Town of New Haven
Enhanced Energy Plan

Approved by Town Vote
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NEW HAVEN ENHANCED ENERGY PLAN

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 we are 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. New Haven is committed to participate in both of these programs to help the State reduce its reliance on greenhouse gas producing fossil fuels. However, New Haven is currently in a complex situation with regard to both parts of this goal. The renewable generation part of the program is complex primarily because of New Haven's unique and early history with solar developments in the State and the lack of transmission line capacity. The energy use reduction part of the program is complex because of the sudden and large increase in energy use by the new VELCO facility scheduled to go online in 2021. This section briefly describes the history of both.

Leading up to the solar development history are two major related situations in New Haven. Renewable generation was already a feature in Town because the Beldens Falls hydroelectric facility was producing large amounts of renewable energy—much more than the Town was using. For instance, in 2017, Beldens Falls generated 20,498.4 MWh of power while the entire Town was using 12,879.3 MWh/yr of power.[2] The second major situation was that New Haven had become, according to the local newspaper, the "northernmost terminus of the New England energy superhighway west of the Green Mountains."[3] This description was the result of the role that New Haven played in the 2005-6 Northwest Reliability Project of the Vermont Electric Power Co. (VELCO). This project paired a large VELCO power substation in Town with the installation of a series of highly visible 79 foot tall utility poles from which hung large canisters and up to 9 high capacity transmission wires. Some New Haven residents had objected to this project due to the visibility and unsightliness of these utility poles and the fact that New Haven was being used only as a pass through for the power running on these transmission lines. Similar feelings emerged with other energy projects that impacted New Haven during this time, including the gas pipeline and the Green Line efforts. New Haven was thus bearing a burden for the transmission and production of both traditional and renewable power for others.

Countering these opinions were others who asserted that New Haven's geographic location and its existing energy infrastructure make it an unavoidable focus for transmission upgrades. In addition, New Haven had an unearned inherent advantage over most other towns in the production of renewable energy because Beldens Falls existed inside Town boundaries. Claiming that renewable energy only for New Haven was akin to saying that our farmers were only responsible for producing food for New Haven residents and not others. All towns had to play a role in producing and delivering energy for the public good.

[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] These figures are from Brighter Vermont's Community Energy Dashboard which uses data from 40 official sources.

[3] Murphree G. Power line questions remain unanswered. Addison Independent, 9/9/15.

There have been other reasons to increase the production of renewable energy in New Haven. Several of our farmers had obtained a direct benefit from solar installations. They had offset their purchase of the large amounts of electricity they require and/or they had contracted to receive decades of income from hosting solar installations. These financial benefits offset the losses and slim margins that farmers too often experience. One New Haven family hosted a solar field because "This provides a way to keep the farm in the family."[4] After decommissioning a solar field, that land can be converted back into farming uses. In addition, while the farm fields are being used for solar, agriculture uses can still be made around and under the solar panels. These possibilities are preferable to the permanent loss of farmland that results when farming losses became unsustainable and farmers sell fields for residential development. In other words, using farm fields for solar still retains the land for agriculture but converting land to residential development is a permanent change.

Around the same time that the debate about New Haven's energy infrastructure was occurring, Vermont enacted legislation (including financial incentives) to spur the development of renewable energy projects. New Haven, with its abundance of flat open agricultural fields and easily accessible energy transmission lines and other infrastructure, was ideally situated for the development of large solar projects. The Town thus attracted the attention of solar developers. The build out started when one of the first large Vermont projects (the 2.2 MW Cross Pollination solar facility on Route 7) was approved by the Vermont Public Service Board (PSB) in 2011. At the time, the PSB was the designated State agency to approve large solar projects; the towns had little to no say in the approval decisions. While the Cross Pollination project had been endorsed by New Haven, the Town soon experienced a rapid expansion in the development of multiple ground-mounted group net metering arrays, plus many dozens of residential rooftop solar arrays. New Haven was thus producing a large amount of solar energy unprecedented in the State.[5] The rapidity of this buildout renewed the objections by some New Haven residents that this small rural town was becoming even more of a hub for too many large energy infrastructure projects that mainly benefitted others.

In support of this position, these residents pointed again to the fact that the amount of energy being produced by Beldens Falls was already providing much more energy than the Town was using. The new solar fields quickly added to that renewable energy generation. While there was still a general understanding that distributed renewable energy produced in one town benefits the public in general, this profusion of large solar projects led some residents to assert that New Haven had done more than its fair share in meeting the State's need for renewable energy production and that New Haven should not have to bear any further burdens of producing renewables for others. The added generation of solar energy also led our electric utility, Green Mountain Power, to classify most of the electric distribution lines serving the Town as "poor", indicating that the transformer substations serving New Haven were at or exceeding capacity. As a result of these constraints, at least one business in Town was prevented from installing a mid-sized solar array for its own clean energy supply. Any further permitting of renewable energy projects when there was no capacity to transmit the power seemed unreasonable. Except for some portions in the central and southern sections of Town (which have less than 20% of capacity remaining), this lack of distribution capacity exists as of the writing of this energy plan.

In addition, residents expressed concern that the many large and visible/unsightly solar fields were degrading important elements of New Haven's environment like farm fields, wetlands, forest, wildlife habitat (such as ground nesting bobolinks), and the visual and cultural landscape valued by residents. The New Haven Selectboard was also spending money and time to address resident complaints and lawsuits and to litigate problems related to solar developments such as when solar developers failed to adhere to contractual promises to screen solar fields from view or when governmental agencies failed to follow their own regulatory approval processes.[6] Finally, there were concerns that the large solar fields would cause property values and taxes to fall as solar fields were unsightly and were being taxed differently than agricultural fields. All of these concerns were magnified by the fact that New Haven residents and its

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[4] https://vermontbiz.com/news/september/proposed-solar-arrays-spark-concern-new-haven

[5] According to Brighter Vermont's Community Energy Dashboard, New Haven was ranked #1 in the State for ground mounted PV/capita and #2 in the State for total solar generation/capita.

[6] See, for instance, Madden v. Town of New Haven (2015 WL 4276463) and In re Petition of New Haven GLC Solar, LLC. (2017 VT 72). The Town has also engaged legal counsel to petition and attend hearings of the Public Service Board regarding several commercial solar developments.

governmental bodies had little control over the existence, size, and siting of large solar fields, the approvals for which remained controlled by the Vermont Public Service Board (now the Public Utility Commission).

Attempts to assert New Haven's position into these State renewable energy approvals were largely unsuccessful until the passage of new legislation[7] in 2015, commonly called Act 174. This legislation provided more local control (called "substantial deference") to towns with energy plans consistent with Vermont's renewable energy objectives. New Haven quickly took advantage of this opportunity and, after multiple public hearings and workshops, drafted an enhanced energy plan and filed it for approval with the Public Service Board in 2017. Unfortunately, the requirements for these new enhanced energy plans had not been fully developed at the time and New Haven's energy plan was rejected for the absence of several of these new requirements.[8] Since then, approval of enhanced energy plans was ceded to the regional planning commissions if their own enhanced regional energy plans had been approved by the Department of Public Service. The Addison County Regional Planning Commission's Enhanced Energy Plan was approved via this process in June 2018. Together, the finalization of the Vermont determinants of an approvable energy plan and ACRPC's energy plan approval paved the way for New Haven to revise its prior plan to (1) address Vermont's goals of lowering energy use and increasing the production of renewable energy, (2) provide New Haven with more control over the permitting of renewable energy projects, and (3) address the need for appropriate installation and siting of renewable energy projects.

The second situation that makes this Energy Plan complicated to execute is the September 2019 VELCO announcement that it was seeking a permit from the Public Utilities Commission to build an 18,000 square foot backup operations and data center in New Haven.[9] This facility is projected to increase the energy use attributed to New Haven under this Energy Plan by a substantial amount, possibly making it extremely difficult to meet the Plan's energy use reduction targets. This situation will be described more fully in Section IV below.

This background history is meant to give context to New Haven's renewed effort and commitment to adopt an enhanced energy plan. New Haven's intent with this Energy Plan is to adopt the State and regional energy mandates allocated to New Haven and to meet the goals and targets set forth herein.

Energy Plan Assumptions

This plan is based on the assumptions that:

- 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;
- The full social, environmental, and economic costs of energy are not reflected in present market prices of fossil fuels,[10]
- Conserving energy, reducing consumption of non-renewable energy, and shifting reliance to local renewable energy improves human health by reducing air[11] and other pollution, provides economic benefits by

[7] Energy Development Improvement Act (aka ACT 174).

[8] See: https://publicservice.vermont.gov/sites/dps/files/documents/2017.07.18%20DPS%20Determination.pdf

[9] Information about the project can be found at: https://www.velco.com/our-work/projects/project-newhaven and https://www.velco.com/library/document/download/6787/01.Petition.pdfin

[10] According to an International Monetary Fund study, US pre-and post-tax fossil fuel subsidies in 2015 amounted to about $650 billion. These financial "tax gifts" constitute market price distortions. This figure includes the receipt by fossil fuel companies of direct subsidies and the fact that fossil fuel prices do not reflect the costs to society of greenhouse gas and other pollution. The costs include things like the medical costs of treating lung and other illnesses caused by exposure to fossil fuel pollution. 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.

[11] For the significant hazardous air pollutants measured in Vermont air, see https://dec.vermont.gov/air-quality/pollutants-health/haz-air-contaminants/significant-hacs.

lowering the costs of energy, expands job opportunities in the renewable energy sector, and protects the environment by reducing the consequences of greenhouse gas pollution.[12]

- 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 New Haven Energy Plan is to adopt the goals of Vermont's Comprehensive Energy Plan 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 New Haven Energy Plan "**substantial deference**" before the Public Utilities Commission's Section 248 permitting process for energy development projects.[13] 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 New Haven Energy Plan will be considered under the "substantial deference" standard. In the past, New Haven had little control over the siting of solar energy developments within its borders because the Town was given only the lower "due consideration" by the PUC in its determination on whether to issue a CPG for renewable energy developments. Increasing the Town's control over the siting of renewable energy projects was one 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 our overall use of energy, will benefit New Haven in other significant ways. Producing our own renewable energy will make New Haven 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. This last goal, for instance, if applied to the weatherization of and energy conservation at the school, will substantially assist Beeman Elementary School in remaining financially viable. Farmers who require more income in order to remain sustainable can host renewable energy developments that, after decommissioning, will allow the fields to revert to farmland.

These are the reasons that the Town of New Haven supports Vermont's comprehensive energy goals. New Haven 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. It also believes the New Haven Town Plan must create a vision and clear policy statements for the Town to follow concerning energy conservation, consumption, and generation within Town.

By this Plan, New Haven intends also to exercise more control over the types of energy choices made within Town.

Specifically, in order for New Haven to gain more control over its energy policies, the Town needs to meet the **municipal determination standards** for enhanced energy planning enabled in 24 V.S.A. 4352. By pursuing enhanced energy planning, New Haven 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:

[12] Union of Concerned Scientists, Benefits of Renewable Energy Use, https://www.ucsusa.org/resources/benefits-renewable-energy-use

[13] "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."

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

To receive a positive **"**Determination of Energy Compliance", an enhanced energy plan must be duly adopted by New Haven, 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 New Haven 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 New Haven 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 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 New Haven'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 (www.acrpc.com).

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 New Haven 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 with accompanying text 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 and size, and suitable locations for energy generation facilities in New Haven. Lastly, it specifies the goals, policies and actions New Haven will undertake to help implement conservation and efficiency policies to help meet the State's larger renewable goals.

Outline of How to Read this Plan

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

Section II, Thermal Use: This Chapter focuses mostly on energy used for space heating and cooling.
Section **III**, Transportation Use: This Chapter focuses on energy used for transportation.
Section IV, Electrical Use: This Chapter 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 first and fourth chapters.
Section V, Land Use, Generation and Transmission: This chapter 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 chapter includes a mapping analysis of energy resources and constraints.
Section VI, Standards for Siting and Installation of Energy Projects: Siting and visual mitigation standards for new energy generation facilities that reflect the land use policies of New Haven.
Glossary, this section defines terms and abbreviations used in the Plan

Section II. Thermal Use

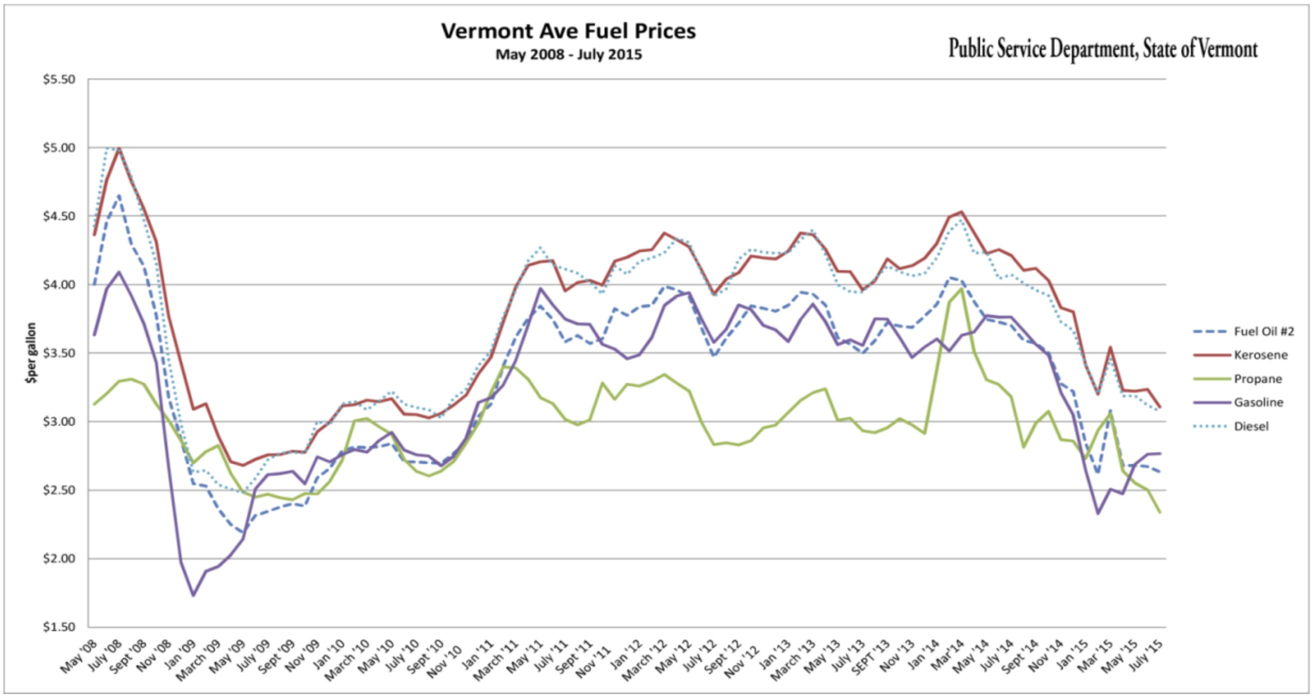
Thermal Use analysis

Table 1 shows the most recent estimate of residential thermal energy demand in New Haven, based on data from the American Community Survey ("ACS"), a product of the United States Census (2012-2016). The data shows that New Haven is relying on two of the most polluting sources of thermal energy. Fuel oil is the most common primary heating source used by New Haven residents (47.8%). Fuel oil is followed by wood, serving about 28.2% of households, with propane serving nearly all of the remaining households (about 19.4%). Note: The 0% solar data generated by ACS may not be totally accurate since some New Haven households were likely using electricity from photovoltaic panels for space heating and cooling equipment and solar powered hot water heaters during this time period. Also, there has likely been a shift toward electricity as households switch to cold climate heat pumps. Since the ACS data is generated from the census, it naturally cannot reflect current situations.

Table 1. Municipal Current Residential Thermal Energy Use

Fuel Source	New Haven Households (ACS 2012-2016)	New Haven % of Households	New Haven Residential Heating Square Feet	New Haven BTU (in Billions)
Natural Gas	3	0.4%	6,048	0
Propane	132	19.4%	221,816	13
Electricity	11	1.6%	13,475	1
Fuel Oil	325	47.8%	612,486	37
Coal	3	0.4%	6,048	0
Wood	192	28.2%	372,834	22
Solar	0	0.0%	0	0
Other	14	2.1%	28,224	2
No Fuel	0	0.0%	0	0
Total	680	100.0%	1,260,931	75

The following graph, Graph 1, compares the average price trends of various fuels used by Vermont residents from May 2008 through July 2015.



Fluctuations around the average prices can be substantial. For instance, bulk amounts of propane purchased on credit within the month of November 2016 ranged from about $1.75 per gallon to close to $5.00 per gallon.[14] Fuel prices are a result of the wide fluctuations in the demand for fossil fuels and their price. Recently, oil price per barrel ranged from a high of $148 in 2008, $60 in 2019, to negative $40 in Spring 2020 because of a glut in production combined with a decrease in demand because of the COVID-19 pandemic.

Like the graph above, the table below lists the relative cost per million BTUs of heating fuels in Vermont as of January 2015 (November 2014 for natural gas and September 2014 for green wood and pellets).

Table 2. Comparing the Cost of Heating Fuels

Comparing the Cost of Heating Fuels — Public Service Department, State of Vermont

Type of Energy	BTU/unit	Typ Effic	$/unit	$/MMBtu		High Efficiency	$/MMBtu
Fuel Oil, gallon	138,200	80%	$2.84	$25.73		95%	$21.67
Kerosene, gallon	136,600	80%	$3.41	$31.23			
Propane, gallon	91,600	80%	$2.73	$37.25		93%	$32.05
Natural Gas, therm	100,000	80%	$1.48	$18.55	*	95%	$15.62
Electricity, kWh (resistive heat)	3,412	100%	$0.15	$43.46			
Electricity, kWh (cold climate heat pump)	3,412		$0.15			240%	$18.32
Wood, cord (green)	22,000,000	60%	$ 227.14	$17.21	*		
Pellets, ton	16,400,000	80%	$294.00	$22.41	*		

* The natural gas price is based on the rate effective 11/1/14. *Wood green and Pellets updated 9/19/14.

Current gas and diesel prices can be obtained from Vermont Agency of Transportation (VTrans) and heating fuel prices can be obtained from the Vermont Department of Public Service (DPS).[15]

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[14] Vermont Fuel Price Report, November 2016, https://publicservice.vermont.gov/sites/dps/files/documents/Pubs_Plans_Reports/Fuel_Price_Report/2016/November%202016%20Fuel%20Price%20Report.pdf.

[15] https://vtrans.vermont.gov/contract-admin/resources/construction-contracting/fuel-price-adjustment, and https://publicservice.vermont.gov/content/retail-prices-heating-fuels

In order to reach the State targets, New Haven residents will need to significantly reduce the use of fossil fuels by 2050. Making homes more thermally efficient is the first step in this process. Improvements in technology can make fuels work more efficiently. However, over the long-term, it will also be necessary to replace fossil fuel sources with renewable fuel sources, such as electricity produced through renewable generation. The cost of refitting older homes, principally the capital investment in new equipment, constitutes a major barrier. However, Table 2 shows that the comparative costs of each type of fuel generally favors switching to the highly efficient renewable electric heat pumps.

Since many New Haven 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.[16] 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 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.[17] Burning wood can also lead to a long-term loss of the carbon sequestering effect that forests provide.[18]. 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.

In addition to switching to more renewable sources of energy, New Haven can work to encourage conservation of energy. For instance, New Haven 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:

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16 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 with drafty windows and doors, 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/organization/commissioner/pip/factsheets/ard/documents/ard-36.pdf, https://www.epa.gov/burnwise/wood-smoke-and-your-health.

17 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.

18 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 from wood burning 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 CO2 emissions? Dynamic lifecycle analysis of wood bioenergy. Environmental Research Letters, 13:1, 2108. https://iopscience.iop.org/article/10.1088/1748-9326/aaa512/meta.

- 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 388-2285). The CVOEO website, CVOEO.org, describes additional fuel assistance programs available to Vermont residents.
- 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 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.
- Champlain Valley Weatherization Service, part of CVOEO, provides free weatherization services to income-qualified Addison County households.
- Button Up Vermont offers substantial rebates on home weatherization projects and will assist in finding zero interest loans for these projects. See https://buttonupvermont.org/rebates
- The Department of Public Service Vermont Energy Saver 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://energysaver.vermont.gov
- NeighborWorks of Western Vermont also offers audits and subsidized weatherization services through their HEAT Squad program https://heatsquad.org/. In addition, NeighborWorks assists income qualified homeowners to obtain energy efficiency improvement loans.
- Window Dressers offers community workshops to train people to make and install insulating window inserts.
- Vermont Gas also offers efficiency measures to its customers. Since Vermont Gas serves a portion of the Town of New Haven, those customers would be eligible for its services.[19]

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

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

The REBS 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 REBS also constitutes an opportunity for the Town to communicate with homeowners regarding energy programs and conservation opportunities.

[19] https://www.vermontgas.com/account/coverage-map/

In addition to the residential thermal uses noted above, New Haven has commercial 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 3, based on data from the Vermont Department of Labor (VT DOL) and the Vermont Department of Public Service (PSD).

Table 3. Current Municipal Commercial Energy Use			
Column1	**Commercial Establishments in Municipality (VT DOL 2017)** [20]	**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	48	.725	34.8

As Table 3 shows, New Haven has 48 commercial establishments, accounting for approximately 35% of the total thermal BTU's used in the Town. Therefore, conservation and reduction of heat energy in this business community has the potential to significantly reduce New Haven'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 in New Haven 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.[21]

[20] 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).

[21] 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 New Haven, the town collectively needs to increase weatherization of homes and businesses and invest in new efficient heat systems, preferably to efficient heat pumps.

See the tables below for one scenario of target numbers to meet the 90 X 50 State goal.[22]

TABLE 4A. Residential Thermal Efficiency Targets- Cumulative	2025	2035	2050
Residential - Increased Efficiency and Conservation (% of municipal households to be weatherized)	2%	9%	47%

TABLE 4B. Commercial Thermal Efficiency Targets- Cumulative	2025	2035	2050
Commercial - Increased Efficiency and Conservation (% of commercial establishments to be weatherized)	17%	18%	51%

Table 4C. Thermal Fuel Switching Targets (Residential and Commercial) - Wood Systems	2025	2035	2050
New Efficient Wood Heat Systems (in units)	2	5	30

Table 4D. Thermal Fuel Switching Targets (Residential and Commercial) - Heat Pumps	2025	2035	2050
New Heat Pumps (in units)	70	169	332

Table 4E. Use of Renewables - Heating	2025	2035	2050
Renewable Energy Use as a Percentage of Heating BTUs	48.6%	61.0%	85.5%

To reach the goal of 90% renewable energy use in New Haven by 2050, targets have been established for each of the three major strategies to reduce or change the type of fuel used for space-heating. In order to hit the targets by 2050, property owners in New Haven will need to make significant improvements to their homes and businesses. Approximately half of the houses and businesses in New Haven will need to be weatherized to conserve energy used to heat those spaces. Currently, electricity plays an insignificant part in heating New Haven's homes. In order to meet targets, nearly all of the houses 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.[23]

Table 4E assumes that the electricity powering the heat pumps referenced will be renewable. By 2050, 85.5% of heating BTU's will need to be supplied by renewable sources.

[22] Tables 4A-4E 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 4A and 4B are cumulative for the town. As an example, in table 4A, 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.

[23] In one case study of an energy makeover of a 1950 ranch house in Jericho, which the homeowners financed with a 5 year home equity loan, the total monthly cost for energy was reduced to about $20 per month while the thermal and electrical emissions for the house were reduced from 222,184 lbs of CO_2 over 30 years to only 1,000 lbs of CO_2. See: 2018 Annual Progress Report, 90% Renewable By 2050, Energy Action Network at https://www.eanvt.org/2018-progress-report/

Thermal Pathways to Implementation - Goals, Policies and Recommended Actions

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

Goals

Goal A.

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.

Policies and Recommended Actions

1. 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.
2. 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.
3. Promote programs (such as EPA's Burn Wise) 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.
4. 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. New Haven will assist these applicants in locating resources to incentivize them to purchase this equipment.
5. 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". [24] [25]

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. 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 New Haven) use our vehicles. Like most Vermonters, the majority of New Haven residents drive themselves to work and to shop, rather than carpool or take public transport. According to New Haven's 2017 Town Plan, over the past several decades, New Haven has become a bedroom community. Most wage earners worked outside of Town in 2012, with 55% commuting to jobs in Addison County and 25% commuting to jobs in Chittenden County, according to U.S. Census Bureau Center for Economic Studies data. The remainder of New Haven's working residents work in town primarily in agriculture and home-based businesses. The last twenty years has also seen an increase in the

[24] https://publicservice.vermont.gov/sites/dps/files/documents/Energy_Efficiency/code_update/2015_VT%20RBES_Clean%20Copy%2011-4-14%20Protected.pdf

[25] See also, Zoning Administrator's distribution of information on Vermont's Energy Codes, Zoning Administrator's Handbook, Vermont Land Use: Education & Training Collaborative (October, 2015).

percentage of the workforce commuting alone rather carpooling, nearly 73% of all 05472 workers in 2010-2014 according to the 2017 Town Plan.

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 flare into homes, and avoids the stress, tension, and wasted time that commuting often produces.[26] Switching to electric vehicles also has many advantages.[27] Given these advantages, Go Vermont was established to reduce the risks, cost, and environmental impacts of driving.

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

Table 5. New Haven Current Municipal Transportation Energy Use	
Transportation Data	**Municipal Data**
Total # of Vehicles (ACS 2011-2015)	1438
Average Miles per Year per Vehicle (VTrans)	11,356
Total Miles Traveled per Year	16,329,928
Realized MPG as of 2015 (VTrans 2017 Energy Profile)	18.6
Total Gallons Used per Year	877,953
Transportation BTUs (Billion)	106
Average Cost per Gallon of Gasoline (RPC)	2.31
Gasoline Cost per Year	$2,028,072

Table 5 above contains New Haven 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 New Haven. It also shows the gallons of transportation fuel used per year. Finally, it demonstrates that New Haven residents spend approximately $2,028,072/yr. on gasoline, a fossil fuel product produced outside the area. Clearly, conservation by reducing miles traveled, fuel-switching, and alternative transportation infrastructure demonstrate potential to save New Haven 's residents money over the long-term.

[26] https://www.connectingcommuters.org/resources/remote-work-telecommuting/

[27] 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.

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 6A** and **6B** below.

Table 6A. Transportation Fuel Switching Target - Electric Vehicles	2025	2035	2050
Electric Vehicles	126	859	1676

Table 6B. Transportation Fuel Switching Target - Biodiesel Vehicles	2025	2035	2050
Biodiesel Vehicles	28	47	68

As **Table 6A** illustrates, to meet the proposed targets by 2050, assuming growth, nearly all personal vehicles in New Haven will need to run on renewably generated electricity. Additionally, **Table 6B** illustrates that most commercial vehicles and farm equipment will need to switch from diesel to biodiesel. To sustain the overall increase in electric vehicles, New Haven 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 so much savings. In order to reduce vehicle miles travelled, New Haven 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 New Haven's working residents by conserving money spent on fuel and on vehicle maintenance. ACTR (Addison County Transportation Resources) and Go Vermont! offer Rideshare programs that allow area residents to match their commuting needs with neighbors interested in carpooling. Currently, New Haven has a Park and Ride facility behind the Town Offices that is available for ridesharing. ACTR sees this location as a future facility to be served as the system expands. New Haven can also begin to create infrastructure that supports biking and walking within the town as a means to reduce vehicle miles travelled. Continuing to promote compact mixed-use development within the Village Center, as set forth in the Town Plan, will increase the potential for new services and 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 with increased services and jobs

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

Goals

Goal A.

Increase the switch to electric and biodiesel vehicles to meet fuel switching targets.

Policy and Recommended Actions

1. Provide residents information about electric vehicle rebates, tax, and other incentives, such as the information from Drive Electric Vermont.[28]
2. Expand public electric vehicle charging sites and incorporate EV ready standards into the building code.

Goal B.

Maintain or reduce vehicle miles traveled per capita by reducing single and low occupancy vehicle trips.

Policies and Recommended Actions

1. 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.

3. Make efforts to increase public transportation options, such as with ACTR.

4. Join and/or promote existing online sites (such as Go Vermont) to assist residents in carpooling and ridesharing.

5. Expand its park and ride sites where feasible

6. Support and promote more compact land development options in specific areas close to necessary public transportation and services.

7. Expand its alternative transportation infrastructure to encourage walking and safe bicycling by, e.g., installing walkways and sidewalks that connect commonly visited places, implementing the tri-town loop bike study findings, and developing bike friendly improvements in future road paving improvements.

8. Investigate creating a Neighborhood Development area next to and including New Haven's village center to reduce permitting costs for housing.

9. Make efforts to educate about and encourage adherence to Vermont's motor vehicle anti-idling law.[29]

10. Support and participate in Vermont's energy and fuel efficiency programs such as the regional Transportation and Climate Initiative.[30]

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[28] 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?emci=6b93c11c-4523-ea11-a601-2818784d6d68&emdi=a63aba4f-5c23-ea11-a601-2818784d6d68&ceid=7301402

[29] 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 CO_2 emissions by more than 10,000 metric tons. See: https://dec.vermont.gov/air-quality/mobile-sources/be-idle-free.

[30] This multi-state coalition which Vermont has joined involves the sale of pollution permits, the income from which will be invested in transportation-related projects, such as public transit, carpooling, and subsidies for the purchase of electric vehicles. The needs of lower-income populations and rural communities are a priority of this initiative.

Section IV. Electrical Use

Electrical Use Analysis

Table 7 depicts an estimate of recent electricity use in New Haven according to Efficiency Vermont and GMP. These numbers represent everyday electrical use by New Haven residents and commercial and industrial businesses. The data shows that New Haven consumed 13,031,304 kWh of electricity, or an average of 1,085,942 kWh/month in 2018.

Table 7. Current Annual Electricity Use - Town of New Haven					
Sector	**2014**	**2015**	**2016**	**2017**	**2018**
Commercial & Industrial Annual (kWh)	4,844,136	4,873,445	5,061,677	6,712,503	6,668,020
Residential Annual (kWh)	6,635,656	6,517,966	6,414873	6,166,775	6,363,284
Total Annual (kWh)	**11,479,702**	**11,391,410**	**11,476,550**	**12,879,278**	**13,031,304**

Currently, residential use accounts for roughly 50% of New Haven's electricity, mainly from lighting and appliances. Commercial use, accounting for the remaining 50%, stems mainly from lights, motors, pumps, and other equipment. As of 2017 there were 16 farms in New Haven, over 50% of all the commercial operations.

Electrical Targets

Like the thermal targets noted above, New Haven 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 8A, below, shows that New Haven must increase its efficiency and conservation (not including the transportation and heating changes noted in Tables 8B and 8C 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 an amount equal to 51% of the total residential, non-thermal electricity used by New Haven residents in 2015. These numbers are realistic because of efficiency gains we as a society have been achieving through technology.[31] One example of an existing reduction in electricity consumption and cost is the LED light bulb.[32]

Table 8A. Electricity Efficiency Targets	2025	2035	2050
Increase Efficiency and Conservation	10.8%	37.2%	59.2%

Yet, even with significant efficiency steps taken by businesses and residents, the models predict that New Haven's electrical usage will increase. The increase from the switch to electric heat pumps and electric cars discussed in the

[31] The percentages noted in Table 8A 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.

[32] 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.

previous two sections is the anticipated source of this expected increase. However, the prediction models were generated before it was known that the new VELCO facility would be built (see the Background and History of this Plan). The additional electricity that will be consumed by this facility is expected to hamper New Haven's ability to reduce its use of electricity. On November 6, 2020, VELCO supplied the following estimate of its electricity use by their New Haven facility:

Estimated ten (10+) years of VELCO's New Haven Operations Facility annual electrical energy consumption[33]:

2022 – 150 k MWh – partial year of equipment installation and testing

2023 – 500 MWh – partial year of commissioned Operations & Data Center
2024 – 1,152 MWh – full year at 25% capacity
2025 – 1,152 MWh – full year at 25% capacity
2026 – 1,152 MWh – full year at 25% capacity
2027 – 1,152 MWh – full year at 25% capacity

2028 – 1,754 MWh – full year at 50% capacity
2029 – 1,754 MWh – full year at 50% capacity
2030 – 1,754 MWh – full year at 50% capacity
2031 – 1,754 MWh – full year at 50% capacity
2032 – 2,339 MWh – full year at 75% capacity

As can be seen, as the facility increases its capacity, the corresponding increases in electricity use are not linear. However, if these estimates run true, at 100% capacity, VELCO will be using about 3,000 MWh of electricity per year. Therefore, and assuming the *status quo*, rather than decreasing New Haven's electricity use over time, VELCO's maximal use would increase New Haven's electricity use by a bit over 23% of the town's 2017 use. This increase will make it very difficult to achieve the energy use reduction goals set in this energy plan.

It remains to be seen if and how this large increase in electricity use attributed to New Haven can be mitigated. Overall, it is clear that more than a reliance on the expected technological advances is needed to achieve the energy reduction targets.

Tables 8B and 8C reflect the significant percentages of conversions illustrated as necessary in the previous two chapters to reduce reliance on carbon-based fuels.

Table 8B. Use of Renewables - Transportation	2025	2035	2050
Renewable Electrical Use - Transportation	2.7%	18.2%	83.5%

Table 8C. Use of Renewables - Heating	2025	2035	2050
Renewable Electrical Use - Heating	48.6%	61.0%	85.5 %

Table 8D. Use of Renewables - Electricity	2025	2035	2050
Total Renewable Electrical Use – (MWh)	2,959.028	5,918.055	8,966.75

[33] As the Vermont electrical system expands and changes over time and as technology changes, VELCO will need to modify and most likely add more equipment to address and control new electrical demands. In addition, VELCO plans to add solar panels to the New Haven site with an approximate capacity of 32 kW. This system is expected to generate approximately 50 MWh per year of electricity with the expectation that their annual electricity consumption will be reduced by that amount.

Table 8D shows the projected additional electricity needed as a result of the fuel switching. New Haven's use of electric renewable energy will increase by an additional 8,966.75 MWh to meet the 2050 goal.[34] However, 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 New Haven 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 New Haven and its residents and businesses will need to adopt to conserve energy and increase efficiency in order to meet statewide targets, New Haven promotes the following Goals, Policies and Recommended Actions for itself and its citizens.

Goals

Goal A.
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.

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. Work with Green Mountain Power to ensure the distribution grid and electrical infrastructure within New Haven are sufficient to support the needs of the community to increase renewable sources of electricity.
4. Seek to use the Town as the anchor to create a community supported solar generation facility that could also support additional citizen members.
5. 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.[35]
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.

Goal B.
Increase electricity conservation by Town, commercial, and residential users to achieve the stated targets.

Policies and Recommended Actions

1. Provide education and training about and promote electrical energy conservation.
2. Identify funding sources for electrical efficiency upgrades for all New Haven buildings.

Goal C.
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.

Policies and Recommended Actions

1. 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.

[34] Again, not considering VELCO's use of electricity.

[35] 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.[36] Our reliance on out-of-state energy sources leaves us vulnerable and out of control. 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. New Haven 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 2017 Town Plan (p.48), New Haven 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. Therefore, New Haven's Village Region, a 500-acre area containing the historic village center and commercial hubs, promotes clustered development of housing, businesses, and services. The Town hopes to construct sidewalks in the future to promote pedestrian access to homes, schools, and businesses. Outside of the Village Region and other established and historic residential settlement areas, New Haven's Town Plan discourages traditional residential development, specifically in the Agricultural Region. Clustered residential development in this Region will be an established land use priority. 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 section of the Town Plan's land use section.

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

Current Renewable Energy Generation

Although New Haven's energy supply is largely consistent with statewide patterns, New Haven does have a number of alternative energy installations that tap local energy resources. The many commercial sized solar facilities have been described in the introduction to this Energy Plan. In addition, 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. New Haven is also home to the Beldens Falls hydroelectric facility that generates a considerable amount of energy. Together, these two forms of renewable energy provide the bulk of New Haven's renewable generation.

Table 9 depicts these existing renewable generation resources as of January 1, 2017 in New Haven.[37]

Table 9. Existing Renewable Generation Sites in New Haven

Source	Sites	Generation (in MW)	Generation (in MWh/year)
Solar	115	7.97	9,774.4
Wind	3[38]	.015	45.99
Hydro	1	5.85	20,498.4
Biomass	0	0	0.0

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

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

[38] Since this data was collected, one windmill has been decommissioned.

Other	0	0	0.0
Total	119	13.835	30,318.79

As Table 9 demonstrates, 119 different sites created 30,318.79 MWh/year of renewable power within New Haven. The discussion below encompasses several types of renewable generation available to New Haven's residents and addresses how they might harness them to meet generation targets for the community.

Types of Generation Potential

Hydropower

Beldens Falls hydroelectric facility on Otter Creek in New Haven is part of the federally certified 22.807 megawatt (MW) Otter Creek Project (FERC No. 2558). The Otter Creek Project includes three developments comprised of Proctor, Beldens, and Huntington Falls, which together generate an average annual energy output of 67,258 MWh. Beldens Falls operates in a "run of the river" mode with instantaneous inflows to the impoundment at all times. As of January 1, 2017, the Beldens Falls hydro facility was producing 20,498.4 MWh/yr of energy. The Beldens Falls hydro facility is owned by Green Mountain Power (GMP). According to GMP, although these hydroelectric plants require substantial operation and maintenance expenses, along with periodic capital expenditures in major improvements, on average, the hydroelectric fleet is one of GMP's lowest-cost power resources. The hydroelectric plants incur no fuel expenses, so the output helps to stabilize GMP's power supply costs and retail rates, and they produce no air emissions. In addition, the energy generated from hydroelectric sources tends to be higher in the winter, which is another incentive to switch to electrically powered heating.

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.[39] The challenge to using solar energy in Vermont is the seasonal difference in the amount 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 New Haven. However, it can and does substantially contribute to New Haven's energy mix. Net metering involves the installation of grid-connected, on-site renewable electric generation. Net-metering 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.

[39] On average, across the US, the capacity factor of a solar panel is 24.5%. This means that solar panels will generate 24.5% of their potential output, assuming the sun shone perfectly brightly 24 hours a day. 1 megawatt (MW) of solar panels will generate around 2,146 megawatt hours (MWh) of solar energy per year.

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.
New Haven has several potential sources of biomass including several large farms. New Haven 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, New Haven supports the use of wood heat only from energy efficient and relatively non-polluting wood stoves in properly ventilated buildings. A further reservation about the use of wood for heat is that New Haven does not have significant forest resources (as can be seen in Map 6) so wood use in New Haven cannot be considered a Town source of renewable energy.

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, New Haven, located in the Champlain Valley Lowland region, does not have the topography to feasibly support large-scale wind generation.

New Haven does support and encourage residential wind turbines. There are many 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 eight 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. New Haven supports residential scale wind in all Regions where feasible.

Geothermal Energy
Energy trickles from Earth's interior to the surface at a modest average rate of about 350 watts per acre, far less than the solar input. For New Haven, far from major geological activity, that number is almost certainly significantly lower. In addition, solar energy warms the Earth, especially in the summer, and some of that energy is stored as heat in the upper layers of soil and rock. The result of these geothermal and solar effects is that soil temperatures just a few yards deep under Vermont average around 45˚F to 50˚F year-round. This temperature is too low for direct heating, although it can help with summer cooling. Nevertheless, the constant ground temperature represents a significant energy resource, and with appropriate technology it can be used as a heat source. On the other hand, subsurface water has high heat capacity and can be used with water-source heat pumps to provide home heating in a way very similar to air-source ("cold climate") heat pumps. These systems often use existing potable well water systems for the heat exchange. The principal energy input required is electricity for pumping water through the system, as well as driving the compressor, so economic feasibility is related to well depth. Currently, it is likely that no geothermal systems relying on heat pump technology are in use in New Haven. 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 New Haven 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. In fact, GMP offers one of the available battery storage devices with software 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, New Haven'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

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

1. ACRPC Renewable Generation Resource planning maps and descriptions in Table 10 contained in this Plan.
   As an example of how the maps will be used, if a solar project is proposed, New Haven would consult the map entitled Renewable Energy: Potential Solar Resource Siting Areas (and Table 10) and determine if the proposed development is located in one of the primary solar siting areas (marked in red on that map). The "known constraints" map 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, New Haven will support that conclusion with a detailed analysis. On the other hand, if the proposed site is located in a "possible constraint" mapped area, but the constraint can be mitigated or is found not to exist, New Haven will likewise support that determination with a detailed analysis using the factors below.
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 can be consulted to identify such features as wildlife corridors.
4. Site visits.
5. These further considerations:

   A. Visual Aesthetic Considerations

Because of the New Haven residents' past reactions to the intrusion on the visual landscape of the relatively early and extensive growth of solar fields, this factor needs to be included in any deliberation about proposed commercial scale renewable energy developments. New Haven will therefore place an emphasis on shielding solar panels from the view of neighbors and, to a lesser extent, from passing motorists. 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 below 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.[40] New Haven is located in the Champlain biophysical region, one of the largest grassland refuge regions in Vermont.[41] 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. New Haven also needs to preserve critical forest blocks, prevent forest fragmentation, and provide habitat for the species that depend on New Haven 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, New Haven will require that fencing be eliminated or be wildlife friendly. For specifics, see the siting and installation criteria in Section VI, below.

C. Agricultural Preservation Considerations

New Haven is largely a farming community and preservation of agricultural soils and uses is important here. One measure of the interest in protecting New Haven farmland from real estate and other development is that 13-14% of the acreage in New Haven is conserved mainly for farm use (3,634 acres of a total of 26,560 acres, according to the Vermont Land Trust). There are farming landowners, however, who can no longer farm their land or maintain a farm use[42] 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 up to 25 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 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

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[40] See, e.g.; https://www.audubon.org/climate/survivalbydegrees and Wildlife Habitat Management for Lands in Vermont. Vermont Fish and Wildlife Department, 2015.

[41] 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 New Haven, see Map 9: Grassland Refuge Target Regions at https://anr.vermont.gov/sites/anr/files/maps/biofinder/Vermont%20Conservation%20Design%20-%20Natural%20Community%20and%20Habitat%20Technical%20Report%20-%20March%202018.pdf

[42] 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.usnews.com/news/best-states/vermont/articles/2020-01-30/number-of-vermont-dairy-farms-drops-to-an-average-of-677 and https://www.uvm.edu/sites/default/files/media/Future-of-VT-Ag-Report-2018-Final_5.pdf.

grassland, nurture native species over invasives, and/or produce food[43] plus low cost renewable energy.[44],[45] Therefore, consideration of both agricultural preservation and dual use is important when deliberating on the installation of commercial size renewable energy development on ag soils. When a solar field is decommissioned, the field can be converted back into farmland, and for New Haven, 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.

Given the centrality of farming to the Town, 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, below.

Mapping Generation Potential[46]

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 New Haven.[47] Online and expandable versions of these maps can be found at:
http://54.172.27.91/public/energysiting/municipal_maps/NewHaven_all36x48.pdf
To identify the various constraint layers and preferred solar sites, see the map at:
http://qgiscloud.com/acrpc/Regional_Energy_Siting/[48]

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 New Haven map shows State and ACRPC known constraints. Constraints local to New Haven are listed instead in **Table 10**. 'Local known critical constraints' identifies natural

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[43] 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

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

[45] 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

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

[47] 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 New Haven by ACRPC and they were adopted by the New Haven Selectboard on 8/1/17.

[48] 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.

resource areas that preclude renewable energy development. Due to the presence of these natural resources, if verified, would make it prohibitive in that area to secure permits for commercial scale renewable energy development. A full description of each type of “Known Constraint” is included on **Table 10**. Statewide “Known Constraints” are listed first, followed by locally identified critical resources as identified in New Haven Town Plan.

Map 2, “**State and Local Possible Constraints**” depicts places where natural resources exist but may not prohibit development. Again, the local constraints are listed in **Table 10** and not on this map. 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 transmission and distribution resources and constraints within New Haven. Knowing what infrastructure is available, and where, is an important planning component for renewable power development. As Map 3 illustrates, as of 2017[49], much of the distribution system in the Town of New Haven is constrained and unable to accommodate any new commercial scale energy production. 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 New Haven is going to meet its new generation targets, GMP (and possibly VELCO) will need to upgrade in order to add new sources of electricity on the local distribution system. Construction of new transmission facilities to support renewable energy generation can also be a substantial driver for the total cost of the power the facility will generate.

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

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.

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**”. 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 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.

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.
http://54.172.27.91/public/energysiting/regional_maps_sm/

A full list of known and possible constraints included on the maps (plus the additional descriptions of local constraints) is located in **Table 10**. The known constraints and possible constraints used to create the maps include constraints that

[49] The electrical line and substation capacity maps change depending on how many renewable and other forms of electricity are added to or removed from the electrical transmission infrastructure and also on any infrastructure upgrades.

are required per the State Determination Standards from the Department of Public Service and those added locally by ACRPC and by the Town of New Haven.

Table 10 – Mapping Constraints		
Solar, Wind and Biomass Maps - Known Constraints		
Constraint	**Description**	**Source**
Confirmed and unconfirmed vernal pools	There is a 600-foot buffer around confirmed or unconfirmed vernal pools.	ANR
State Significant Natural Communities and Rare, Threatened, and Endangered Species	Rankings S1 through S3 were used as constraints. These include all of the rare and uncommon rankings within the file. For more information on the specific rankings, explore the methodology for the shapefile.	VCGI
DEC River corridors	Mapped River Corridors were depicted.	ANR
National Wilderness Areas	Parcels of Forest Service land congressionally designated as wilderness.	VCGI
Class 1 and Class 2 Wetlands	Vermont State Wetlands Inventory (VSWI) and advisory layers from site specific work collected by the municipality	VCGI
New Haven Forest District	Areas labeled FD (Forest District) on source map	ACRPC, Town of New Haven Zoning Districts Map, adopted 2015,
New Haven Flood Hazard District	Areas labeled FHD (Flood Hazard District) on source map	ACRPC, Town of New Haven Zoning Districts Map, adopted 2015

Solar, Wind and Biomass Maps - **Possible Constraints**		
Constraint	**Description**	**Source**
Protected Lands	This constraint includes public lands held by agencies with conservation or natural resource oriented missions, municipal natural resource holdings (ex. Town forests), public boating and fishing access areas, public and private educational institution holdings with natural resource uses and protections, publicly owned rights on private	VCGI and VLT

	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. For instance, at the time of the writing of this Plan, 13-14% if the land in New Haven is conserved by the Vermont Land Trust, most of which (but not all) is off limits to large scale renewable energy development.	
Deer wintering areas	Deer wintering habitat as identified by the Vermont Agency of Natural Resources.	ANR
Hydric soils	Hydric soils as identified by the US Department of Agriculture.	VCGI
Agricultural soils	Local, statewide, and prime agricultural soils are considered, depending on landowner determination, an agricultural component, and other mitigations.	VCGI
Act 250 Agricultural Soil Mitigation Areas	Sites conserved as a condition of an Act 250 permit.	ANR

FEMA Flood Insurance Rate Map (FIRM) special flood hazard areas	Special flood hazard areas as digitized by the ACRPC were used (just the 100-year flood plain - 500-year floodplain not mapped). The inclusion of this resource as a regional constraint is consistent with goals and policies of the Addison County Regional Plan.	ACRPC
Vermont Conservation Design Highest Priority Forest Blocks	The lands and waters identified here are the areas of the state that are of highest priority for maintaining ecological integrity. Together, these lands comprise a connected landscape of large and intact forested habitat, healthy aquatic and riparian systems, and a full range of physical features (bedrock, soils, elevation, slope, and aspect) on which plant and animal natural communities depend. The inclusion of this resource as a regional constraint is consistent with goals and policies of the Addison County Regional Plan. (Source: ANR)	ANR
New Haven Wildlife Travel Corridors	Habitat connecting populations of wildlife otherwise separated by cultivated land, roads, etc.	Vermont Fish & Wildlife and New Haven
New Haven Grasslands Suitable for or With Established Ground Nesting Bird Sites		Grasslands enrolled with the Audubon Vermont Bobolink project, Vermont Fish & Wildlife, and New Haven
For large installations only- Neighborhood Commercial[50]	Identified in Town of New Haven Zoning Districts map, 2015	ACRPC, New Haven

[50] This constraint is listed because the Neighborhood Commercial district is the likeliest site for the development of density housing and commercial developments.

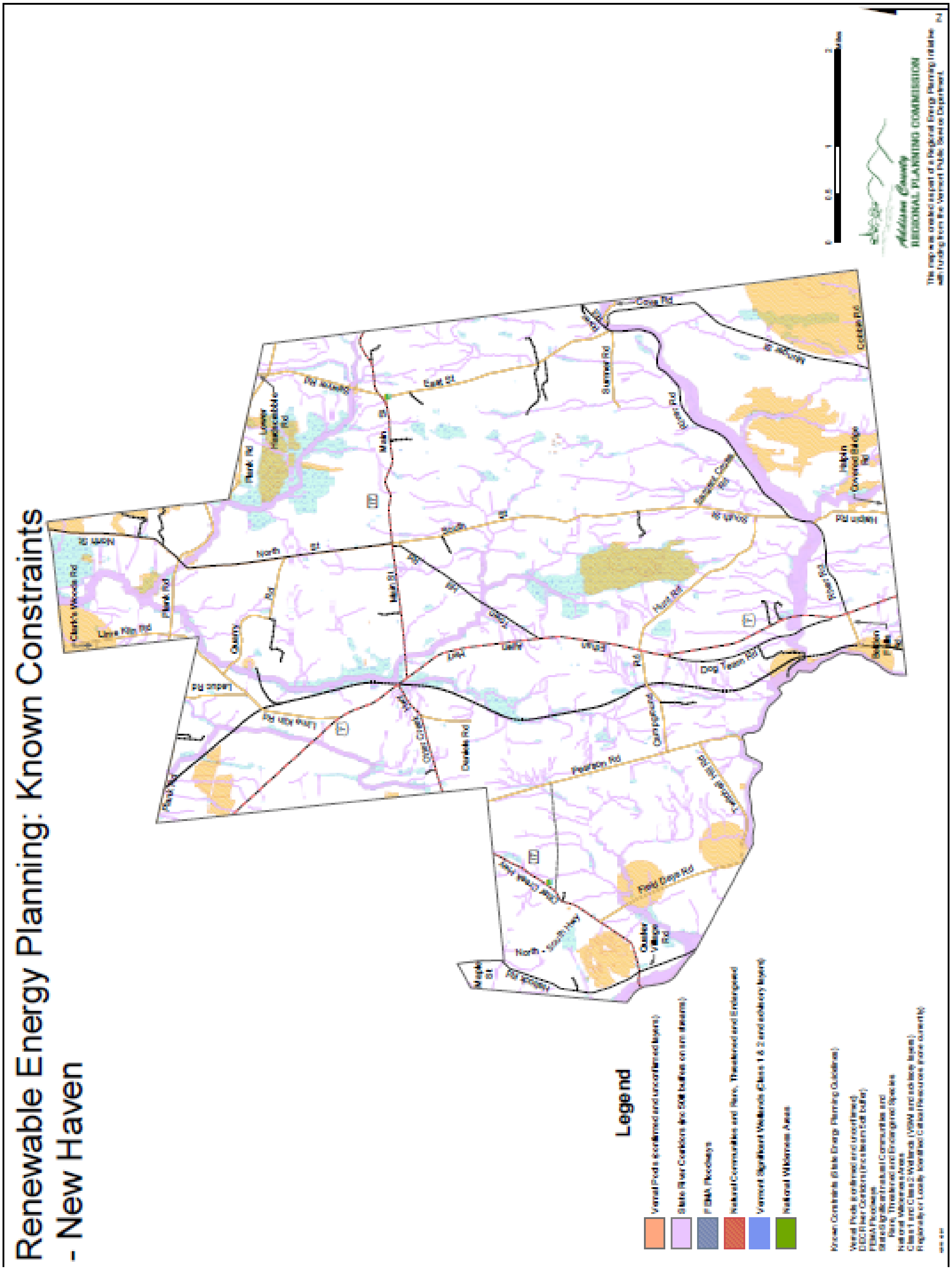
Preferred Sites for Commercial Scale Renewable Energy Development[51]		
Site	**Description**	**Source**
New Haven Industrial Zone	Zoning identified as Industrial on Town of New Haven Zoning Districts map, 2015	New Haven
Site	**Description**	**Source**
New Haven Highway Commercial Zone	Zoning identified as Highway Commercial on Town of New Haven Zoning Districts map, 2015	New Haven

Potentially Preferred Sites for Commercial Scale Renewable Energy Development[52]		
Site	**Description**	**Source**
Lands Abutting New Haven Industrial and Highway Commercial Zones	Land abutting these two zones, taking into consideration other factors discussed above and in Section VI.	New Haven
For Solar Developments: Areas Designated as Primary or Secondary Solar Siting Areas	Areas marked red and tan on Map 4, entitled Potential Solar Resource Siting Areas, taking into consideration other factors discussed above and in Section VI.	ACRPC and New Haven. New Haven reserves the right to designate additional sites as primary and secondary sites or to remove solar resource siting areas after site review and inspection reveal consistency or inconsistency with the siting criteria described in this Plan.

[51] Preferred sites of Industrial and Highway Commercial were listed since these are areas that have been disturbed and developed (some heavily) such that the addition of renewable energy developments in these sites have the potential for disrupting the landscape and view sheds much less than other sites.

[52] These sites, while having the potential for preference given their closeness to developed zones and their designation as primary solar sites, would require further review to determine their suitability for renewable energy development. In addition, the red areas in Map 4 may or may not identify all of the sites that meet the preferred siting criteria contained in this Plan. New Haven will designate sites as preferred once a review and site inspection is completed and determined that the site is consistent with the siting criteria in this Plan.

Map 1

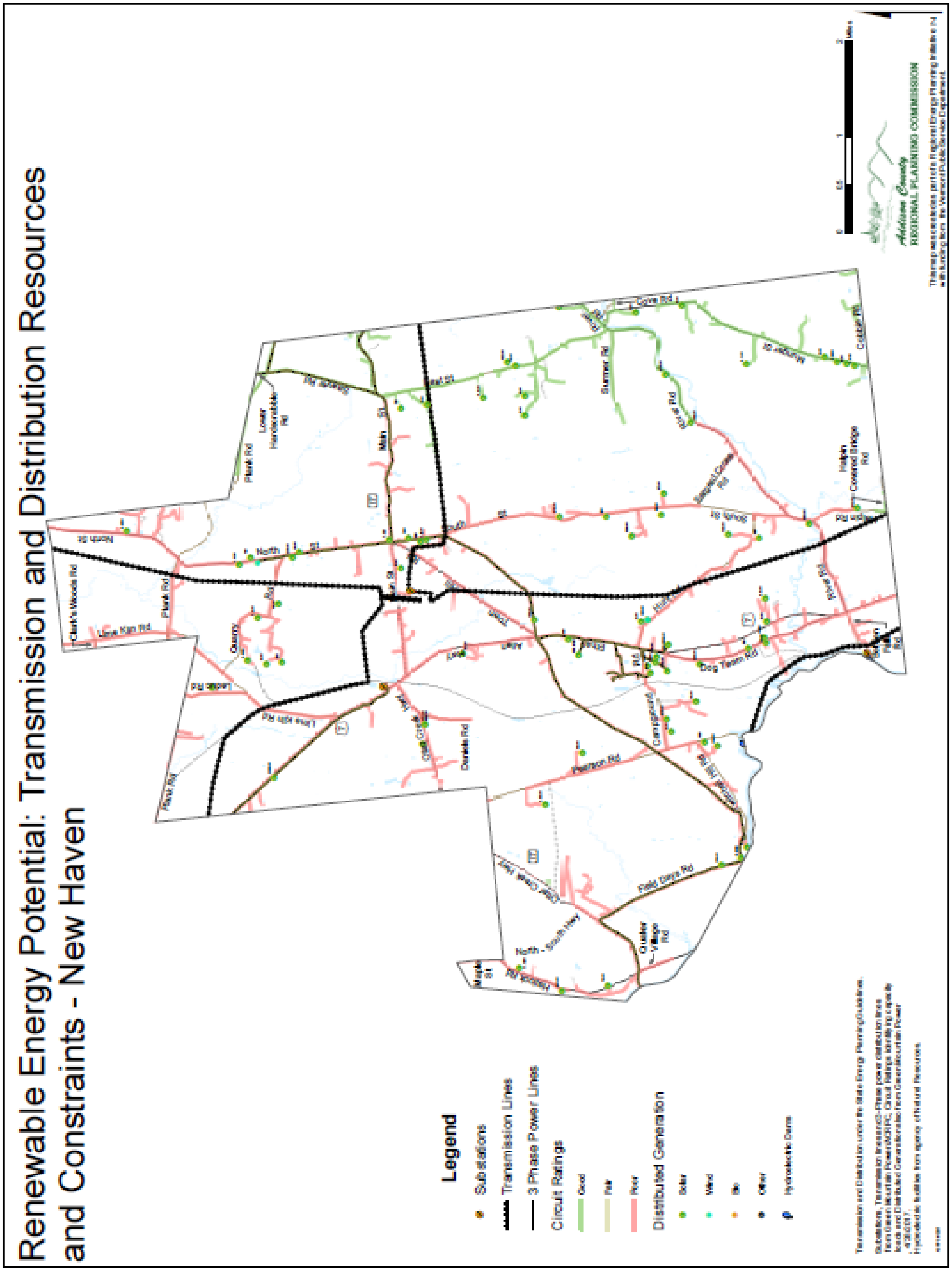


Renewable Energy Planning: Known Constraints
- New Haven
Legend

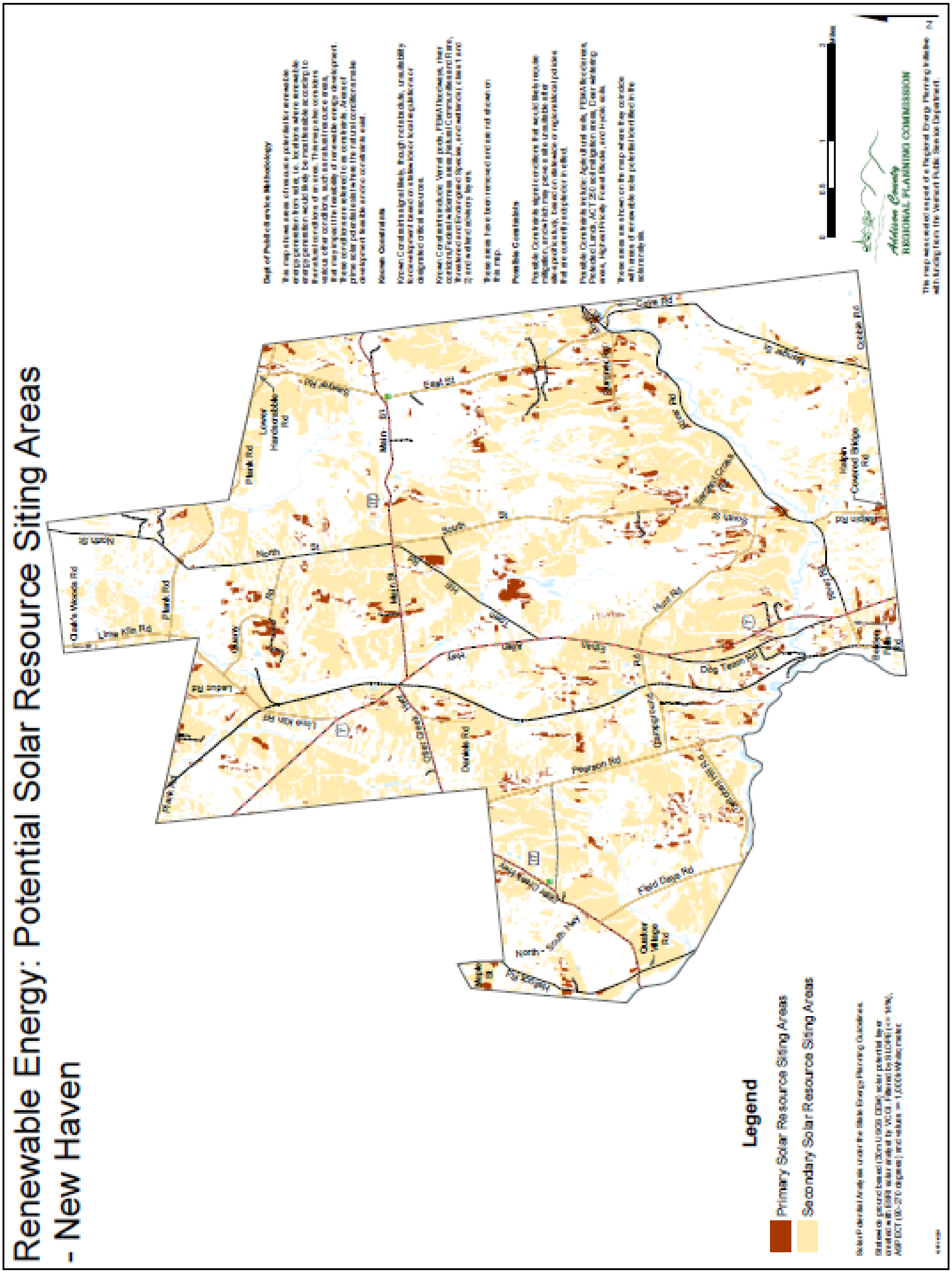
Map 2

Renewable Energy Planning: Possible Constraints - New Haven
Legend
Agricultural Soils
FEMA Special Flood Hazard Areas
Protected Lands
Agricultural Soil Mitigation (Act 250)
Deer Wintering Areas
Highest Priority Forest Blocks
Hydric Soils
Addison County
REGIONAL PLANNING COMMISSION
Pearson Rd
Field Days Rd
Dog Team Rd
Hunt Rd
Campground Rd
Daniels Rd
Little Kiln Rd
Clark's Woods Rd
Plank Rd
North St
South St
Main St
Ethan Allen Hwy
Cove Rd
Munger St
Burpee Rd
Sargent Crest Rd
Halpin Rd
Halpin Covered Bridge Rd
Quarry Rd
Lower Hardscrabble Rd
River Rd
North - South Hwy
Maple St

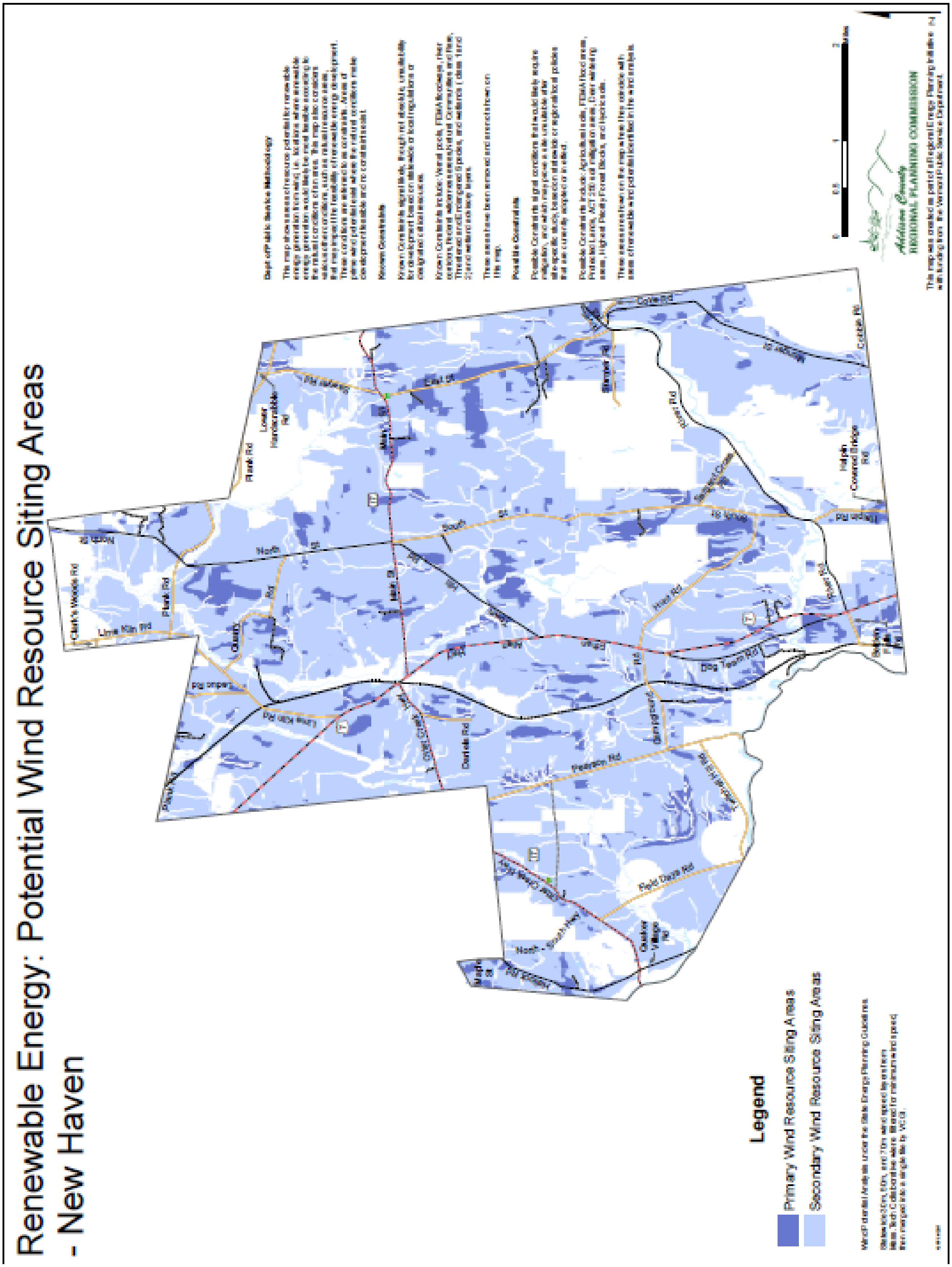
Map 3

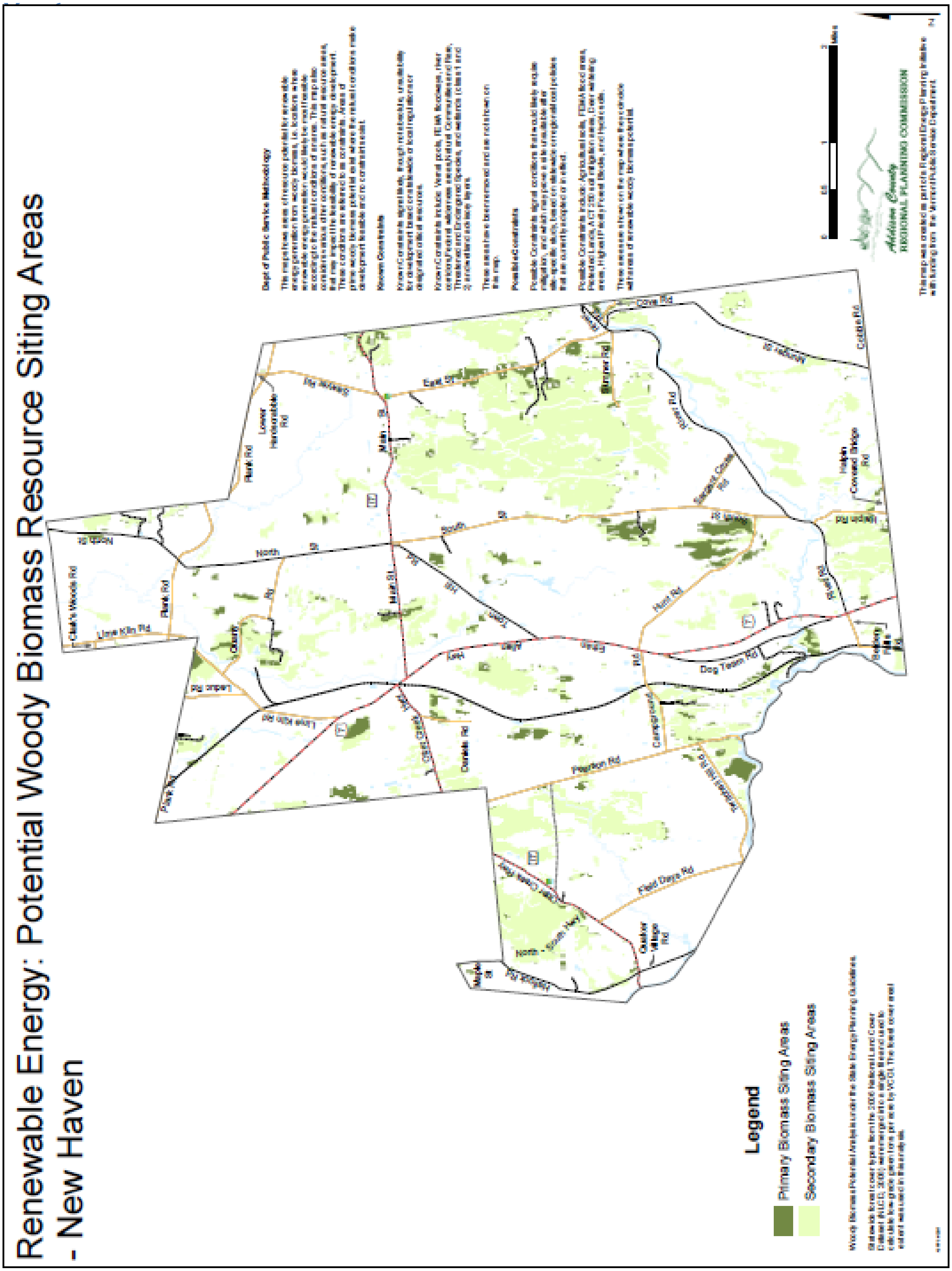

Renewable Energy Potential: Transmission and Distribution Resources and Constraints - New Haven
Legend
Substations
Transmission Lines
3 Phase Power Lines
Circuit Ratings
Distributed Generation
Addison County
REGIONAL PLANNING COMMISSION

Map 4


Renewable Energy: Potential Solar Resource Siting Areas - New Haven
Legend
Primary Solar Resource Siting Areas
Secondary Solar Resource Siting Areas

Map 5


Renewable Energy: Potential Wind Resource Siting Areas
- New Haven
Legend
Primary Wind Resource Siting Areas
Secondary Wind Resource Siting Areas


Renewable Energy: Potential Woody Biomass Resource Siting Areas
- New Haven
Legend
Primary Biomass Siting Areas
Secondary Biomass Siting Areas
Addison County
REGIONAL PLANNING COMMISSION
North St
South St
Main St
Dog Team Rd
Hunt Rd
Field Days Rd

Calculating Theoretical Generation Potential

The ACPRC used the maps above to identify the amount of energy potential in New Haven. In addition to the maps, the calculations use some assumed values for the amount of land necessary to produce specified amounts of solar and wind energy. 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.[53]
The results of this analysis, 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 New Haven".

Table 11. Renewable Generation Potential in New Haven		
Source	**Additional Generation Potential (in MW)**	**Generation Potential (in MWh)**
Rooftop Solar[54]	5	6,034
Ground-mounted Solar	1,230	1,507,859
Wind	5,465	16,754,924
Hydro	0	0
Biomass and Methane	0	0
Other	0	0
Total	6,699	18,268,816

Note: This table is theoretical in nature. It represents the development of **all** of the New Haven 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 on their land and it also eliminates important considerations such as local constraints identified by New Haven, view impact, agricultural soils, electrical line capacity, technology advancements, etc. However, one metric provided by the State is potentially useful given that New Haven 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 727 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", 727 acres have the generation potential of almost 91 MW of solar derived electricity, or 111,557 MWh. Fully built out in solar, these areas would not only more than triple the renewable energy being produced currently in New Haven but also vastly exceed the targets set for New Haven for local renewable energy production as specified in **Table 12**.

As **Table 11** shows, the amount of annual renewable generation potential in New Haven, as theoretically calculated from the maps, stands at **18,268,816 Megawatt hours**. To provide context, **Table 7** shows us that New Haven currently uses **13,031.3 Megawatt hours** (13,031.3 MWh = 13,031,304 kWh as depicted in Table 7). Additionally, **Table 9** shows us that, in 2017, New Haven produced 30,318.79 **Megawatt hours** of renewable electricity (30,318,790 kWh).

The theoretical generation potential shown in **Table 11** above dramatically overestimates the potential generation available. Not every acre that could be developed for energy in New Haven will be developed. However, it also illustrates that New Haven has an abundance of land from which it could theoretically generate renewable electricity. Therefore,

[53] 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.
[54] The calculation for the potential for roof top solar was derived from State averages and is considered a very rough estimate.

New Haven 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.

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 New Haven 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 (NWRPC) 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 New Haven will need to produce an **additional** 8,369.59 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, Table 19, page 7-92 (2018).

Table 12. Additional Renewable Generation Targets	2025	2035	2050
Total Renewable Generation Target (in MWh/yr)	2,959.028	5,918.055	8,966.75

As noted previously, usage is expected to increase largely because of the increased use of electric heat pumps and electric vehicles (**Table 8D**) and VELCO's use. Given that this projection is 30 years into the future, and the data comes from different sources, New Haven 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 New Haven.
Under the statewide formula allocating land to different renewable sources:

- 1 Megawatt of electricity generated by a solar facility would require 8 acres of land.
- 1 Megawatt of wind energy generated from and a wind facility would require 4 acres of land.
- 1 Megawatt of electricity generated from a bio-digester requires about 3,000 cows. 3000 cows = 1 megawatt

Therefore, if New Haven were to generate all of the energy demanded to reach its 2050 target from solar, it would need about 55 acres allocated to solar facilities. If the total 2050 generation target were to come from wind, 11 acres would be required. If the total 2050 generation target were to come from bio-digesters, the manure of 6,140 cows would be required.[55] Ideally, a mix of these sources will be possible by 2050 and these resource totals will be adjusted as allowable circumstances dictate.

While the Town of New Haven has incorporated the regional targets into its plan as noted above, it has a significant issue with how the targets were created. When ACRPC created its targets, it chose to start "counting" new renewable power generation in the Region as any power produced after January 1, 2017. Renewable power produced prior to that date was subtracted from the Regional Goal. It then allocated the renewable generation targets to each municipality according to a uniform State formula based largely on population and land area. New Haven understands the State's need for a uniform formula given the statewide scale of this planning. However, it believes the goal places an unduly heavy burden on the Town relative to other Vermont towns. There are two reasons for this statement. First, New Haven hosts the Beldens Falls Hydroelectric facility, one of the largest hydroelectric facilities in the Region. That facility alone creates more power than New Haven consumes or is projected to consume. Second, and more importantly, from approximately 2012 – 2016 this small town was ground zero for Vermont solar industry growth. New Haven experienced rapid deployment of large solar installations in its fields and meadows during this time. The nearly 8 MW of solar power produced in New Haven make it one of the largest solar producing municipalities in the State. However, since most of

[55] If all new generation is in solar: 8369.59MWH/8760/.14=6.82MW 6.82MW x 8acres =54.59 acres are needed
If all new generation is in wind: 8369.59MWh/8760/.35= 2.73 MW 2.73MW x 4acres=10.92 acres are needed
If all new generation is in bio digesters ('cow power'): 8369.59MWh/8760/.35=2.04MW 2.04MW x 3000cows=6137 cows are needed

New Haven's solar facilities were developed prior to 2017, New Haven received no credit in the allocation targets for the energy it generated. Given the pre-2017 New Haven acreage under solar production, meeting the additional new production targets will be especially difficult. Accordingly, New Haven accepts the renewable generation targets assigned to it but requests that the State and the Region take this situation into consideration when making determinations about compliance with State generation targets.

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, New Haven promotes the following Goals, Policies and recommended Actions for itself and its citizens.

Goals

Goal A.

Meet increased electric demand in partnership with Green Mountain Power and Efficiency Vermont while maintaining progress to achieve energy targets.

Policies and Recommended Actions

1. Work with GMP to address the capacity issues within the distribution grid serving the Town of New Haven specifically and northern Addison County more generally to allow more energy generation; see **Map 3** showing the constrained distribution system in New Haven.
2. Work with GMP to explore ways of increasing the power produced by the Belden Falls Hydro-electric facility
3. Work with VELCO to explore ways for more community energy generation on their site

Goal B.

Enable new renewable generation in areas designated as preferred or allowed under this plan.

Policies and Recommended Actions

1. The Planning Commission and Selectboard shall work together and with ACRPC to advocate for this plan and its siting criteria in all significant Section 248 application proceedings.
2. Seek ways to increase the local power generated by all feasible renewable energy generation sources (hydroelectric from Beldens Falls), 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.
3. 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.
4. Give preference to solar developments that produce electricity for local use.[56]

Goal C.

Mitigate the negative consequences of installation and decommissioning of large renewable energy development projects.

Policies and Recommended Actions

1. 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.

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

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.

2. New Haven will educate the community about these standards
3. New Haven will serve as a resource for landowners considering renting or selling land for renewable energy projects.

Goal D.

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.

Policies and Recommended Actions

1. Amend New Haven's Plan, as necessary, to provide the vision for more density and development within New Haven's Village Center and other suitable areas.
2. Implement the vision outlined in New Haven's Town Plan by amending its zoning and subdivision regulations to provide for the density implementing the vision.
3. Apply for a Neighborhood Designation Area from the State of Vermont adjacent to and including the Village center to reduce permitting costs associated with housing and other economic development.

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 New Haven must evaluate and address the proposed site's impact both in terms of the aesthetic and ecological impacts on the surrounding landscape.

The historical working landscape that defines New Haven 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 New Haven's standards for siting new energy generation. New Haven shall 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 the 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 New Haven. 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) are encouraged in all areas of the Town of New Haven except for verified known constraints and (for large developments) in the neighborhood commercial zone. The larger the project, the more important it is to follow the siting standards.

Commercial solar projects of a size greater than that permitted by the net-metering rules (>500kW) are subject to the siting criteria below. New Haven 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, small solar, and hydroelectric generation projects, 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 New Haven 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 New Haven, 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.

1**. 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.

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;[57]
- Sites that require public investment in transmission and distribution infrastructure in order to function properly;[58]
- Areas of forestland that need to be clear cut for the installation of solar array;
- The determination by a wildlife expert that the site will significantly interfere with wildlife or wildlife corridors which cannot be mitigated.

2. **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;

[57] 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.
[58] Practically speaking, developers are unlikely to seek approval in these situations.

- 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 shall 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 shall 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 shall 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 provisions (which may have commercially sensitive price terms redacted). Such contract shall be for a term of no less than three years. Screening maintenance shall 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 shall 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, shall 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 same year.
    e) Responsibility for maintenance of landscaping and screening is allocated in the contract between the renewable energy developer and the owner of the property on which the project is constructed, maintained, and operated. The name and contact information of the responsible party shall be filed with the Town as well as any change in responsibility for this landscaping and maintenance.[59] 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 shall be a condition of and enforced through any Certificate of Public Good granted by the PSB, or any successor administrative agency having jurisdiction over such project.

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

- The siting of solar equipment shall minimize view blockage for surrounding properties. As an example, a landowner may not site an array on his or her property in a location calculated to diminish the visual impact of the array from his or her residence but places the array immediately within their neighbor's or the public's viewshed. Locating solar equipment in a manner designed to reduce impacts on neighbors or public viewsheds 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 shall have a compatible agricultural and ecological component. Examples of an agricultural component include the planting of pollinators, raising crops and foods, and/or small livestock grazing. For guidance, see the UVM Sustainable Agriculture Guide for farm-friendly solar projects.[60]
- 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.[61]
- By ecological component is meant that the project shall 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 night lighting) and producing less than 1 MW of electricity.

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.

1. **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 system to minimize the new infrastructure required to serve the project;
- Use or reuse of former built or impacted property or brownfields 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[62] before it reaches the property line.
- Sites designated as "preferred" areas by this plan.
- The removal of productive agricultural land from agricultural use (but see Section V, Agricultural Preservation Considerations and footnote 57)
- Interferes as little as possible with wildlife and wildlife corridors[63]

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 viewshed.
- Sites that require public investment in transmission and distribution infrastructure in order to function properly.

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[60] https://www.uvm.edu/extension/sustainableagriculture/guide-farming-friendly-solar

[61] https://www.uvm.edu/sites/default/files/Agriculture/Pollinator_Solar_Scorecard_FORM.pdf

[62] See PUC Rule establishing standards for the sound produced by wind generation facilities, as required by legislation passed in 2016 (Section 12(a) of Act 174): http://puc.vermont.gov/about-us/statutes-and-rules/current-rules-and-general-orders.

[63] For guidance, see https://www.usgs.gov/faqs/can-wind-turbines-harm-wildlife?qt-news_science_products=0#qt-news_science_products

- 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

2. **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 brighter colors).
- Follow mitigation methods to prevent harm to birds and bats

TRANSMISSION:

1. **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; (but see FN 57)
- The determination by a wildlife expert that the site will significantly interfere with wildlife or wildlife corridors which cannot be mitigated.

2. **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 New Haven, 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.

SUBSTATIONS

1. **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 array from view from at least two sides;
- Reuse of former impacted property or brownfields that have qualified for and are listed in the State of Vermont Brownfield program;
- 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 sub-station to be visible against the skyline from common vantage points like roads or neighborhoods;
- A location in proximity to and interfering with a significant viewshed.
- The removal of productive agricultural land from agricultural use; (see FN 54)
- The determination by a wildlife expert that the site will significantly interfere with wildlife or wildlife corridors which cannot be mitigated)

2. **Mitigation methods**:

- Locate the structures on the site to keep them from being "skylined" above the horizon from public and private vantage points;
- Shorter structures may be more appropriate in certain spaces than taller structures to keep the project lower on the landscape;
- Developers shall meet setbacks equal to 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 substation;
- In the absence of existing natural vegetation, the substation 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;
- Practice a "good neighbor policy". Site the sub-station so that it creates no greater burden on neighboring property owners or public infrastructure than it does on the property on which it is sited;
- Use black or earth tone materials (panels, supports fences) that blend into the landscape instead of metallic or other brighter colors).

Projects found to have poor siting characteristics pursuant to the standards contained in Sections 1 above that cannot be mitigated by the methods contained in the policy, violate these standards regarding orderly development.

DECOMSSIONING AND RESTORATION:

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

GLOSSARY

ACRPC	Addison County Regional Planning Commission
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.
ACTR	Addison County Transit Resources
ANR	Vermont Agency of Natural Resources
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
Capacity Factor of Solar Panel	The measure of the efficiency of the panel to convert sunshine into electricity.
CEP	Vermont Comprehensive Energy Plan (CEP**)** sets out a pathway for Vermont to obtain 90% of its energy from renewable sources by 2050. https://legislature.vermont.gov/assets/Legislative-Reports/Executive-summary-for-web.pdf
Commercial scale solar developments	Those larger than 500 kilowatts, or as designated by the State of Vermont
CVOEO	Champlain Valley Office of Economic Opportunity
DEC	Vermont Department of Energy Conservation
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 (like LED's), high-efficiency heating, ventilating and air conditioning (HVAC) systems or control modifications, efficient building design, advanced electric motor drives, and heat recovery systems.

DOL	Vermont Department of Labor

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
FERC	Federal Energy Regulatory Commission. FERC 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
GMP	Green Mountain Power
Go Vermont	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 www.connectingcommuters.org.
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.
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 (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).
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. [64]

[64] As an example, for a solar panel getting 5 hours of direct sunlight per day, the solar panel output is calculated this way: 5 hours x 290 watts (an example wattage of a premium solar panel) = 1,450 watts-hours, or roughly 1.5 kilowatt-hours (kwh). Thus, the output for each solar panel in this array would produce around 500-550 kWh of electricity per year.

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
LEAP	Long-range Energy Alternatives Planning
MW	A megawatt (MW) is a unit of measuring power that is equivalent to 1,000 kW. Depending on where it is located a 1 MW solar system can generate between 1,300,000 - 1,600,000 kWh per year. This equates to around 3,500-4300 kWh/day on average.
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.
Nameplate rating (solar)	In reference to a solar panel system**:** The maximum rated output potential of electric power production under specific conditions designated by the manufacturer. Installed solar nameplate capacity is commonly expressed in megawatts (MW) and is usually indicated on a nameplate physically attached to the equipment.
Prime agricultural soils	As defined in 10 VSA 6001
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
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
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
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

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
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

VELCO	Vermont Electric Power Company, Inc., a regulated utility, operates Vermont's transmission system and represents the state's utilities in power pool matters with the New England regional transmission operator, Independent System Operator—New England (ISO-NE). VELCO was created in 1956 when Vermont's electric utilities pooled their transmission systems to connect with hydroelectric generators in New York and Canada.
VCGI	Vermont Center for Geographic Information, provided information for renewable planning map constraints
VTrans	Vermont Agency of Transportation