how to build an Energy Star home, home heating help, rebate information, and Efficiency Vermont's reference library. Efficiency Vermont also assists homeowners to find many income-based loan options: as low as 0% interest, and up to 100% financing.
- Button Up Vermont (BUV) offers substantial rebates on home weatherization projects and will assist in finding zero interest loans for these projects. See https://www.buttonupvermont.org/rebates
- The Vermont Department of Public Service Vermont Energy Saver (VES) program is a resource for homeowners to learn about ways to more efficiently heat and cool homes or businesses, save money, increase indoor comfort, and get the best return on weatherization investments. See https://www.energysaver.vermont.gov
- NeighborWorks of Western Vermont (NWWV) also offers audits and subsidized weatherization services through their HEAT Squad (HS) program https://www.heatsquad.org. In addition, NeighborWorks assists income qualified homeowners to obtain energy efficiency improvement loans.
- Window Dressers (WD), https://www.windowdressers.org, offers community workshops to train people to make and install insulating window inserts.

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 5th edition September 1, 2020[10] contains Vermont's residential building standards. RBES encompasses two requirements:

[10] https://publicservice.vermont.gov/sites/dps/files/documents/2020-VT_Residential_Energy_Code_Handbook_v8.pdf

- A technical requirement that includes minimum standards for energy-efficient building standards and construction practices.
- 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.

The RBES standards noted above are enforced through the local Zoning Administrator. Because the Zoning Administrator needs to interact with the builder and homeowner, the Zoning Administrator's duty to enforce the RBES also constitutes an opportunity for the Town to communicate with homeowners regarding energy programs and conservation opportunities.

Compliance with Vermont's RBES standards for insulation, infiltration, ventilation should be encouraged for all residences in Waltham in order to achieve the goals of this Plan.

Waltham encourages all new construction and renovations to follow these building science principles that will promote both energy conservation and reduced reliance on non-renewable sources of energy:

- Energy efficient windows and exterior doors, carrying low "U" values (same as high "R" values)
- High "R" value insulation ratings for foundations, walls, and roofs that meet the requirements of RBES
- "Tight" construction that minimizes air infiltration and confirmed with blower door testing (also prescribed in RBES)
- Controlled ventilation, that use energy recovery ventilators (ERV), to promote healthy indoor air by introducing fresh air and exhausting stale indoor air
- Efficient heating and cooling systems that rely on renewable energy sources (geothermal, wind, and solar)

In addition to the residential thermal uses noted above, Waltham has commercial[11] buildings using energy for heating. Estimates for commercial and industrial thermal energy use are more difficult to calculate. An estimate of total commercial thermal energy use, or heat, is provided in **Table 2**, based on data from the Vermont Department of Labor (VT DOL) and the Vermont Department of Public Service (PSD).

[11] Commercial establishments are defined as any firm/establishment that participates in the unemployment insurance program in Vermont. This excludes railroad workers and sole proprietors (VT DOL, June 2017).

Table 2. Current Municipal Commercial Energy Use			
	Commercial Establishments in Municipality (VT DOL)	Estimated Thermal Energy BTUs per Commercial Establishment (in Billions) (VT Dept. of Public Service)	Estimated Thermal Energy BTUs by Commercial Establishments in Municipality (in Billions)
Municipal Commercial Energy Use	6	.725	4.35

Table 2: Current Municipal Commercial Energy Use

As **Table 2** shows, Waltham has 6 commercial establishments. Conservation and reduction of heat energy in this business community has the potential to reduce some of Waltham's overall thermal use. Green Mountain Power (GMP) has efficiency incentives for businesses as well as homeowners. While GMP's programs have traditionally focused on electric efficiency, the program has recently expanded to include thermal benefits. All businesses, as well as residences, in Waltham are encouraged to contact GMP about conducting an energy audit and determining improvements that may help them increase their thermal efficiency to reduce the amount of energy they use.[12]

[12] In one 2015 example, a family of four in Rutland VT used 3,411 kWh of electricity and 325 gallons of fuel oil in a 4 month period. After a GMP-sponsored home energy make-over, the couple used 2,856 kWh of electricity and no oil in the following year's same 4 month period. The couple reduced the carbon footprint of their house by 88% in a matter of days, and at no net cost since GMP allowed the couple to finance the cost through their electric bill. Ref: https://www.newyorker.com/magazine/2015/06/29/power-to-the-people

Thermal Targets

In order to reach the 2050 thermal targets for Waltham, the town collectively needs to increase weatherization of homes and businesses and invest in new efficient heat systems, preferably to efficient heat pump systems.

See the tables below for target numbers to meet the 90 X 50 State goal.

Table 3A. Residential Thermal Efficiency Targets	2025	2035	2050
Residential - Increased Efficiency and Conservation (% of municipal households to be weatherized)	2%	9%	47%

Table 3B. Commercial Thermal Efficiency Targets	2025	2035	2050
Commercial - Increased Efficiency and Conservation (% of commercial establishments to be weatherized)	17%	18%	51%

Table 3C. Thermal Fuel Switching Targets (Residential and Commercial) - Wood Systems	2025	2035	2050
New Efficient Wood Heat Systems (in units)	0	1	7

Table 3D. Thermal Fuel Switching Targets (Residential and Commercial) - Heat Pumps	2025	2035	2050
New Heat Pumps (in units)	19	46	90

Table 3E. Use of Renewables - Heating	2025	2035	2050
Renewable Energy Use - Heating	47.40%	60.60%	87.70%

Table 3: Thermal Efficiency Targets

To reach the goal of 90% renewable energy use in Waltham by 2050, targets[13] 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 Waltham will need to make significant improvements to their homes and businesses. Currently, electricity plays an insignificant part in heating Waltham's homes and businesses. In order to meet targets, nearly all of the houses and businesses currently heating with oil, propane, or wood will need to switch to efficient electric heat pumps. Fortunately, changes such as installation of solar, heat pumps, and weatherization also create an overall cost saving for residents and an increase in the value of a home or business.

Table 3D assumes that the electricity powering the heat pumps referenced will be renewable. By 2050, 87.7% of heating BTU's will need to be supplied by renewable sources.

[13] Tables 3A-3E are based on a methodology developed by the PSD and VEIC using data from the regional Long-range Energy Alternatives Planning (LEAP) analysis and ACS. The data in the table represents the percentage of municipal households that will need to be weatherized in the target years. The targets for Tables 3A and 3B are cumulative for the town. As an example, in table 3A, only 2% of households will need to be weatherized by 2025 to meet the interim goal, but 47% of households will need to be weatherized by 2050.

Thermal Pathways to Implementation - Goals, Policies and Recommended Actions

Given the large changes that Waltham will need to make to conserve energy and switch fuels in pursuit of its energy targets, Waltham adopts the following Goals, Policies and Recommended Actions for itself and its citizens.

Goals

1. Increase the Town's thermal energy efficiency and self-sufficiency by reducing its energy use, and reducing its carbon footprint to meet town, regional, and State targets under Vermont's Comprehensive Energy Plan.
2. Reduce emissions of greenhouse gases and substances that cause acid rain.

Policies and Recommended Actions

1. Supply the applicants of building permits with a comprehensive packet of information on thermal efficiency and encourage the adoption of energy efficiency design (including building orientation to take advantage of passive solar heating and the use of thermally efficient materials) and installation of efficient appliances and heating sources. Waltham will assist these applicants in locating resources to incentivize them to purchase this equipment.
2. Conserve forest land as a renewable energy resource, tempered by the responsible use of wood for biomass energy production.
3. Educate residents about the cost savings that can be obtained with fuel switching, weatherization, and heating/cooling efficiencies and assist residents in obtaining financial support for these upgrades.
4. Encourage and assist residents, business owners, and Town officials with conducting energy audits and locating providers and resources (such as Efficiency Vermont, NeighborWorks of Western Vermont, Button Up Vermont, and Window Dressers) to incentivize them to weatherize and purchase energy efficient heating and cooling devices such as heat pumps.
5. Promote programs (such as EPA's Burn Wise, https://www.epa.gov/burnwise) and assist residents in locating resources to incentivize them to replace older polluting wood stoves, burners, fireplaces, and outdoor hydronic heaters with clean burning efficient Vermont and EPA certified wood burning equipment.
6. Support the conversion of oil and propane heating to efficient wood heating or electric heat pump systems.
7. Commit to incorporate energy efficiency and conservation when conducting

residential and economic planning and when creating local zoning regulations such as requiring that new building energy standards comply with "stretch codes". [14] [15]

8. Investigate a revision to the zoning bylaw that would incentivize compliance with the state's stretch code, or similarly high environmental standard, through the issuance of a density bonus when approving PUD-density applications.
9. Demonstrate leadership by promoting thermal efficiency in Waltham's municipal buildings. Conduct further energy audits of all town buildings to identify weatherization retrofits; incorporate the recommendations into the town capital budget.
10. Lead the community in thermal renewable energy generation.

[14] https://codes.iccsafe.org/content/VTRES2020P1

[15] See also, Zoning Administrator's distribution of information on Vermont's Energy Codes, Zoning Administrator's Handbook, Vermont Land Use: Education & Training Collaborative (October, 2005) http://www.vpic.info/Publications/Reports/ZoningAdministratorsHandbook.pdf.

Section III. Transportation Use

Transportation Use Analysis

The transportation sector is the largest source of greenhouse gas emissions in the nation, and accounts for 40% of the emissions in the region. Vermont emissions from transportation continue to grow and, in 2017, were 28% higher than they were in 1990. While some Vermonters have switched to electric vehicles, 97% of vehicles are still gasoline and diesel powered, and 80% of vehicles purchased in 2018 were low gas mileage SUV's and trucks, according to the State's 2017 Vermont Transportation Energy Profile.[16] Overall per capita vehicle miles traveled in Vermont, which is above the national average, has been rising in recent years. These high numbers are in large part due to the way we (in sparsely populated rural Waltham) use our vehicles. Like most Vermonters, the majority of Waltham residents drive themselves to work and to shop, rather than carpool or take public transport. Over the past several decades, Waltham has become a bedroom community. The remainder of Waltham's working residents work in town primarily in some agriculture and home-based businesses. The last twenty years has seen a high percentage of the Waltham workforce commuting alone, rather than carpooling; nearly 96% of all Waltham workers commute according to 2017 Census Data, when the population of Waltham was 469.

Lowering the use of automobiles and other vehicles has many advantages for residents. It:

- reduces the cost of operating and maintaining a vehicle
- avoids accidents
- makes roads safer for bicyclists
- lowers the risk of road kill
- reduces road wear and tear thus lowering taxpayer funded road repair budgets
- reduces air pollution from vehicles powered by gasoline and diesel fuel
- allows work life to be more efficient for those who work from home
- lowers ambient noise levels for those living close to roadways
- reduces nighttime headlight glare into homes
- avoids the stress, tension, and wasted time that commuting often produces.[17]

Switching to electric vehicles also has many advantages.[18] Given these advantages, Go

[16] https://vtrans.vermont.gov/sites/aot/files/planning/documents/planning/The%20Vermont%20Transportation%20Energy%20Profile_2019_Final.pdf
[17] https://www.connectingcommuters.org/resources/remote-work-telecommuting/

[18] A 2016 study from the American Lung Association found that Vermont stands to save $313 million in total health and climate costs by transitioning to a majority of electric vehicles (65%) by 2050.

Vermont was established to reduce the risks, cost, and environmental impacts of driving.

More than any other sector, the transportation costs borne by Waltham's residential vehicle use demonstrate the scope of the change that will need to take place in Waltham to meet the State's energy goals.

Table 4. Current Municipal Transportation Energy Use			
Transportation Data	**Regional**	**Municipal Data**	**Information Source**
Total # of Vehicles	18,696	276	American Community Survey
Average Miles per Vehicle (statewide)	11,888	11,888	VTrans 2019 Energy Profile[15]
Total Miles Traveled	222,258,048	3,281,088	Calculated
Average Realized MPG (2017)	19.5	19.5	VTrans 2019 Energy Profile[15]
Total Gallons Use per Year	11,397,849	168,261	
Transportation BTUs (Billion)	1,299.36	19.182	Standard conversion of BTUs from 1 gallon of Gasoline: 114000
Average Cost per Gallon of Gasoline	$2.81	$2.81	VTrans Fuel Prices (2021)
Gasoline Cost per Year	$32,027,954.61	$472,813.19	

Table 4: Current Municipal Transportation Energy Use

Table 4 above contains Waltham data compiled by the American Community Survey and shows the number of vehicles, average miles per vehicle, and miles traveled by vehicles per year in Waltham. It also shows the gallons of transportation fuel used per year. Finally, it demonstrates that Waltham residents spend approximately $472,813/yr. on gasoline (assuming $2.81 per gallon), a fossil fuel product produced outside the area. Clearly, conservation by reducing miles traveled, fuel-switching, and alternative transportation infrastructure demonstrate potential to save Waltham's residents money over the long-term.

Transportation Targets

The increasing expense, price fluctuation, and harm of fossil fuels noted above should provide a significant incentive to move towards the proposed targets contained in **Tables 5A** and **5B** below.

Table 5A. Transportation Fuel Switching Target - Electric Vehicles (EV)	2025	2035	2050
Electric Vehicles	34	229	448

Table 5B. Transportation Fuel Switching Target - Biodiesel Vehicles	2025	2035	2050
Biodiesel Vehicles	7	13	18

Table 5: Transportation Fuel Switching Targets

As **Table 5A** illustrates, to meet the proposed targets by 2050, assuming growth, nearly all personal vehicles in Waltham will need to run on renewably generated electricity. Additionally, **Table 5B** illustrates that most commercial vehicles and farm equipment will need to switch from diesel to biodiesel. To sustain the overall increase in electric vehicles, Waltham will also need to develop and promote infrastructure that supports electric vehicle use and charging. However, converting fuels, but continuing to primarily rely on single family vehicles will only produce some savings. In order to reduce vehicle miles travelled, Waltham will need to encourage other lifestyle changes. These include supporting and building alternative transportation infrastructure and promoting more compact land development options in specific areas close to necessary services. Offering increased public transportation options is another way for residents to cut down on transportation costs and energy consumption.

Carpooling would also benefit the majority of Waltham's working residents by conserving money spent on fuel and on vehicle maintenance. ACTR (Addison County Transportation Resources), now Tri-Valley Transit, and Go Vermont!, https://www.connectingcommuters.org, offer Rideshare programs that allow area residents to match their commuting needs with neighbors interested in carpooling. Waltham will create Park and Ride facilities that are available for ridesharing. Continuing to promote

compact mixed-use development, as set forth in the 2019 Waltham Zoning and Subdivision Regulations, Section 450, can increase the potential for new services and a few job opportunities for local residents, further reducing the community's reliance on single and low occupancy vehicular travel.

Finally, promoting more home-based businesses and reliable high-speed Internet will also reduce the need to use automobiles for commuting.

Transportation Pathways to Implementation - Goals, Policies and Recommended Actions

Given the significant changes that Waltham will need to adopt to switch fuel sources and reduce vehicle use in order to meet statewide targets, Waltham promotes the following Goals, Policies and Recommended Actions for itself and its citizens.

Goals

1. Increase the switch to electric and biodiesel vehicles to meet fuel switching targets.
2. Maintain or reduce vehicle miles traveled per capita by reducing single and low occupancy vehicle trips.

Policy and Recommended Actions

1. Provide residents information about electric vehicle rebates, tax, and other incentives, such as the information from Drive Electric Vermont.[19]
2. Demonstrate leadership by expanding public electric vehicle charging sites and incorporate EV ready standards into the building code.
3. Promote opportunities for people to work, operate a business, and study from home by, e.g., providing access to high-speed Internet when feasible and amending relevant zoning regulations. Maple Broadband in Addison County may be a significant improvement to Waltham's Internet Services.
4. Make efforts to increase public transportation options, such as with ACTR, now Tri-Valley Transit.
5. Join and/or promote existing online sites (such as Go Vermont) to assist residents in carpooling and ridesharing.
6. Since Waltham does not have a town center where biking and/or walking could reduce vehicle trips, it is difficult to immediately identify where biking and walking trails or paths could be useful. But, certainly, over time, if there are other major centers of town that develop, new biking or walking trails will be evaluated. In addition, the Selectboard will give consideration to the VTrans Complete Streets Guidance[20] as state roads within the Town of Waltham are maintained or rebuilt.
7. Continue to engage and participate in the Triangle Bike Loop Master Plan[21] that

[19] Drive Electric Vermont provides information on state, federal and utility financial benefits for purchasing an electric vehicle See https://www.driveelectricvt.com/why-go-electric/purchase-incentives

[20] https://vtrans.vermont.gov/sites/aot/files/highway/documents/publications/Complete%20Streets%20Guidance%20Document.pdf

[21] https://acrpc.org/wp-content/uploads/2021/04/Addison-County-Triangle-Bike-Loop-Document-FINAL_reduced.pdf

connects Vergennes to Bristol and Middlebury through Waltham, which promotes safer co–existence between people on bikes and people in cars sharing the road, makes bicycling on these roads more appealing to a wider range of people, connects natural, cultural, and recreational points of interest along and adjacent to the route(s), builds community acceptance of everyday walking and biking, and supports mutual respect and trust among all users of Addison County's roads.

8. Expand Waltham's park and ride sites where feasible.
9. Support and promote more compact land development options in specific areas close to necessary public transportation and services.
10. Make efforts to educate about and encourage adherence to Vermont's motor vehicle anti-idling law.[22]

[22] Under 23 V.S.A. § 1110, motor vehicle idling for more than 5 minutes in any 60-minute period is prohibited. According to the Vermont Department of Environmental Conservation, if every car and truck in Vermont reduced unnecessary idling by just one minute per day, over the course of a year Vermonters would save over 1 million gallons of fuel and over $2 million in fuel costs, and we would reduce CO2 emissions by more than 10,000 metric tons. See: https://dec.vermont.gov/air-quality/mobile-sources/be-idle-free.

Section IV. Electrical Use

Electrical Use Analysis

Table 6 depicts an estimate of recent electricity use in Waltham according to Efficiency Vermont. These numbers represent everyday electrical use by Waltham residents and commercial and industrial businesses.

Table 6: Current Electricity Use - Town of Waltham				
Sector	**Current Electricity Usage KWh by Year (Efficiency Vermont)**			
	2017	**2018**	**2019**	**2020**
Commercial & Industrial	144,775	228,693	192,721	214,038
Residential	1,715,453	1,569,111	1,500,503	1,663,290
Total	**1,860,228**	**1,797,804**	**1,693,224**	**1,877,328**
Count of Residential Premises	**213**	**213**	**196**	**213**
Average Residential Usage	**8,054**	**7,367**	**7,656**	**7809**

Table 6: Current Electricity Use - Town of Waltham

Currently, residential use accounts for roughly 89% of Waltham's electricity, mainly from lighting and appliances. Commercial use, accounting for the remaining 11%, stems mainly from lights, motors, pumps, and other equipment.

Electrical Targets

Like the thermal targets noted above, Waltham will need to focus on efficiency and conservation to impact the amount of electricity that it uses. Individual homeowners and businesses equally will need to increase the efficiency of their appliances, electrical fixtures, motors, machinery, and bulbs.

Table 7A, below, shows that Waltham must increase its efficiency and conservation (not including the transportation and heating changes noted in **Tables 7B** and **7C** below) by 59.2% by 2050 to meet the proposed targets. This plan anticipates significant decreases in residential, non-thermal electricity consumption due to investments in more efficient technology and conservation. By 2050, these new improvements should save a substantial amount of the total residential, non-thermal electricity used by Waltham residents in 2015. These numbers are realistic because of efficiency gains we as a society have been achieving through technology.[23] One example of an existing reduction in electricity consumption and cost is the LED light bulb.[24]

Table 7A. Electricity Efficiency Targets	2025	2035	2050
Increase Efficiency and Conservation	10.80%	37.20%	59.20%
Table 7B. Use of Renewables - Transportation	**2025**	**2035**	**2050**
Renewable Energy Use - Transportation	2.70%	18.20%	83.50%
Table 7C. Use of Renewables - Heating	**2025**	**2035**	**2050**
Renewable Energy Use - Heating	47.40%	60.60%	87.70%
Table 7D. Use of Renewables - Electricity	**2025**	**2035**	**2050**
Renewable Energy Use – Electricity (MWh per year)	2836	5676	8594

Table 7: Electric Efficiency Targets; Use of Renewables - Transportation, Heating, Electricity

Yet, even with significant efficiency steps taken by businesses and residents, the models predict that Waltham's electrical usage will increase. The increase from switching to electric heat pumps and electric car charging stations discussed in the previous two sections is the

[23] The percentages noted in Table 7A constitute the percentage savings based upon the reference scenario (limited changes) calculated in the LEAP model for Addison County. In other words, by changing how we act and the tools we use, we will use 59% less energy in 2050 to accomplish the same tasks that we currently perform at a much higher rate of energy consumption.

[24] According to the Energy Saver program of the U.S. Department of Energy, because of their high efficiency and longevity, widespread use of LED lighting has the greatest potential impact on energy savings in the United States. By 2027, widespread use of LEDs could save about 348 TWh of electricity compared to no LED use. This is the equivalent annual electrical output of 44 large electric power plants (1000 megawatts each), and a total savings of more than $30 billion at today's electricity prices.

anticipated source of this expected increase.

Tables 7B and 7C reflect the significant percentages of conversions illustrated as necessary in the previous two sections to reduce reliance on carbon-based fuels.

Table 7D shows the projected additional electricity needed as a result of the fuel switching. This increase in electric use will replace fossil fuels in both heating and transportation, which generally comprise more than 70% of all fuel use in Vermont. Moreover, since the electricity Waltham uses will be derived from renewable sources, its use of fossil fuels will drop even more significantly.

Electrical Pathways to Implementation - Goals, Policies and Recommended Actions

Given the significant changes that Waltham and its residents and businesses will need to adopt to conserve energy and increase efficiency in order to meet statewide targets, Waltham promotes the following Goals, Policies and Recommended Actions for itself and its citizens.

Goals

1. Reduce reliance on nonrenewable energy sources such as oil and gas, and shift reliance to renewable electrical energy sources, thereby reducing carbon emissions and acid rain.
2. Increase electricity conservation by Town, commercial, and residential users to achieve the stated targets.
3. Increase the use of efficient electrically powered appliances, lighting, outdoor power, and other equipment used by the Town and in commercial and residential facilities to achieve the stated targets.
4. Conserve renewable and non-renewable energy resources.

Policies and Recommended Actions

1. Provide information about availability and promote the installation of solar roof panels and tiles and ground mounted solar arrays.
2. Encourage new building construction and roof replacement permit applicants to install roof-mounted solar panels or other equipment powered by renewable energy.
3. Seek to use the Town as the anchor to create a community supported solar generation facility that could also support additional citizen members.

4. Assist owners of all solar installations in locating resources to incentivize them to purchase efficient solar panels and tiles when the technology has advanced significantly to make this switch cost effective in the long run.[25]
5. Consider funding for firefighters to receive training in fighting fires on structures which have roof-mounted solar installations.
6. Provide information about availability and promote the installation of electrical storage equipment.
7. Provide information about availability and promote the installation of small wind turbines.
8. Continue the policy of requiring builders to adhere to the RBES and CBES (Commercial Building Energy Standards) standards by distributing code information to permit applicants and by working closely with the Zoning Administrator.
9. Provide education and training about and promote electrical energy conservation.
10. Identify funding sources for electrical efficiency upgrades for all Waltham municipal buildings.
11. Provide information about availability, and promote the adoption of, more efficient appliances, lighting, water heaters (preferably solar powered), and other indoor and outdoor electrically powered equipment.
12. Work with Green Mountain Power to ensure the distribution grid and electrical infrastructure within Waltham are sufficient to support the needs of the community to increase renewable sources of electricity.

[25] Since more efficient solar panels are most often smaller, more of the newer panels can occupy the same space as the older less efficient panels, thus producing more renewable energy on the same land or roof area. Newer PV panels are also becoming lighter, reducing the need for roof reinforcements in older buildings.

Section V. Land Uses, including Generation and Transmission

Land Use, Generation and Transmission Analysis

According to the US Energy Administration, Vermont consumes almost four times as much energy as it produces.[26] Our reliance on out-of-state energy sources leaves us vulnerable. This situation can be overcome by installing our own renewable sources of energy, the benefits of which are many. With local renewable energy, Vermonters everywhere can control their energy sources and prices, improve the efficiency of our grid, cut air and carbon pollution, and likely lower electricity prices for all Vermonters. Waltham is dedicated to balancing these benefits of developing local renewable forms of electricity with the need to protect its prime agricultural lands (and the crops grown there), forests, wetlands, floodplains, wildlife corridors, the habitats these lands create and the species they support. This balancing is strongly influenced by land use policies and patterns. For instance, as stated in its 2019 Waltham Zoning and Subdivision Regulations, Section 450, Waltham supports land use concepts of clustered development as a means to preserve its natural resources, prime agricultural soils, and the inherent scenic view sheds. Clustered development also generally provides for greater energy efficiency. Clustering can potentially reduce the miles of road needed to connect homes and commercial buildings. As a result, school buses and snowplows travel shorter distances, and electric utility lines need not extend as far. Another example of land use that impacts energy use is building placement. Carefully considered placement of a building on a lot adds to the efficiency of any new structure by increasing passive solar gain and decreasing wind pressures. These and other land use policies and practices favoring energy efficient land use will be tied to the land use sections of the 2016 Waltham Town Plan and 2019 Waltham Zoning and Subdivision Regulations.

The remainder of this Section focuses on land use decisions addressing energy infrastructure.

Current Renewable Energy Generation

A growing number of homes and businesses have photovoltaic systems that supply at least a portion of their energy use. Thanks to Vermont's net-metering law, owners of these renewable energy systems can sell excess power back to the grid during periods of high production and purchase grid power only when needed. Waltham has three solar arrays used as a Community Solar Array (CSA) for ultimate sale of excess power back to the grid

[26] https://www.eia.gov/state/?sid=VT

and a reduction of electrical cost for members of the CSA.
Table 8 depicts these existing renewable generation resources as of January 1, 2020 in Waltham.[27]

Table 8. Existing Renewable Generation in Waltham	MW	MWh per Yr
Solar	0.64	796.72
Wind	0.0025	7.67
Hydro	0	0
Biomass	0	0
Other	0	0
Total Existing Generation	0.65	804.39

Table 8: Existing Renewable Generation in Waltham

As **Table 8** demonstrates, various sites created 804.39 MWh/year of renewable power within Waltham. The discussion below encompasses several types of renewable generation available to Waltham's residents and addresses how they might harness them to meet generation targets for the community.

Types of Generation Potential

Hydropower

None.

Solar Energy

On average, the energy equivalent of over five megawatt hours of solar energy falls on each acre of land in Vermont annually. Despite long winters and a variable climate, there is a relative abundance of sunshine and potential for utilizing solar energy. The challenge to using solar energy in Vermont is the seasonal difference in the amount of daylight hours between summer and winter. Thus, it would probably not be feasible at this time to rely solely on solar energy as the only power source in Waltham. However, it can and does substantially contribute to Waltham's energy mix. Net metering involves the installation of grid-connected, on-site renewable electric generation. Net-metering

[27] Data was taken from https://www.vtenergydashboard.org/my-community Jan 2021

customers purchase power from the grid when needed, and export power to the grid when output exceeds demand, resulting in a credit against charges for purchased power.

Solar water heating is another cost-effective solar application. Water heating is one of the largest energy costs for the Town's households. A water heating system that utilizes solar energy can reduce energy costs by up to 65 percent. A solar water heater cannot generally supply all the hot water needed year-round because of the climate and weather, so a back-up system is often required.

New developments in photovoltaic cell (PV) technology, which converts solar energy into electricity, has led to PVs that are smaller, lighter, less expensive, and more consumer-friendly – trends that should continue into the future. Photovoltaic cells come in a wide range of sizes and applications, from large collectors for utility-sized power plants to tiny cells built into consumer appliances. Newly developed solar roof tiles and shingles promise to become a more attractive, light weight, and efficient alternative to standard roof mounted solar panels.

The simplest use of sunlight, however, is passive use for lighting and heating. Properly insulated buildings oriented so that their long axis is within 30 degrees of true south with unobstructed south facing windows can offset space heating costs by 15 to 50 percent. Taking this one step further, floors and walls can be built of materials that will capture and store warmth from the sun. In many cases, passive solar buildings can be constructed at little or no extra cost, providing free heat and light – and substantial energy cost savings – for the life of the building.

Biomass

Biomass consists of renewable organic materials, including forestry and agricultural crops and residues, animal manure, wood and food processing wastes, and municipal solid waste. All these products or waste can be used as energy sources. The benefits of these resources are that they are local, preferably will be comprised of waste materials, and can be sustainable if managed well (with the drawback of wood's years-long gap in carbon sequestration).

Some biomass materials, principally wood, have been traditionally burned to provide heat. However, some organic materials such as manure can also be used in more efficient ways, such as producing gas that can then be burned to generate heat or power.

Waltham has a potential source of biomass including one large farm. Waltham supports the use of biomass on local farms to create renewable natural gas for heat and power.

Taking into consideration the harmful effects of wood smoke described above, Waltham supports the use of wood heat only from energy efficient and relatively non-polluting wood stoves in properly ventilated buildings.

Wind

Wind power can be harnessed for both large and small-scale power generation. In recent years, several studies have shown that Vermont's wind resource is abundant enough to meet a significant portion of the state's electric energy needs. Ridgelines provide the best location for wind generation facilities, with elevations between 2,000 and 3,500 feet above sea level being ideal for maximum power production. However, Waltham, located in the Champlain Valley Lowland region, does not have the topography to feasibly support large-scale wind generation.

Waltham does support and encourage residential wind turbines. There are locations throughout the town that reportedly experience strong winds due to site specific conditions. Small wind turbines, designed for individual residential or business use, usually generate under 15 kW. They have two or three blades usually with a diameter of 8 to 24 feet. They are often mounted on a guyed monopole or a freestanding lattice tower ranging in height from about 80 to 120 feet. Turbines need to be 40 to 60 feet above nearby trees or other obstructions for optimum efficiency. This technology is developing rapidly and over the next decade it is expected that small wind turbines will become smaller, more efficient and affordable. Waltham supports residential scale wind in all Regions where feasible.

Geothermal Energy

Constant ground temperatures of 45°F to 50°F year-round represent a significant energy resource, and with appropriate technology, can be used as a heating and cooling source. "Closed Loop" geothermal systems circulate water thru drilled wells (5-600 FT deep) which tap the energy contained in the ledge and transfer it to the circulating water. Heat pumps then extract that energy and convert it to hot or cold water to be used for heating or cooling. "Open Loop" geothermal systems pumps depend on wells to tap existing groundwater where there is sufficient flow. The water is pumped to the surface for use by the heat pumps, before it is returned to the water table to have its temperature replenished. Currently, there is only one geothermal system in use in Waltham. However, the technology is potentially viable and should be considered in the future renewable energy portfolio of the Town.

Energy Storage

Discussion of the various types of renewable energy generation will not be complete

without addressing the issue of battery storage of generated electricity. This is because battery storage allows for rapid responses to peak loads and thus facilitates the development and use of renewable sources of electricity. To the extent Waltham permits commercial or industrial scale generation in its jurisdiction, it should also advocate to include an associated storage facility to supplement the power generated to improve its short-term resiliency and replace expensive peak power purchases. Battery storage, while currently expensive, is decreasing in price, both at the industrial and the consumer level, and can provide similar benefits to both. In 2017, Green Mountain Power Corporation (GMP) installed a 1 MW battery storage facility associated with its 5MW photovoltaic project in the Town of Panton. GMP is in the process of developing and building a very similar project in Ferrisburgh. It appears that these developments will have the ability to effectively create microgrids and supply power locally for some limited period of time if the bulk transmission grid fails. Additionally, currently available battery banks can store some of the output of the associated solar array and feed it back for local consumption in peak power periods, saving GMP and its ratepayers the higher cost of power (which is based on peak load demand).

At the homeowner level, viable offerings of battery storage products have made an appearance. GMP offers one of the available battery storage devices to homeowners for a reasonable one-time purchase or a low monthly payment plan with an agreement to let GMP draw power from the unit and aggregate with others during peak demand periods. In the event of an outage, the homeowner has backup power capable of several hours of typical use.

As a note of caution, lithium-based batteries burn at very high temperatures. Battery fires are quite rare but, as people adopt this technology for storage, Waltham's emergency responders need to be able to identify the existence of storage batteries and receive training on how to manage fires from them.

Process in Evaluating Renewable Energy Development Proposals, Siting, and Installation

Waltham will consider the appropriateness of local renewable energy proposals according to the following criteria:

1. ACRPC Renewable Generation Resource planning maps (**Maps 1-7**) and descriptions in **Table 9** and **Table 10** contained in this Plan. As an example of how the maps will be used, if a solar project is proposed, Waltham would consult the map entitled Renewable Energy: Potential Solar Resource Siting Areas, **Map 4**, and **Table 9** and **Table 10** to determine if the proposed development is located in one

of the primary solar siting areas (marked in red on **Map 4**). The "known constraints" map, **Map 1**, would also be consulted to determine if the proposed site is in one of these areas. Following these determinations, the factors below will be considered before endorsing or refusing to endorse the proposed development. Again, as an example, if the proposed development is located in a "known constraint" mapped area but the factors below and an analysis of the site do not support the conclusion that the site is off limits to development, Waltham will support that conclusion with a detailed analysis. If the proposed site is located in a "possible constraint" mapped area, but the constraint can be mitigated or is found not to exist, Waltham will likewise support that determination with a detailed analysis using the factors below. In addition, **Map 7** will be consulted for wildlife corridor restrictions.

2. Renewable energy siting and installation criteria in Section VI of this plan.
3. Advice from recognized experts in disciplines relevant to the proposed site. Such experts are in the disciplines of forestry, wildlife, natural resources, etc. Other online maps such as Google Earth and **Map 7** can be consulted to identify such features as wildlife corridors.
4. Proposed site location visits
5. These further considerations:
    a. Visual Aesthetic Considerations
    Waltham will place an emphasis on shielding solar panels from the view of neighbors and, to a lesser extent, from passing motorists on town owned roads. A favored way to accomplish the preservation of view sheds is to place photovoltaic panels on roof tops. In addition, the degree to which ground mounted solar installations are out of view will have a significant effect on the approvability of these developments. For specifics, see the siting and installation criteria in Section VI.

    b. Natural Resources and Wildlife Considerations
    In developing a list of areas that are potentially appropriate or inappropriate locations for future renewable generation facilities, it is important to consider the impact on local and connected natural resources and wildlife habitats. All energy developments (both fossil fuels and renewables) have some impact on habitats and wildlife. But in the big picture, the threat of pollution and climate change from the extraction and use of fossil fuels poses a far greater risk to the environment and even to entire species than renewable energy installations. For instance, the global temperature rise from the greenhouse gas emissions threatens more than 300 species of North American birds and thousands more worldwide. Grassland birds especially are disappearing at an alarming rate,

because of both climate change and habitat intrusion. Between 1966 and 2012, they have experienced steeper, more consistent, and more widespread population declines than any group of birds in North America.[28] Waltham is located in the Champlain biophysical region, one of the largest grassland refuge regions in Vermont.[29] Therefore, commercial scale renewable energy developments should be placed outside of non-agricultural grasslands that are suitable (e.g. 25 acres or more) for ground nesting birds. Waltham also needs to preserve critical forest blocks, prevent forest fragmentation, and provide habitat for the species that depend on Waltham woodlands. Careful site selection for renewable facilities of all types is important to minimize the loss and fragmentation of wildlife habitat and corridors, as well as forests, and wetlands. Therefore, evaluations of the appropriateness of renewable energy development proposals will take these environmental considerations into account and, if feasible, suggest mitigations that prevent environment harms.

Various ways to minimize environmental harms from solar installations is, again, to place them on roof tops. For ground mounted solar installations, see the siting and installation criteria in Section VI.

c. Agricultural Preservation Considerations

Waltham is largely a residential community now, with few operating farms. However, preservation of agricultural soils and uses is still important in Waltham. There are farming landowners, however, who can no longer farm their land or maintain a farm use[30] and will be able to obtain more value from their property when it is used for solar generated electricity. One way for farmers to survive, when the economics are against them, is to host a solar field with a compatible farm use. Since the solar income can last for many years, that income can be enough for a farmer to survive. Making such dual use of an agricultural field is being called ‘’low impact solar” or “agrivoltaics“ to

[28] See, e.g. https://www.audubon.org/climate/survivalbydegrees and Wildlife Habitat Management for Lands in Vermont. Vermont Fish and Wildlife Department 2015, https://vtfishandwildlife.com/sites/fishandwildlife/files/documents/Learn%20More/Library/REPORTS%20AND%20DOCUMENTS/WILDLIFE%20MANAGEMENT%20AREAS/WMA%20ANNUAL%20REPORTS/2015%20WMA%20HABITAT%20REPORT.pdf

[29] Refuge grassland is capable of supporting numbers of ground nesting birds (e.g., bobolinks, meadowlarks, savannah sparrows, etc.) increasing the land for which would prevent the State listing them as Threatened or Endangered. Grasslands provide seeds and insects for many other birds. These fields are also habitat for numerous species of wildlife that use grasslands for their life requirements such as food, animal shelter, and deer bedding. Reducing unnecessary mowing would increase the land available for all of these plants and animals. For the grasslands in and around Waltham, see Vermont Grassland Refuge Target Regions https://anrmaps.vermont.gov/websites/BioFinder/Documents/ComponentAbstracts/GrasslandRefuges.pdf

[30] It is commonly known that Vermont has been steadily losing farms. According to the Vermont Agency of Agriculture, an average of 48 dairy farms were lost in 2019 alone, dropping the total number of dairies to about 677, with the smaller operations taking the biggest hit. The many causes for farm loss are expected to continue. See: https://www.thebullvine.com/news/number-of-vermont-dairy-farms-drops-to-an-average-of-677-2/ and https://www.uvm.edu/sites/default/files/media/Future-of-VT-Ag-Report-2018-Final_5.pdf

differentiate it from the monopolization of the land for just a solar use. Research has shown that the addition of pollinators, crops, or small grazing animals to a solar installation can, depending on the agricultural component, improve soil health, hold nutrients, retain water, increase grassland, nurture native species over invasive, and/or produce food[31] plus low cost renewable energy. [32] [33] Therefore, consideration of both agricultural preservation and dual use is important when deliberating on the installation of commercial size renewable energy development on agricultural soils. When a solar field is decommissioned, the field can be converted back into farmland, and for Waltham, this preservation of farmland is preferable to permanent use of the land for single family residential development.

Landowners will, of course, determine whether their properties and farming businesses will be converted into renewable energy production.

This plan will require farm landowners to maintain or introduce an agricultural component to commercial sized solar fields if feasible. The addition of a farming component is also needed to mitigate the State designated possible constraint against the use of agricultural soils for renewable energy development. For more on this requirement, see Section VI.

[31] For instance, New Haven is the site for a solar field where saffron is grown. Saffron is the world's most expensive spice retailing at $5,000 per pound. https://www.vtenergydashboard.org/stories/saffron-and-solar-farms-a-win-win-for-the-environment-and-agriculture-2

[32] Beneath Solar, The Seeds of Opportunity Sprout. https://www.nrel.gov/news/features/2019/beneath-solar-panels-the-seeds-of-opportunity-sprout.html

[33] Pairing solar panels with small grazing animals makes sense for several reasons. Vermont law 13 V.S.A. § 365 requires shade and shelter for outdoor livestock. Solar panels can provide both. Grazing animals are an environmentally positive mowing method since they both "mow" and fertilize the field. According to Andre-Denis Wright, former chairman of the Animal Science Department at the University of Vermont, a sheep or a goat produces only 1/10th the methane produced by a dairy cow. Grazing is often cheaper than machine mowing. In addition, pollution from gas powered mowing machines is reduced by using small grazing animals. Finally, "resting" agricultural soils from constant tillage improves the fertility of that soil by allowing natural bacteria and fungi to re-establish, increases soil carbon sequestration, improves water quality, and reduces water runoff. See: https://e360.yale.edu/features/soil_as_carbon_storehouse_new_weapon_in_climate_fight

Mapping Generation Potential [34]

Renewable Generation Resource Mapping

Using data supplied by the State, ACRPC created a series of maps depicting generation resources and potential constraints for the Town of Waltham.[35] Online and expandable versions of these maps can be found at:

- https://acrpc.org/wp-content/uploads/2022/02/Waltham_all36x48-1.pdf
- To identify the various constraint layers and preferred solar sites, see the map at: https://arcg.is/1yz0zr0[36]

These maps illustrate data as required by the Department of Public Service Determination Standards and are a required element of enhanced energy planning. The maps also show areas that are potentially appropriate or inappropriate locations for future renewable generation facilities.

The maps are a planning tool only. They generally, but not precisely, indicate locations where siting a facility might be acceptable. When proposing a generation facility, applicants must verify the presence or absence of the natural resources and other specific characteristics of the site as a part of the application.

Map 1, "**State and Local Known Constraints**" The Waltham map shows State and ACRPC known constraints. A full description of each type of "Known Constraint" is included on **Table 9**.

Map 2, "**State and Local Possible Constraints**" depicts places where natural resources exist but may not prohibit development. A full description of each type of "State Possible Constraint" included on **Map 2** is also located in **Table 10**. Prime agricultural soils constitute one example of a "Possible Constraint." Statewide "Possible Constraints" are listed first, followed by locally identified resources that also serve as "Possible Constraints" on commercial scale renewable energy production.

Map 3 depicts the current electric transmission and distribution resources and constraints

[34] All maps depict information available at the time of their creation. Energy Developers and others must use the most current maps available.

[35] The data and mapping layers for the State were developed by a number of experts and sources including the Vermont Energy Investment Corporation, the Vermont Center for Geographic Information, Long Range Energy Alternatives Planning, the American Community Survey, Efficiency Vermont, the Vermont departments of Labor and Public Service, and the Vermont Agency of Transportation. The State renewable generation planning maps were used to create planning maps specifically for Waltham by ACRPC.

[36] This map allows for the layering of various natural resource features that can help to determine what areas to avoid for development. To adjust the map, click the Maps & Tools button at the upper right corner, then Layers & Legend, then select the individual layers.

within Waltham. Knowing what infrastructure is available, and where, is an important planning component for renewable power development. GMP has stated that these constraints do not impact residential scale facilities of 15kW or less. However, they do constrain any new commercial facilities from being built in those areas served by already constrained lines, shown in red. If Waltham is going to meet its new generation targets, GMP is currently indicating that requirements for additional electrical resources will need to be handled using solar installations in conjunction with battery storage, in order to add new sources of electricity on the local distribution system, since the GMP current maps indicate less than 10% capacity left in their Waltham transformer system[37]. Construction of new transmission facilities to support renewable energy generation can be a substantial driver for the total cost of the power the facility will generate.

Maps 4, 5 and 6 identify locations where solar resources, wind resources and biomass resources, respectively, exist in quantities that would support generation. These maps depict where generation resources exist, in relationship to the natural resources "Known Constraints" and "Possible Constraints" identified on **Maps 1 and 2**. For Waltham, forest zoning areas are removed from siting considerations. Also noted are existing conserved areas in town, conserved through the Vermont Land Trust.

Map 7 identifies Vermont Conservation Design Habitat Blocks and Potential Wildlife Crossing Zones where there are potential constraints for any energy site. At any time of a proposal for an energy site, current Habitat Blocks and Potential Wildlife Crossing Zone maps from Vermont Conservation Design maps will be analyzed.

Map 3 is a highly dynamic map since available electricity transmission capacity changes frequently depend on the loads that are constantly being introduced and removed. For the current version of this map, see the GMP Solar Map 2.0[38].

Map 4 is to be considered in context with the written renewable energy siting criteria since this map alone cannot accurately depict the most appropriate solar sites. Places with no "Known Constraints", no "Possible Constraints" and baseline generation potential (meaning areas of renewable energy potential) are intended to show as "**Primary siting areas.**" Places with "Possible Constraints" and baseline generation potential are intended to show as "**Secondary siting areas.**" According to the Vermont Land Trust (VLT), on conserved land, a max of 1% of the land can be used for solar panels. Since the maps depict baseline generation resources, not necessarily the "best" places for generation resources in the area, users are encouraged to treat them cautiously. For example, the "Primary siting

[37] https://www.arcgis.com/apps/webappviewer/index.html?id=4eaec2b58c4c4820b24c408a95ee8956
[38]

areas" on the Wind Resource Map depicts where the wind blows at the minimum velocity necessary to support wind power and where no "Known or Possible" natural resource constraints exist. As noted in the wind discussion above, while many places may meet the minimum criteria for wind development, they may not be the "best" areas for wind resources.

In general, Waltham's **PREFERRED** commercial energy siting areas will be located:

1. In an area of like development
2. With ease of access
3. With transmission using battery storage
4. Along the Route 7 corridor

Maps similar to those contained in this plan are available in a searchable format at ACRPC's website. The "scalability" of the digital version of the maps makes them a much more valuable tool for those desiring to understand resources or constraints within a small area of the Region. However, these Regional maps do not contain locally identified constraints and should be read in that context.

https://acrpc.org/regional-programs/energy/

A full list of known and possible constraints included on the maps (plus the additional descriptions of local constraints) are located in **Table 9** and **Table 10**. 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 those added locally by ACRPC and by the Town of Waltham.

Table 9 – Known Mapping Constraints Solar, Wind and Biomass Maps - Known Constraints		
Constraint	**Description**	**Source**
Class 1 and Class 2 Wetlands	Vermont State Wetlands Inventory (VSWI) and advisory layers from site specific work collected by the municipality	VCGI
Confirmed and unconfirmed vernal pools	There is a 600-foot buffer around all confirmed or unconfirmed vernal pools.	ANR
DEC River corridors	Mapped River Corridors.	ANR
National Wilderness Areas	Parcels of Forest Service land congressionally designated as wilderness.	VCGI
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

Table 9: Known Mapping Constraints

Legend:	
ANR	Vermont Agency of Natural Resources
ACRPC	Addison County (Vermont) Regional Planning Commission
VCGI	Vermont Center for Geographic Information

Table 10 – Possible Mapping Constraints		
Solar, Wind and Biomass Maps - Possible Constraints		
Constraint	**Description**	**Source**
Act 250 Agricultural Soil Mitigation Areas	Sites conserved as a condition of an Act 250 permit.	ANR
Agricultural soils	Local, statewide, and prime agricultural soils are considered.	VCGI
Deer wintering areas	Deer wintering habitat as identified by the Vermont Agency of Natural Resources.	ANR
FEMA Flood Insurance Rate Map (FIRM) special flood hazard areas	Special flood hazard areas as digitized by 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
Hydric soils (soil which is permanently or seasonally saturated by water, resulting in anaerobic (without oxygen) conditions, as found in wetlands)	Hydric soils as identified by the US Department of Agriculture.	VCGI
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

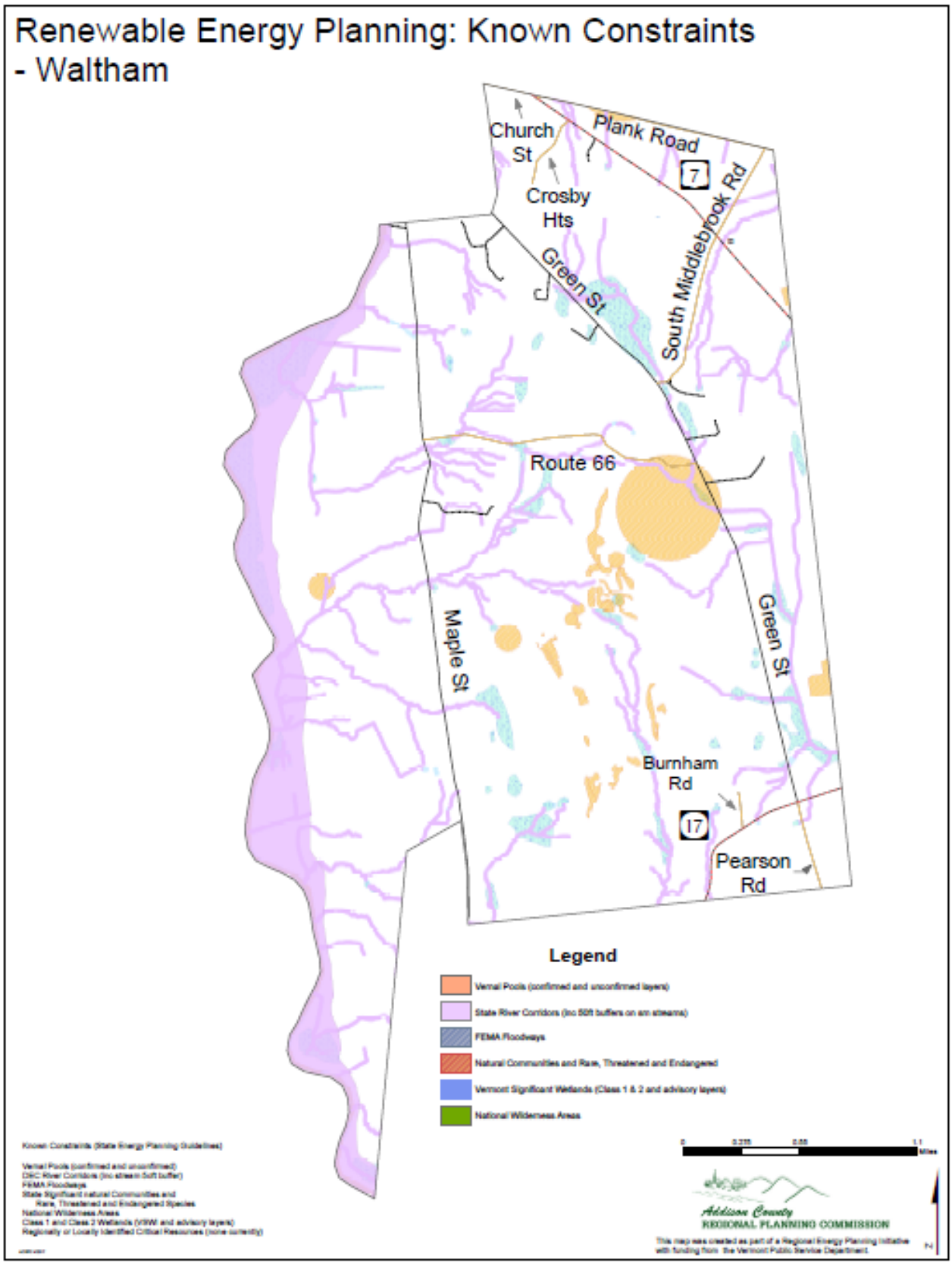
Solar, Wind and Biomass Maps - Possible Constraints		
Constraint	**Description**	**Source**

Vermont Conservation Design Highest Priority Forest Blocks and Rare Physical Landscape Diversity 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.	ANR

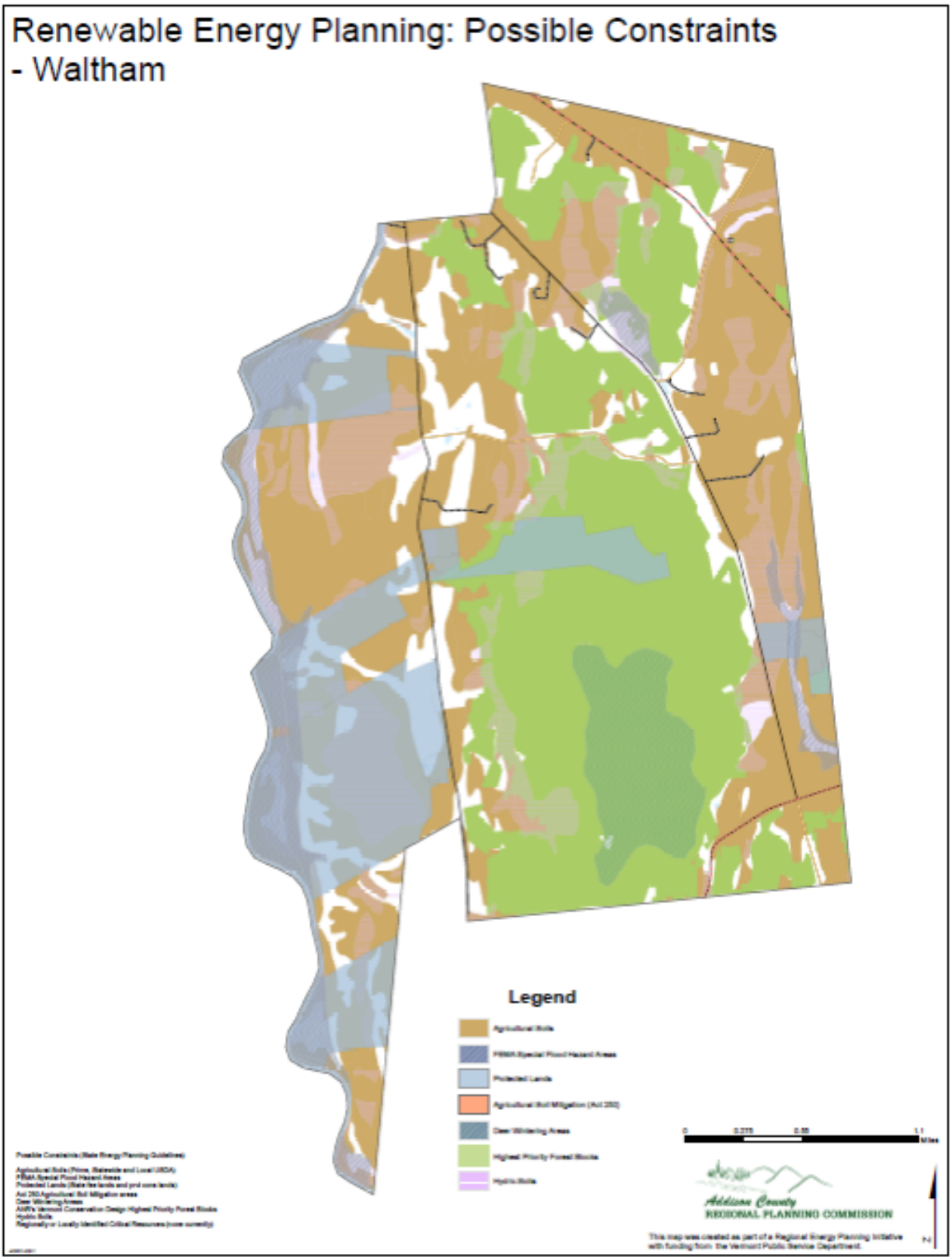
Table 10: Possible Mapping Constraints

Legend:	
ANR	Vermont Agency of Natural Resources
ACRPC	Addison County (Vermont) Regional Planning Commission
VCGI	Vermont Center for Geographic Information

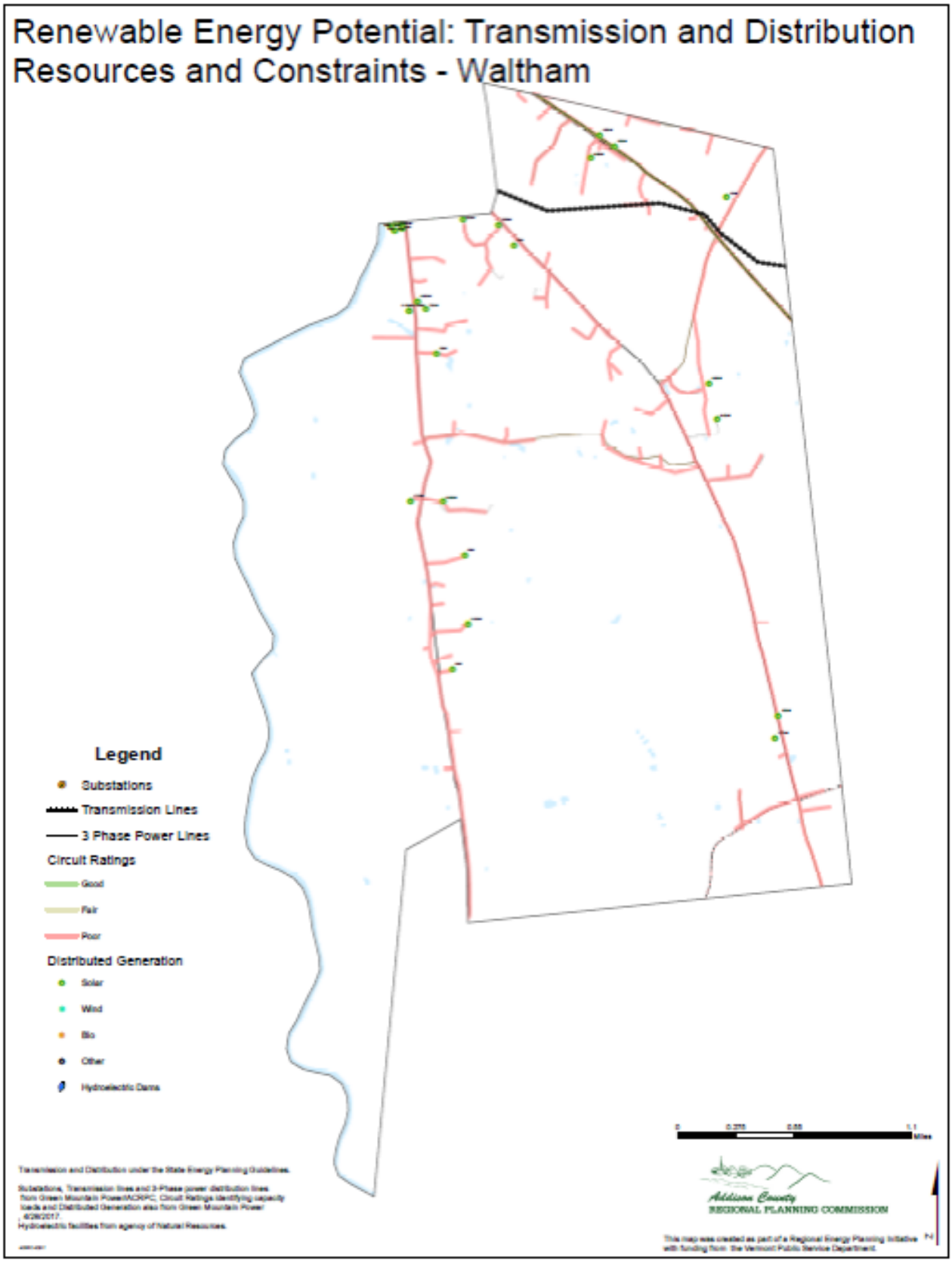
Map 1 - Known Constraints - Waltham



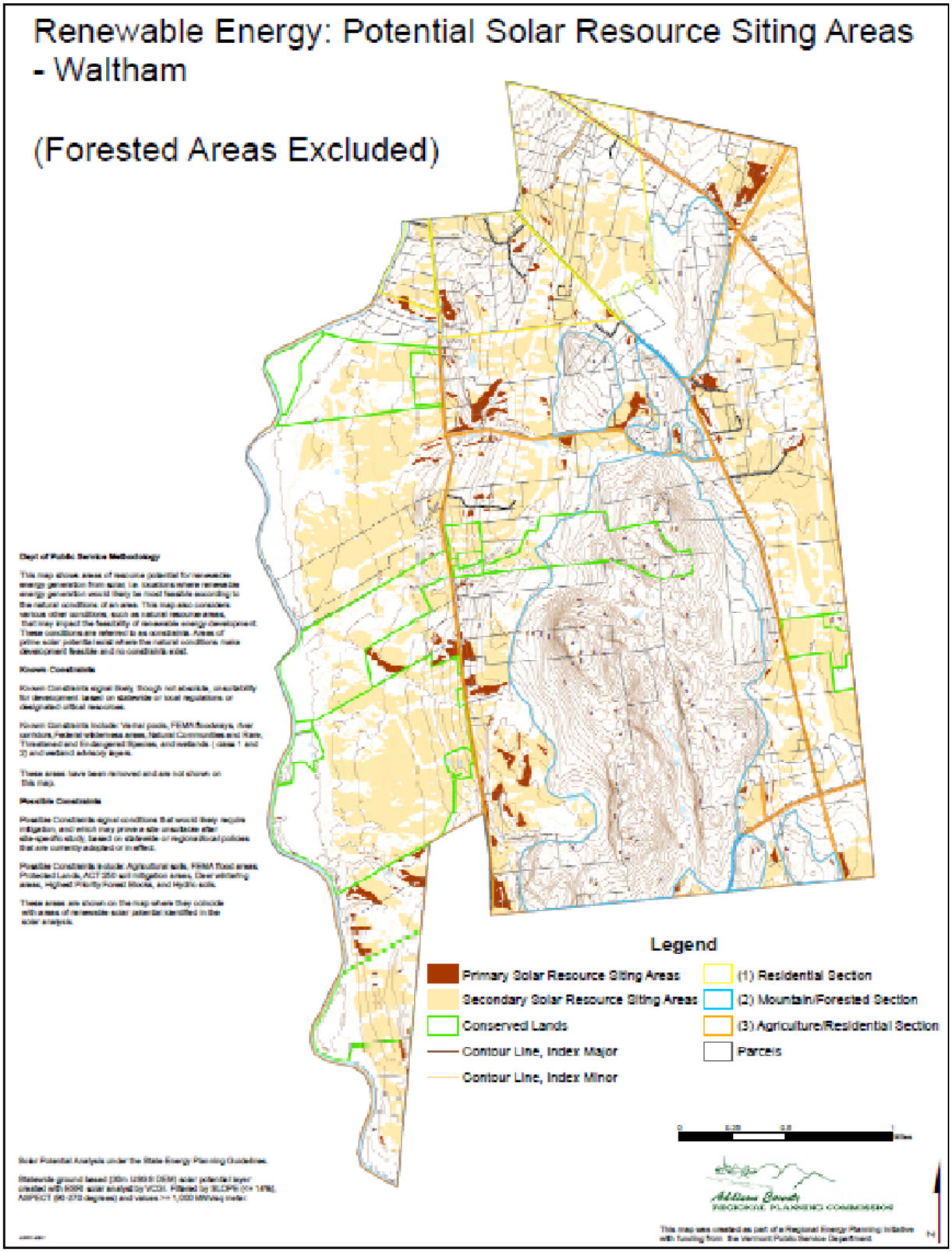
Map 2 - Possible Constraints - Waltham



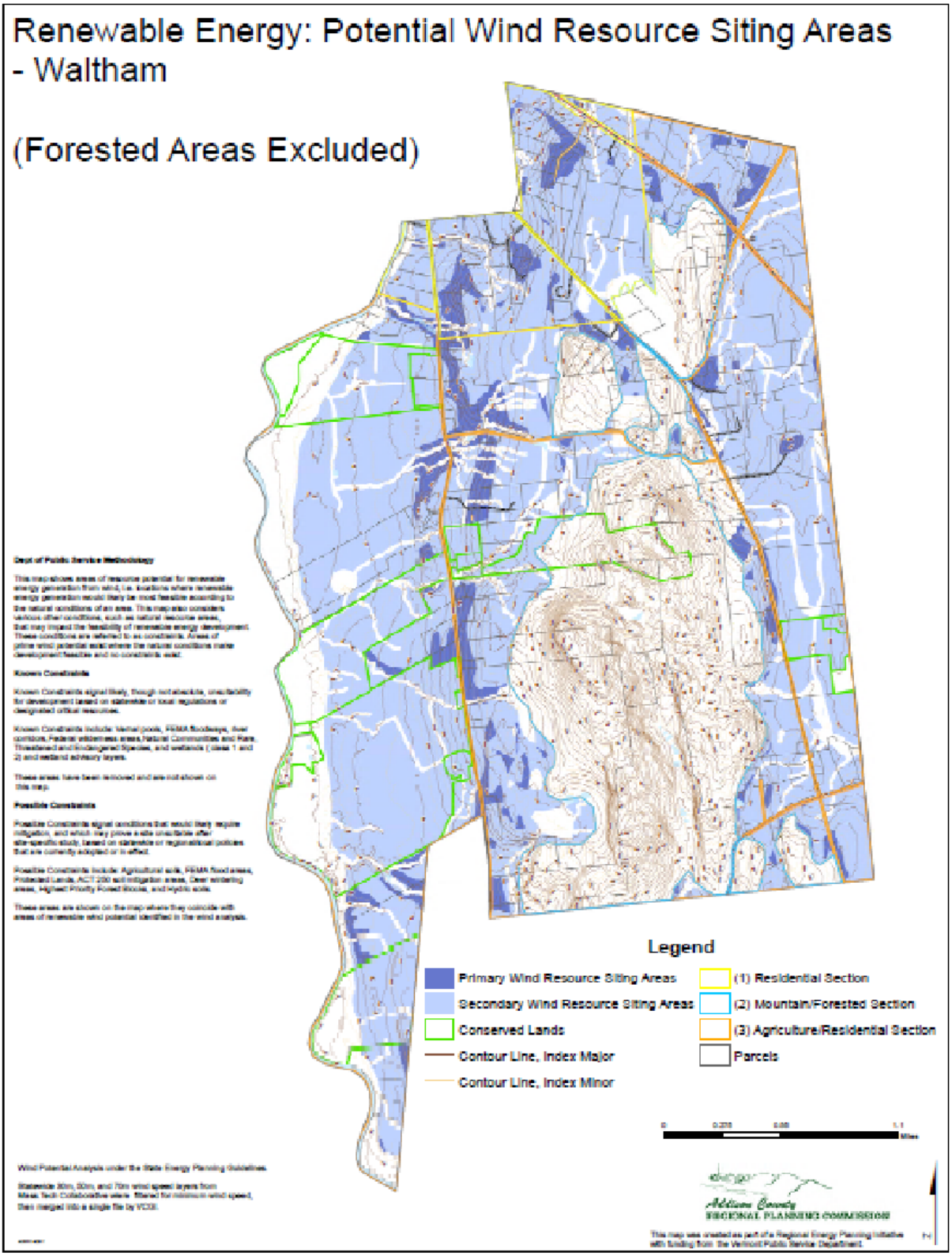
Map 3 - Transmission and Distribution Resources and Constraints - Waltham



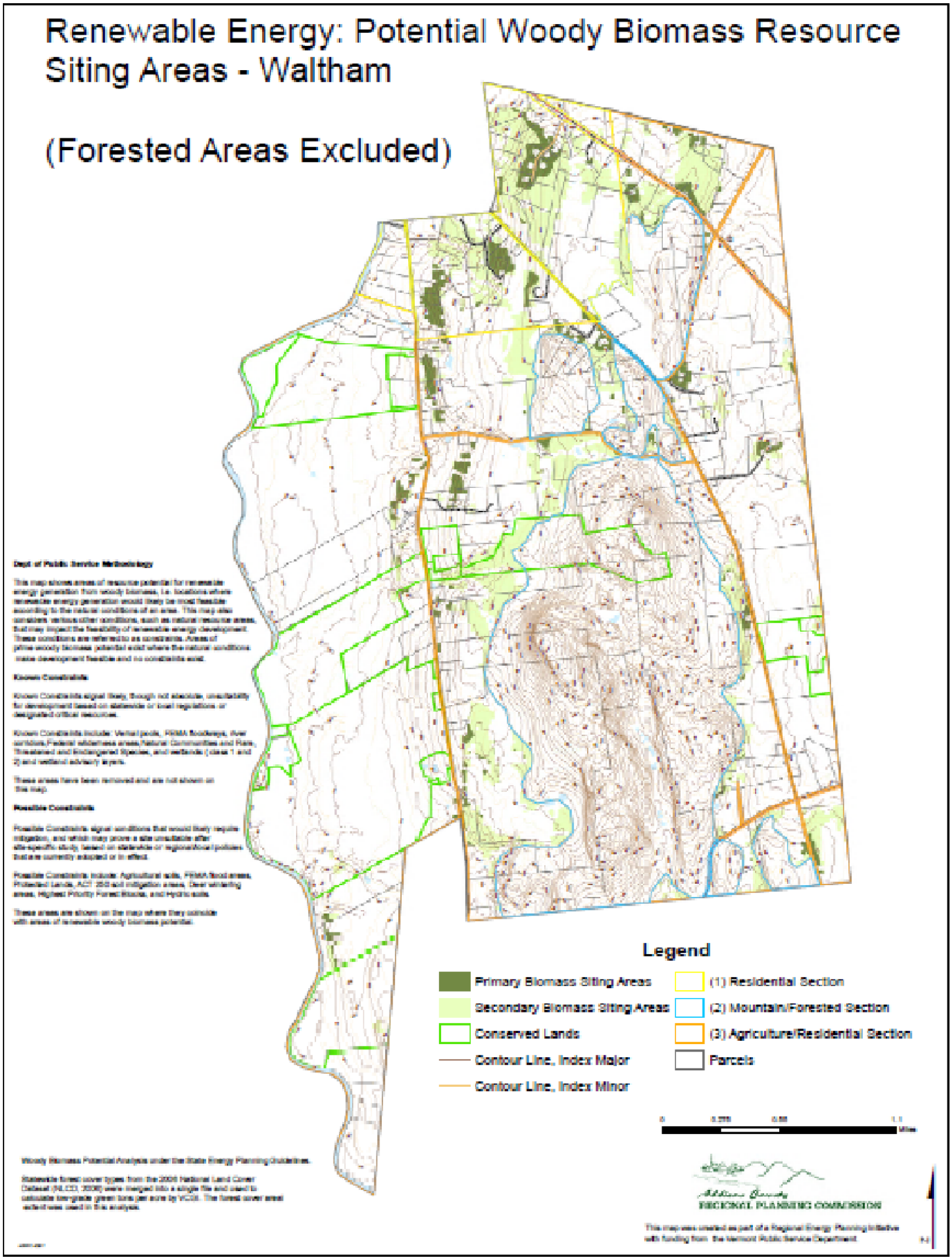
Map 4 - Potential Solar Resource Siting Areas - Waltham



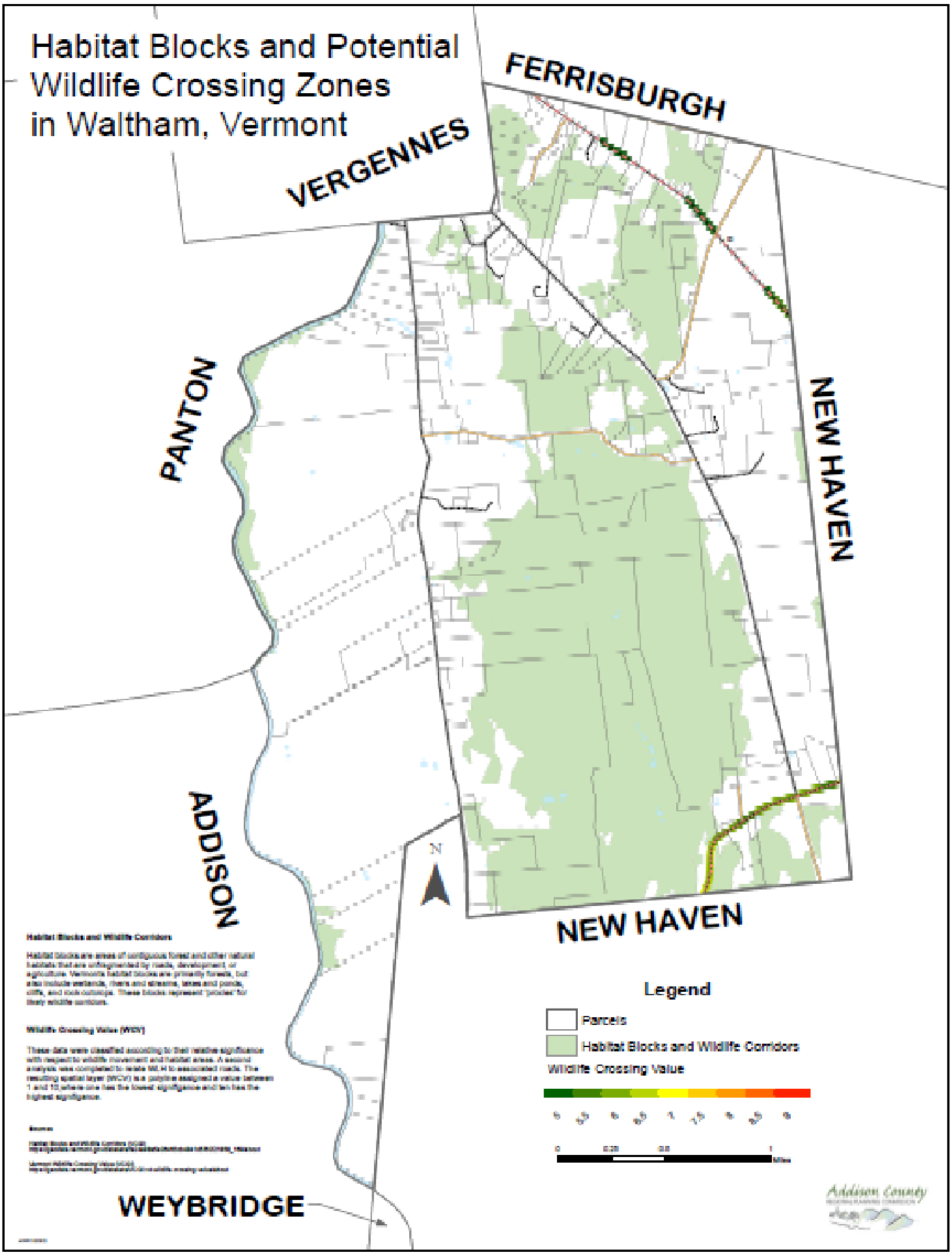
Map 5 - Potential Resource Citing Areas – Waltham



Map 6 - Potential Woody Biomass Resource Siting Areas - Waltham



Map 7 - Habitat Blocks and Potential Wildlife Crossing Zones– Waltham



Calculating Theoretical Generation POTENTIAL

The ACPRC provided maps that visualize the regions of Waltham that have the potential to generate various forms of renewable energy. In addition to the maps, values for the amount of land necessary to produce specified amounts of solar and wind energy can be assumed. For example, to generate 1 Megawatt of electricity, a solar facility would currently require 7-8 acres of land and a wind facility would require 4 acres of land.[39]

The results of the LEAP Scenario analysis completed by ACRPC in 2017, which constitutes a required part of the PSD's "determination standards" to establish an "Enhanced Energy Plan," are depicted in **Table 11** entitled, "Renewable Generation Potential in Waltham."

Table 11. Renewable Generation POTENTIAL in Waltham		
Source	**Generation POTENTIAL (in MW)**	**Generation POTENTIAL (in MWh)**
Rooftop Solar	0.5548	680.40672
Ground-mounted Solar	235	288,204
Wind	1624.5	4,980,717
Hydro	0	0
Biomass and Methane	0	0
Other	0	0
Total	1860.0548	5,269,601.41

Table 11: Renewable Generation Potential in Waltham

Note: This table is **theoretical in nature**. It represents the development of **all** of the Waltham land that is not included in the mapped "known constraints" areas. It is intended to show how much energy can be generated from a full build out of renewable energy projects. Therefore, this table is **not a realistic calculation** of potential additional renewable generation. For instance, it does not take into consideration whether landowners will allow renewable energy generation projects

[39] As the efficiency of this equipment improves, the panels will become smaller and the amount of land required to produce the same amount of energy will be reduced.

on their land. It also eliminates important considerations such as local constraints identified by Waltham, view impact, agricultural soils, electrical line capacity, technology advancements, etc.

As **Table 11** shows, the amount of annual renewable generation **potential** in Waltham, as **theoretically calculated** from the maps, stands at 5,269,601 Megawatt hours. To provide context, **Table 6** shows us that Waltham used 1,877 Megawatt hours of energy in 2020. Additionally, **Table 8** shows us that, in 2020, Waltham produced 804.4 Megawatt hours of solar and wind renewable electricity.

The theoretical generation potential shown in **Table 11** above overestimates the **potential** renewable generation available. Not every acre that could be developed for energy in Waltham will be developed. However, it also illustrates that Waltham has an abundance of land from which it could theoretically generate renewable electricity. Therefore, Waltham can carefully consider the areas in which it wants to prefer and to allow renewable energy generation and the areas in which it wants to restrict generation, especially in the context of its renewable energy targets.

For example, Waltham is best suited to add solar renewable energy rather than the other types of renewable energy. **Map 4** in this Plan entitled "Renewable Energy: Potential Solar Resource Siting Areas" designates in red areas described as primary solar siting areas. These red areas comprise 113 acres. According to State calculations, 1 Megawatt of electricity generated by a solar facility would require 8 acres of land. Therefore, assuming that these sites can be verified as "primary", 113 acres have the generation potential of almost 14.125 MW of solar derived electricity, or 17,317 MWh each year. Fully built out in solar, these areas would exceed the targets set for Waltham for local renewable energy production.

Land Use - Renewable Generation Targets

As a part of PSD requirements for Enhanced Energy Planning, ACRPC calculated renewable energy generation targets for the Town of Waltham for the years 2025, 2035 and 2050. A set of regional targets for solar and wind energy were produced for each regional planning commission by the Northwest Regional Planning Commission (NRPCVT) and the PSD. Due to the amount of renewable energy currently generated in the Region, ACRPC chose to work with the low targets for solar and wind generation, to more closely match the Region's targets to the Region's projected use. ACRPC then used the Regional targets to create targets for each town within the Region. ACRPC calculated that by 2050 Waltham will need to produce an **additional** 2,162.14 MWh of electricity from renewable sources **annually** to meet the State's 90 x 50 goals (**Table 12**). (See also the Addison County Regional Energy Plan 2018, **Table 19**).

Table 12. Municipal Renewable Generation Targets (in MWh)

Renewable Generation Targets (in MWh)	2025	2035	2050
Total Municipal Renewable Generation Target (in MWh per year)	1,528.05	2,236.55	2,966.52

Table 12: Municipal Renewable Generation Targets (in MWh)

As noted previously, usage is expected to increase largely because of the increased use of electric heat pumps and electric vehicles (**Table 8D**). Given that this projection is 30 years into the future, and the data comes from different sources, Waltham should continue to plan and adjust these targets as future need and conditions dictate.

The following provides calculations for the amount of land or numbers of cows needed to meet the renewable generation targets assigned to Waltham. Under the statewide formula allocating land to different renewable sources:

1. 1 Megawatt of electricity generated by a solar facility would require 8 acres of land.
2. 1 Megawatt of wind energy generated from a wind facility would require 4 acres of land.
3. 1 Megawatt of electricity generated from a bio-digester requires about 3,000 cows.

Therefore, if Waltham were to generate all of the energy demanded to reach its 2050 target

from solar, it would need about 56 acres allocated to solar facilities. If the total 2050 generation target were to come from wind, 8 acres would be required. If the total 2050 generation target were to come from bio-digesters, the manure of 8409 cows would be required.[40] Ideally, a mix of these sources will be possible by 2050 and these resource totals will be adjusted as allowable circumstances dictate.

Land Use and Generation Pathways to Implementation - Goals, Policies and Recommended Actions

In order to meet the energy generation targets cited elsewhere in this document, Waltham promotes the following Goals, Policies and recommended Actions for itself and its citizens.

Goals

1. Meet increased electric demand in partnership with Green Mountain Power and Efficiency Vermont while maintaining progress to achieve energy targets.
2. Enable new renewable generation in areas designated as preferred or allowed under this plan.
3. Mitigate the negative consequences of installation and decommissioning of large renewable energy development projects.
4. Implement land use development patterns promoting a densely settled community center surrounded by rural and working landscape so as to achieve energy and transportation efficiencies and preserve agricultural lands, scenic view sheds, and natural resources.
5. Promote Land Use planning that supports reducing energy usage and conserving resources.

Policies and Recommended Actions

1. Work with GMP to address the capacity issues within the distribution grid serving the Town of Waltham specifically and northern Addison County more generally to allow more energy generation; see **Map 3** showing the constrained distribution system in Waltham.
2. The Planning Commission and Selectboard will work together and with ACRPC to

[40] If all new generation is in solar: 8594.2MWH/8760 hrs per year/.14 =7.01 MW 7.01MW x 8 acres =56.06 acres are needed
If all new generation is in wind: 8594.2MWh/8760 hrs per year /.47 = 2.09 MW 2.09MW x 4 acres=8.35 acres are needed
If all new generation is in bio digesters ('cow power'): 8594.2MWh/8760 hrs per year /.35 = 2.80MW 2.80MW x 3000 cows=8409 cows are needed

advocate for this plan and its siting criteria in all significant Section 248 application proceedings.

3. Seek ways to increase the local power generated by all feasible renewable energy generation sources: solar (both ground and roof mounted, with roof mounted being preferred), wind (from individual residential or business use), biomass (preferably from farm and other local waste materials), and geothermal.
4. In new building construction and major remodels, promote and facilitate the installation of renewable generation equipment such solar panels and roof tiles, wind turbines, and geothermal systems.
5. Give preference to solar developments that produce electricity for local use.[41]
6. Adopt the Section VI Standards for Siting and Installation of Energy Projects, including:
    a. As much as is feasible, require that installation of large renewable power developments contain a compatible agricultural or ecological component. See further explanation in Section VI Standards for Siting and Installation of Energy Projects.
    b. Require renewable energy developers to adopt wildlife friendly practices when installing, maintaining, and decommissioning equipment. See further explanation in Section VI Standards for Siting and Installation of Energy Projects.
    c. Require that decommissioning of large renewable power developments leave the land in its pre-development state, including removal of infrastructure, disposal/repurposing/recycling/selling of any components, and the stabilization and re-vegetation of the site.
7. Waltham will educate the community about these standards.
8. Waltham will serve as a resource for landowners considering renting or selling land for renewable energy projects.
9. To achieve greater energy conservation and efficiency, amend Waltham's Plan, as necessary, to provide the vision for more density and development within suitable areas. Greater density increases energy conservation.
10. Consider participation in the state designation program to identify key areas for increased density.
11. Implement the vision outlined in the Waltham 2016 Town Plan by amending the Waltham zoning and subdivision regulations to provide for increased density.
12. Encourage settlement patterns that reduce travel requirements for work, services, and recreation.
    a. Encourage development of compact neighborhoods within Waltham's

[41] See: https://vtdigger.org/2020/02/25/michael-shank-keeping-renewable-energy-credits-local/

Neighborhood Commercial, High Density Residential and Medium Density Residential Planning Areas.

b. Allow infilling of existing large-lot development where higher density development is desirable and appropriate.
c. Provide opportunities for appropriate home occupations and telecommuting.
d. Support continued improvements in broadband connectivity and encourage telecommuting.

13. Appoint a Waltham Town Energy Coordinator. The Coordinator can engage in a variety of projects, ranging from the weatherization of Town owned buildings or private homes, to organizing educational events on energy issues, or helping citizens to understand the various state energy efficiency programs and financial incentives available.

Section VI. Standards for Siting and Installation of Energy Projects

Where a project is placed in the landscape and a project's impact on the land and wildlife are critical, poor siting cannot be adequately mitigated. Accordingly, all solar and wind energy generation projects proposed in Waltham must evaluate and address the proposed site's impact both in terms of the aesthetic and ecological impacts on the surrounding landscape, as well as impact on wildlife corridors.

The historical working landscape that defines Waltham is dominated by view sheds across open fields to Lake Champlain, the Adirondacks, Green Mountains and Mt. Abraham and forested hills. Rural structures like barns and farmsteads fit into the landscape because their scale and mass generally do not impact large tracts of otherwise open land. Large scale generation projects, however, may need to be limited in height and mass, and/or have their height and mass broken by screening to fit in with this landscape. Following are Waltham's standards for siting new energy generation. Waltham will apply the siting standards by the process and criteria listed below but not so strictly so as to eliminate the opportunity to meet its electrical generation targets. This last clause is an ACRPC requirement for approvable enhanced municipal energy plans. It means that Town cannot use the siting criteria as a pretext or in an arbitrary and capricious manner so as to prohibit renewable energy development and make it impossible to achieve the renewable energy generation goals set forth in this Plan.

SOLAR:

Unless prohibited by verified "known constraints" designated in the energy planning maps:

Residential scale solar projects, defined as grid-connected/net-metered projects up to 15 kW, whether rooftop or ground mounted, are encouraged in all areas of the Town of Waltham. Owners are encouraged to use the siting standards noted below when siting their array on their property.

Net metered commercial solar projects (defined as any project subject to Rule 5.100 governing net-meter solar arrays and ranging in size from 15kW – 500kW) will be considered in the Town of Waltham except for verified known constraint areas.

Commercial solar projects of a size greater than that permitted by the net-metering rules (>500kW) are subject to the siting criteria below. Waltham will refrain from specifying a size limit for large solar installations and will focus instead on proper siting. In support of this decision and, for instance, if the percentage increases to meet renewable generation

targets were evenly distributed over large solar and small solar, limiting large solar array size to 300 kW generation potential would require 53 new 300 kW arrays to reach the 2050 renewable generation target. It is likely that many residents would consider this number objectionable. There are likely to be appropriate sites where larger arrays can be installed that would limit the visual and other negative impacts of that many 300 kW systems. Neither will Waltham attempt to rely solely on large solar to meet its renewable energy targets. In another example, if roof and ground mounted small solar (both residential and business) were extensively installed in Waltham, a significant portion of the renewable energy targets could be met with small solar. Given the fact that any build out will be a mix of sizes and generation, necessarily each solar project application (especially large scale) will be considered on its merits based on the criteria described below.

Siting and Installation:

Good sites have one or more of the following characteristics:

- Building and roof-mounted systems;
- Systems located in close proximity to existing larger scale commercial, industrial or agricultural buildings;
- On parking lots, landfills, gravel pits, and other previously developed areas;
- Proximity to existing topographical features that naturally screen the proposed array from view from at least two sides;
- "Preferred" areas as defined by Public Utilities Commission Rule 5.100 governing net metered sites;
- Sites designated as "preferred" areas by this Plan.
- Interferes as little as possible with wildlife and wildlife corridors.[42]

Poor Sites have one or more of the following characteristics:

- Known constraints identified in the energy planning maps and verified by qualified experts;
- Inability to adequately screen from view;
- Topography that causes the arrays to be visible against the skyline from common vantage points like roads or neighborhoods;
- The removal of productive agricultural land from agricultural use;[43]
- Sites that require public investment in transmission and distribution infrastructure

[42] See wildlife corridor impacts: https://wildlife.org/wp-content/uploads/2014/05/Wind07-2.pdf For guidance, see https://www.usgs.gov/faqs/can-wind-turbines-harm-wildlife?qt-news_science_products=0#qt-news_science_products

[43] As noted above, if the landowner determines that the best use of the land is to provide solar energy, this criterion wanes in importance. Additionally, as described above in Section V, the inclusion of an agricultural component can significantly improve the suitability of the site.

in order to function properly;[44]

- Areas of forestland that need to be clear cut for the installation of the solar array;
- The determination by a wildlife expert that the site will significantly interfere with wildlife or wildlife corridors which cannot be mitigated.

Mitigation methods:

- Locate the structures on the site to keep them from being "skylined" above the horizon from public and private 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 the Municipal Zoning Regulations within the Zoning District in which it lies;
- 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 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 of the project may be appropriate. Plantings will be made in accordance with a screening maintenance plan, included with the application for, and made a condition of the project's Certificate of Public Good.
    a) Such screening maintenance plan will include at a minimum:
        (i) A schematic showing the location of both existing and planned planting material, earthwork and structures;
        (ii) A plant material list including all plants to be made as part of the screening, listed by both common and botanical name, the size at installation, expected size at maturity, and expected number of years to maturity. Plants used will provide year-round screening;
        (iii) The name, telephone number, street address, and e-mail address of the person or persons responsible for screening installation and maintenance, the timing of installation, and a plan for ensuring year-round screening maintenance. For further elaboration of this responsibility, see e) below;
        (iv) A copy of an on-going screening maintenance contract or lease contract

[44] Practically speaking, developers are unlikely to seek approval in these situations.

provisions (which may have commercially sensitive price terms redacted). Such contract will be for a term of no less than three years. Screening maintenance will include at a minimum: watering, dead heading, trimming where appropriate, prompt replacement of any diseased, damaged or dead planted material, and control of invasive species;

(v) Pre-construction photographic images of the site to document the site's condition prior to planting or project construction. These images will set the standard for decommissioning.

b) The screening requirements of this Section apply year-round during the entire period of existence of a project, whether or not a solar project is still in service. Screening must remain in place and be maintained until a project has been fully decommissioned or deconstructed and the site restored to its condition prior to installation or construction;

c) Where new screening materials must be installed or planted, natural, living, or native screening materials, such as native trees and shrubs, will be used in lieu of artificial screening materials such as walls, fences, and other structures; provided, however, that limited use of artificial screening materials is permissible to the extent that

(i) the use of living screening in that area is not feasible, and

(ii) the artificial screening is of size, scale and materials that are consistent with the character of the surrounding neighborhood and landscape.

d) All planting must be completed within four weeks of the date on which the solar project first feeds electricity onto the electric grid (the "in service date"), or in the case of new commercial development, the completion of principal construction. A solar project with an in-service date falling during frozen ground conditions must complete all plantings by May 31 of the year frozen ground conditions have passed;

e) Responsibility for maintenance of landscaping and screening is allocated in the contract between the renewable energy developer and the property owner on which the project is constructed, maintained, and operated. The name and contact information of the responsible party will be filed with the Town as well as any change in responsibility for this landscaping and maintenance.[45] These maintenance obligations extend for the life of the installation but the obligations may be transferred by contract, such as with the sale of the property;

f) In the case of any project, such obligations will be a condition of and

[45] See: Act 56 Report: A Report to the Vermont General Assembly on Municipal Adoption of Solar Screening Regulations, 1/13/17.

enforced through any Certificate of Public Good granted by the PSB, or any successor administrative agency having jurisdiction over such project.

- Practice a "good neighbor policy." The siting of solar equipment will minimize view blockage for surrounding properties. The siting of an 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 a neighbor's or the public's view shed. Locating a solar array in a manner designed to reduce impacts on neighbors or public view sheds constitutes reasonable mitigation;
- Use black or earth tone materials (panels, supports, fences) that blend into the landscape instead of metallic or other brighter colors);
- As much as is feasible, all project sites will have a compatible agricultural and ecological component. Examples of an agricultural component include the planting for pollinators, raising crops and foods, and/or small livestock grazing. For guidance, see the UVM Sustainable Agriculture Guide for farm-friendly solar projects;[46]
- When installing pollinator plantings, the development should follow the voluntary pollinator-friendly solar standards as defined by the Solar Site Pollinator Habitat Planning & Assessment Form available from UVM;[47]
- By ecological component is meant that the project will interfere with wildlife habitat and corridors as little as possible and/or improve wildlife habitats and corridors;
- No fencing or, if there is fencing of a solar array, it is raised above the ground to allow small animal passage and the fencing is in sections with corridors in between for large animal passage. The only exception to these requirements is if fencing is needed for livestock grazing.

WIND:

Residential (on property) Scale Wind consists of a single tower less than 120 feet high generating less than 15kW of energy.

Community (Commercial) Scale Wind consists of 1 or more towers all less than 200 feet high (so as not to require FAA night lighting) and producing less than 1 MW of electricity.

[46] See: https://www.uvm.edu/extension/sustainableagriculture/guide-farming-friendly-solar
[47] See: https://www.uvm.edu/sites/default/files/Agriculture/Pollinator_Solar_Scorecard_FORM.pdf

Industrial Scale wind consists of wind projects with a total capacity of greater than 1MW or with a tower or towers taller than 200 feet or requiring night lighting for any reason.

Siting:

Good sites have one or more of the following characteristics:

- Systems located in close proximity to existing larger scale, commercial, industrial or agricultural buildings;
- Proximity to existing transmission systems to minimize the new infrastructure required to serve the project;
- Use or reuse of former built or impacted property or brownfields[48] that have qualified for and are listed in the State of Vermont Brownfield program;
- Significant isolation distances from existing residential uses to allow the noise from the turbine to dissipate to a level of at least the State decibel standard[49] before it reaches the property line;
- Sites designated as "preferred" areas by this plan;
- Interferes as little as possible with wildlife and wildlife corridors.[50]

Poor Sites have one or more of the following characteristics:

- Known constraints identified in the energy planning maps;
- A location in proximity to and interfering with a significant view shed;
- Sites that require public investment in transmission and distribution infrastructure in order to function properly;
- The determination by a wildlife expert that the site will significantly interfere with wildlife or wildlife corridors which cannot be mitigated;
- Sites negatively impacting significant natural resources.

Mitigation methods:

- At a minimum, all wind turbines must observe setback restrictions such that if a tower falls, the entire structure will land on property owned or controlled by the tower's owner. Commercial Developers must increase setbacks to mitigate noise to State decibel standard and mitigate shadowing impacts;
- Use white or other colored materials (tower, hub blades) and earth tones for ground infrastructure or fences that blend into the landscape instead of metallic or other

[48] Brownfield: A property on which expansion, redevelopment, or reuse may be complicated by the release or threatened release of a hazardous material.
[49] See PUC Rule establishing standards for the sound produced by wind generation facilities, as required by legislation. http://puc.vermont.gov/sites/psbnew/files/doc_library/PSBRule5.700.pdf
[50] See wildlife corridor impacts: https://wildlife.org/wp-content/uploads/2014/05/Wind07-2.pdf For guidance, see https://www.usgs.gov/faqs/can-wind-turbines-harm-wildlife?qt-news_science_products=0#qt-news_science_products

brighter colors);

- Follow mitigation methods to prevent harm to birds and bats.

TRANSMISSION:

Siting:

Good sites have one or more of the following characteristics:

- Systems located in close proximity to existing larger scale, commercial, industrial or agricultural buildings;
- Proximity to existing topographical features that naturally screen the proposed corridor from view from at least two sides that best screen the installation from view;
- Shared or neighboring right of way with other transmission or transportation infrastructure;
- Interferes as little as possible with wildlife and wildlife corridors.

Poor Sites have one or more of the following characteristics:

- No natural screening;
- Topography that causes the lines to be visible against the skyline from common vantage points like roads or neighborhoods;
- The removal of productive agricultural land from agricultural use;
- The determination by a wildlife expert that the site will significantly interfere with wildlife or wildlife corridors which cannot be mitigated.

Mitigation methods:

- Consider burying the transmission infrastructure in sensitive areas;
- Locate the structures on the site to keep them from being “skylined” above the horizon from public and private vantage points;
- Shorter towers may be more appropriate in certain spaces than taller towers to keep the project lower on the landscape;
- Developers are encouraged to increase setbacks away from public roads to reduce the views of the infrastructure;
- Use the existing topography, development or vegetation to screen and/or break the mass of the transmission facility;
- 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 of the project may be appropriate;

- Use black or earth tone materials that blend into the landscape instead of metallic or other brighter colors.

In Waltham, according to ACRPC Regional Standards for Siting Energy Generation and Transmission Projects, transmission projects with tower heights greater than 72 feet are higher than the tree line and nearly all other structures within the town. They cannot be adequately screened or mitigated to blend into the landscape and therefore must be designed to travel underground or to limit the total height of the structures to 72 feet.

DECOMSSIONING AND RESTORATION:

All projects will be decommissioned at the end of their useful life pursuant to the requirements contained in Rule 5.900 of the Vermont Public Utility Commission rules. In Waltham, the requirements of section 5.904 (A) will apply to commercial scale solar installations greater than 100 kW.

GLOSSARY

Reference	Description
ACRPC	Addison County Regional Planning Commission serves the 21 towns of the Addison Region and provides assistance on a range of community development activities and issues. https://acrpc.org/
ACS	American Community Survey, a survey conducted as part of the US Census Bureau. This survey provides yearly information about people, jobs, education, hospitals, residences, etc., the data from which determines the distribution of federal and state funds and assists public agencies and businesses to plan. https://www.census.gov/programs-surveys/acs
ACTR	Addison County Transit Resources, now Tri-Valley Transit, connects the people and places of Addison, Orange, and Northern Windsor Counties of Vermont with their network of community transportation alternatives. https://www.trivalleytransit.org/
ANR	Vermont Agency of Natural Resources, charged with oversight and management of Vermont's natural environment on behalf of the people of Vermont. https://anr.vermont.gov/
BTU	British Thermal Unit, a traditional unit of the heat content of fuels defined as the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit. 3,412 BTUs is equivalent to 1 kWh
BW	Burn Wise, an EPA program that promotes the importance of burning the right wood, the right way, in the right appliance. https://www.epa.gov/burnwise

Reference	Description
BUV	Button Up Vermont provides recommendations for winterizing a home. https://buttonupvermont.org/
CBES	Vermont Commercial Building Energy Standards is a minimum standard of energy efficiency for new commercial construction. https://publicservice.vermont.gov/energy_efficiency/cbes
CEP	Vermont Comprehensive Energy Plan (CEP) sets a pathway for Vermont to obtain 90% of its energy from renewable sources by 2050. https://publicservice.vermont.gov/publications-resources/publications/energy_plan
Commercial scale solar developments	See definitions in Section VI, Solar
CSA	Commercial Solar Array
CVOEO	Champlain Valley Office of Economic Opportunity provides fuel assistance, housing assistance, Champlain Valley Weatherization, and other services. It is a nonprofit corporation formed in 1965 to carry out the Economic Opportunity Act of 1964 in Vermont's Northwest Counties of Addison, Chittenden, Franklin and Grand Isle. It is one of five Community Action Agencies in Vermont. https://cvoeo.org/
DEC	Vermont Department of Energy Conservation preserves, enhances, restores and conserves Vermont's natural resources and protects human health for the benefit of this and future generations. The DEC, along with the Department of Fish and Wildlife and the Department of Forests, Parks and Recreation, is part of the Vermont Agency of Natural Resources. https://dec.vermont.gov/
DOL	Vermont Department of Labor

Reference	Description
DRV	Drive Electric Vermont provides information on electric vehicles in Vermont. https://www.driveelectricvt.com/
Energy audit	A program in which an auditor inspects a building and suggests ways energy can be saved.
Energy efficiency, Electricity	Refers to programs that are aimed at reducing the energy used by specific end-use devices and systems, typically without affecting the services provided. These programs reduce overall electricity consumption. Such savings are generally achieved by substituting technologically more advanced equipment to produce the same level of end-use services (e.g. lighting, heating, motor drive) with less electricity. Examples include high-efficiency appliances, efficient lighting programs, high-efficiency heating, ventilating and air conditioning (HVAC) systems or control modifications, efficient building design, advanced electric motor drives, and heat recovery systems.
Efficiency Vermont	Efficiency Vermont was created in 2000 as a statewide energy efficiency utility. It is administered by VEIC. Through education, services, and incentives, Efficiency Vermont advances sustainable energy solutions for all Vermont homeowners and businesses. https://www.efficiencyvermont.com/
EPA	Environmental Protection Agency, Federal https://www.epa.gov/
EV	Electric Vehicle
FAA	Federal Aviation Administration https://www.faa.gov

Reference	Description
FERC	Federal Energy Regulatory Commission is the United States federal agency that regulates the transmission and wholesale sale of electricity and natural gas in interstate commerce and regulates the transportation of oil by pipeline in interstate commerce. https://www.ferc.gov/
GMP	Green Mountain Power provides electrical power for Waltham. https://greenmountainpower.com/
GV	Go Vermont is VTrans web-based clearinghouse for all kinds of alternative transportation options, including carpools, vanpools, public transit, and rail services, as well as park-&-ride locations. Go Vermont can be accessed at https://www.connectingcommuters.org.
Greenhouse gases	Greenhouse gases (GHGs) are gases in the earth's atmosphere that absorb solar radiation and trap that energy as heat in the atmosphere. Examples of GHGs include carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6).
HS	Heat Squad is a service of NeighborWorks of Western Vermont, providing low-cost energy audits for homes and businesses, home and energy loans, and help to identify contractors to complete the renewable energy related work. https://www.heatsquad.org/
kWh	Kilowatt hour, a measure of electrical energy equivalent to a power consumption of 1,000 watts for 1 hour. When referring to a solar array, kWh is the measure of how much electricity that array is producing.

Reference	Description
kW	A kilowatt (kW) is a unit for measuring power that is equivalent to one thousand watts. When applied to a solar array, the kW figure is often used to describe electrical generation (or nameplate) capacity--not actual production
ISO New England	A nongovernmental nonprofit entity that regulates the Northeast six-state electrical grid. ISO-New England coordinates the flow of electricity over the region's high-voltage transmission system, oversees wholesale electricity markets, and does long-range planning. https://www.iso-ne.com/
LEAP	Long-range Energy Alternatives Planning is a widely-used software tool for energy policy analysis and climate change mitigation assessment developed at the Stockholm Environment Institute. https://cleanenergysolutions.org
MWh	Megawatt hour is a measure of electrical energy equivalent to a power consumption equal to 1,000 kilowatts of electricity used continuously for one hour
Prime agricultural soils	As defined in 10 VSA 6001
NWWV	Neighbor Works of Western Vermont is committed to sustainable homeownership for Vermonters, working to help Vermonters become educated about home ownership and financing, find homes to purchase, get the loans they need to buy homes, and renovate existing homes. https://www.nwwvt.org/
NRPCVT	Northern Regional Planning serves Franklin and Grand Isle counties in Vermont. https://www.nrpcvt.com

Reference	Description
PSD	Vermont Department of Public Service. In the context of this Energy Plan, PSD represents the public interest in matters regarding energy. Examples include: providing long range planning for the state's energy needs, promoting energy efficiency, administering federal energy programs, and making and administering contracts for the purchase of power on behalf of the state. https://publicservice.vermont.gov/
PUC	Vermont Public Utility Commission, a three-member, quasi-judicial commission that supervises the rates, quality of service, and overall financial management of Vermont's utilities https://puc.vermont.gov/
RBES	Vermont Residential Building Energy Standards is a minimum standard of energy efficiency for new residential construction. https://publicservice.vermont.gov/energy_efficiency/rbes
RES	30 V.S.A. § 8002-8005 enacted in 2015 established a renewable energy standard (RES) that Vermont electric distribution utilities are required to meet. Under the RES, these utilities must procure a defined percentage of their total retail electric sales from renewable energy. https://puc.vermont.gov/electric/renewable-energy-standard
RGGI	Vermont is a member of the Regional Greenhouse Gas Initiative (RGGI), established to reduce greenhouse gas emissions from power generation. Proceeds from the sale of RGGI carbon allowances help fund energy efficiency programs. https://www.rggi.org/

Reference	Description
Section 248 Application Proceeding	Section 248, which is administered by the Public Utilities Commission (PUC), is a Vermont law (30 VSA § 248) that, in part, requires utilities and companies to obtain approval from the PUC for energy infrastructure projects including electric generation from solar and wind farms, electric transmission and grid facilities and equipment. Section 248 is intended to minimize the environmental impact of this kind of development.
TCI	Transportation Climate Initiative is a regional collaboration of 13 Northeast and Mid-Atlantic states and the District of Columbia that seeks to improve transportation, develop the clean energy economy and reduce carbon emissions from the transportation sector. https://www.transportationandclimate.org/
VEIC	Vermont Energy Investment Corporation, a non-profit that seeks to reduce the economic and environmental costs of energy consumption through energy efficiency and renewable energy adoption. https://www.veic.org/
VES	Vermont Energy Saver, part of the Vermont Public Service, is teaching ways one may be able to more efficiently heat and cool a home or business, save money, increase comfort and get the best return on investment. https://energysaver.vermont.gov/
VCGI	Vermont Center for Geographic Information, part of Vermont Agency of Digital Services, provides information for renewable planning map constraints. https://vcgi.vermont.gov/

Reference	Description
VTrans	Vermont Agency of Transportation is responsible for planning, development, implementation, and maintenance of a variety of transportation infrastructure including, but not limited to, roads, bridges, state-owned railroads, airports, park and ride facilities, bicycle facilities, pedestrian paths, public transportation facilities and services, and Department of Motor Vehicles operations and motor carrier enforcement. https://vtrans.vermont.gov/
WD	Window Dressers brings volunteers together to improve the warmth and comfort of homes, lower heating costs, and reduce CO2 emissions by producing low-cost insulating window inserts that function as interior-mounted storm windows. https://windowdressers.org/

Table 13: Glossary