GUIDANCE FOR REGIONAL & MUNICIPAL ENHANCED ENERGY PLANNING STANDARDS

Vermont Department of Public Service

January 16, 2024

Table of Contents

Introduction

Thank you for your interest in enhanced energy planning. Act 174 of 2016 gives communities and regions a way for their plans to receive greater weight in the Section 248 review process. Analyzing your region's and community's energy consumption and generation can be helpful, not only in strengthening your participation in siting decisions but also to take steps to achieve reduced emissions and to make your use of energy more efficient and affordable.

In 2017, the Vermont Department of Public Service (Department) provided initial guidance about best practices for writing enhanced energy plans that will meet the standards for achieving an affirmative determination of energy compliance. At that time, the Department issued separate guidance for regions and municipalities looking to developing Enhanced Energy Plans. In this 2024 update, those two guidance documents have been combined into one set of guidance, highlighting differences for regions and municipalities as necessary. This updated guidance document seeks to continue highlighting such best practices for enhanced energy planning, including lessons gleaned from the initial round of planning conducted between 2017 and 2021, as well as changes resulting from the updates released with the 2022 Comprehensive Energy Plan update to the Act 174 Enhanced Energy Planning Standards ("standards"). It provides guidance about how regions and municipalities can meet the standards and is a companion guide to two other documents:

1. The Municipal Determination Standards and the Regional Determination Standards – there are instructions in the standards which are not repeated here, so please read the standards before work begins to amend a plan.
2. Planners should also read the original Overview document that was released with the standards. It provides useful context regarding the purpose of Act 174, enhanced energy planning, what substantial deference means, and other issues.

Though there are many details to work through, at its core, the process of enhanced energy planning consists of three major tasks:

1) Understanding your region or municipality's **current energy use and setting targets for the future** that are in alignment with State energy and climate goals and requirements;
2) Deciding **how to reach the targets** through "pathways," or implementation actions; and
3) Preparing **maps** to help guide renewable energy development in the municipality or region.

This document is a step-by-step guide that provides updated methods, data sources, possible pathways, and guidance on how to meet the standards. It is organized, as the standards are, into three main sections: 1) analysis and targets; 2) pathways and implementation actions; and 3) mapping.

As of December 2023, all 11 regional planning commissions in the State and 107 municipalities have received affirmative determinations of energy compliance for their enhanced energy plans. The experiences and lessons learned by these entities are a valuable resource for municipalities embarking on their own enhanced energy plans, or regions and municipalities looking to revise their plans. The Department looks forward to continuing engagement with planners as they move forward to adopt or update their enhanced energy plans and welcomes feedback to help improve this guidance and other resources. Please do not hesitate to contact Department staff with questions and clarifications or to discuss what additional resources may prove helpful in the future.

Section 1: Analysis and Targets

This section provides guidance and outlines how regions and municipalities can meet the *Analysis and Targets* section of the regional and municipal enhanced energy planning standards. These *Analysis and Targets* standards must be met if a region or municipality wants the land conservation measures and specific policies expressed in their plans to receive substantial deference in Section 248 energy siting proceedings before the Public Utility Commission (PUC or Commission).

The process of analysis and target-setting is intended to provide planners with an overview of current energy use in the transportation, heating, and electric sectors, and with a sense of the trajectories and pace of change needed, which can be translated into concrete actions in the *Pathways* section below. Targets provide regions and municipalities with milestones along the way toward a path of meeting 90% of their total energy needs with renewable energy and achieving their share of greenhouse gas emissions reductions associated with the Global Warming Solutions Act (GWSA) of 2020.[1] Targets for generation can be compared with the potential generation from areas identified as potentially suitable in the *Mapping* standards exercise below to give communities a sense of their ability to accommodate renewable energy that would meet their needs.

Additionally, regions are tasked with breaking out their analyses and targets to their municipalities. **Municipalities that use their region's analyses and targets will meet the municipal *Analysis and Targets* determination standards**. Municipalities that choose not to use their region's analysis and targets will need to meet the same set of *Analysis and Targets* standards as the regions, per the guidance provided and expectations outlined in this document.

This section explains how regions can use the updated regional LEAP outputs to satisfy the *Analysis and Targets* standards. There are four distinct criteria in the *Analysis and Targets* section of the Determination Standards, each derived from Act 174:

A. Does the plan estimate current energy use across transportation, heating, and electric sectors?

B. Does the plan establish targets for 2025, 2035, and 2050 for thermal efficiency improvements and use of renewable energy for heating and evaluate the amount of thermal-sector conservation, efficiency, and conversion to alternative heating fuels needed to achieve these targets?

C. Does the plan establish targets for 2025, 2035, and 2050 for use of renewable energy for transportation and evaluate transportation system changes and land use strategies needed to achieve these targets?

D. Does the plan establish 2025, 2035, and 2050 targets for electric efficiency improvements and use and renewable energy for electricity, and evaluate electric-sector conservation and efficiency needed to achieve these targets?

<u>Data & Tools to Support Regions Meeting Standards 4-5</u>

[1] https://aoa.vermont.gov/sites/aoa/files/Boards/VCC/ACT153%20As%20Enacted.pdf

Since the Regional and Municipal Act 174 Planning Standards were updated, the Department has worked to update a number of data sources and related tools to support the regions in meeting the *Analysis and Targets* standards. These include:

- Regionalized Data from the Vermont Pathways Analysis ("LEAP Data")
- Municipal Consumption Tool
- Analysis & Targets Aid – Bottom Up
- Generation Scenarios Tool

Regionalized Data from Vermont Pathways Analysis ("LEAP Data"):
In the first round of enhanced energy plans, the Department and Vermont Energy Investment Corporation (VEIC) assisted the regions in developing analyses and targets in order to satisfy the *Analysis and Targets* standards using the Stockholm Environment Institute's (SEI) Low-Emissions Analysis Platform (formerly known as the Long-Range Energy Alternatives Platform) – or LEAP – tool.[2] This tool was also used to inform the 2022 Comprehensive Energy Plan (CEP) and 2021 Climate Action Plan (CAP).[3] With the 2022 update, the Department has worked – with support from SEI – to help regions update their analyses and targets by providing a revised set of "regionalized" modeling results consistent with what was used in the statewide plans.

The results of this effort were provided to each of the 11 Regional Planning Commissions in October 2023 in spreadsheet form. Additional copies of these results can be requested from the Department or accessed via the Departments Act 174 website. The data from this effort offer indicative projections of the following for the baseline ("Business as Usual") and CAP Central Mitigation scenarios analyzed for the 2022 CEP and 2021 CAP:

- **Residential Sector**
    - Total Residential Energy Demand by Fuel
    - Thermal Energy Demand by Fuel (including demand from select specific electric technologies to align with previous VEIC outputs) - *includes space heating, space cooling, and water heating*
    - Number of new residential heat pumps and heat pump water heaters
    - Number of new residential retrofits (housing units)
- **Commercial Sector**
    - Total Commercial Energy Demand by Fuel

[2] LEAP is a software tool that supports quantitative modeling of a variety of things including energy systems, pollutant emissions from energy and non-energy sources, and cost and benefits. LEAP is not a model itself, but a tool for creating models. While the LEAP tool was used both in the original modeling done by VEIC and the updated modeling based on the 2022 CEP and 2021 CAP modeling, the two models were distinct.
[3] LEAP was used by the Department and the Vermont Climate Council to support the development of the 2022 Comprehensive Energy Plan and 2021 Climate Action Plan, identifying indicative pathways Vermont could pursue in order to achieve the GHG gas reduction requirements codified in the Global Warming Solutions Act and 10 V.S.A § 592.As noted above, following on those two statewide modeling efforts, the Department has worked to take the results of the statewide modeling effort and "regionalize" final energy use and greenhouse gas emissions outputs of four core sectors: residential, commercial, industrial, and transportation. Results of the analysis for the 2022 CEP can be found in the 2022 CEP Appendix D and E available from https://publicservice.vermont.gov/content/2022-plan

    - Number of new commercial heat pumps
- **Industrial Sector**
    - Total Industrial Energy Demand by Fuel
- **Transportation Sector**
    - Passenger, Light, Medium, and Heavy-Duty Vehicle Energy Demand by Fuel
    - Non-Road Transportation Energy Demand by Fuel
    - Total Number of Passenger Cars and Light Trucks (Light Duty) EVs
- **Greenhouse Gas Emissions**
    - Gross GHG Emissions for Each Sector (Transportation, Residential, Commercial, Industrial, and Electricity)

The workbook provided to the regions provides additional details on how the regionalization was conducted and links to supporting materials.

Municipal Consumption Tool

This tool was designed to support regional planners in developing municipal-level estimates of current energy consumption and has been updated in 2023 to reflect more current population, vehicle, and commercial establishment data, among other updates. This tool provides one pathway for regions to estimate municipal thermal and transportation-based energy use and use those estimates in aggregate to estimate regional energy use. It also provides a way to develop municipal shares of energy consumption that can be used to take each region's LEAP Data outputs and "municipalize" them.

Other approaches may also be used. If using a different method, regions (or municipalities, if relevant) should include a detailed overview of the method taken and data sources used.

This tool is available at https://publicservice.vermont.gov/document/act-174-municipal-consumption-template-2023-update

Analysis & Targets – Bottom-Up Tool

This tool was designed to help regions develop targets around weatherization, fuel-switching, and electric efficiency. It has been updated in 2023 based on the new LEAP Data available to regions (which now includes estimates of anticipated residential retrofits, residential and commercial heat pump adoption, and electric and plug-in hybrid vehicle adoption in the CAP Central Mitigation Scenario).

This tool is available at https://publicservice.vermont.gov/document/act-174-analysis-targets-aid-bottom-regions

Generation Scenarios Tool

New in the 2022 update, a *Generation Scenarios Planning Tool* developed by the Department seeks to assist planners in developing their preferred set of renewable generation targets[4]. The new tool will help regions explore a variety of generation targets suitable for their region and the municipalities they serve depending on factors such as percent of future generation needs hosted in-region, resource potential, and available headroom on the grid. It supports enhanced consideration of grid-related constraints in regions and municipalities based on information from the Vermont Electric Power Company (VELCO) on

[4] Available from: https://publicservice.vermont.gov/document/generation-scenarios-planning-tool

transmission system hosting capacity and from distribution utilities on distribution system hosting capacity. Regions and municipalities are not required to include specific targets by technology, such as utility-scale wind, but should consider that different technologies and scales of technology have different land use and grid impacts for a given amount of installed capacity or energy production. In developing generation targets and utilizing the tool, planners may want to reference Chapter 7 of the 2022 Comprehensive Energy Plan ("Electric Resources") and 2021 VELCO Long Range Transmission Plan (LRTP). For example, page 44 of the 2021 LRTP discusses optimized solar PV distribution by regional planning commission.

This tool is available at https://publicservice.vermont.gov/document/generation-scenarios-planning-tool

Supporting Data Sources

In addition to the data provided in the above tools, regions and municipalities may also find data to support these analyses through:

- The Department's **Annual Energy Report** (available from https://publicservice.vermont.gov/about-us/plans-and-reports/legislative-reports#Annual%20Energy%20Reports) which offers annually updated state-wide data on the thermal, transportation, and electric sector
- The Energy Action Network Annual Progress Report (https://eanvt.org/annual-report/)
- The American Community Survey (https://www.census.gov/programs-surveys/acs) – table DP04 provides information on number of housing units, vehicles per housing unit, age of building stock, and size of housing units by town, among other information
- Drive Electric Vermont (ex. https://www.driveelectricvt.com/Media/Default/docs/maps/vt_ev_registration_trends.pdf)
- Vermont Department of Labor, counts of commercial establishments

If planners have questions about data sources, please reach out to Department staff. Through 2024, the Department will be working to pilot a new phase of its ongoing effort to make data on Vermont's energy sector more publicly available. It expects this effort should, over time, make data needed to meet the *Analysis and Targets* standards more readily available to regions and municipalities.

The original guidance provided to the regions and municipalities (see Appendix A) detailed how to meet these standards. That guidance is still available for review[5] and the approaches outlined in that document will still meet the *Analysis and Targets* standards (although, some data points may need to be updated). Regions may choose to utilize other methods to meet these standards. Alternative methodologies should be thoroughly explained and include references to any datasets used to develop the analysis. The Department encourages regions and municipalities to highlight where they face data gaps or limitations in their plans. This will support ongoing efforts to address such gaps.

[5] Appendix A from the original *Guidance for Regional Enhanced Energy Plans* (published March 2017) is available here: https://publicservice.vermont.gov/sites/dps/files/documents/Pubs_Plans_Reports/Act_174/Regional%20Guidance_Final.pdf, page 37 onward.

In lieu of updating that document (Appendix A), the Department provides guidance on addressing Standards 4A-D and Standard 5 here. Regardless of the approach taken, it is necessary for plans produced by regions to break out their analyses (Standards 4A-4D) by municipality (as required by Standard 5). This can be done in a variety of ways, each of which will require planners to think critically about how to break out municipal-level energy use with limited data (the *Municipal Consumption Tool* provides one possible avenue). The examples of how to account for municipal-level differences in energy consumption do not necessarily represent the single best approach to this challenge. Planners may have access to information that makes other approaches more suitable, and the Department encourages application of local knowledge to their analyses.

Analysis & Targets Standard 4:

Does your plan's energy element contain an analysis of resources, needs, scarcities, costs, and problems within the region or municipality across all energy sectors (electric, thermal, transportation)?

4A. Does the plan estimate current energy use across transportation, heating, and electric sectors?

Plans will meet this standard if they include transparently calculated estimates of energy consumption for three types of end-uses: 1) passenger transportation, 2) non-industrial building heat, and 3) consumption of electricity. In addition to an estimate of current consumption, energy plans should include a discussion of historical drivers of local demand for each of these three uses of energy. Passenger transportation is synonymous with light-duty vehicle use (passenger cars and light trucks in the LEAP data). Regions and municipalities are not required to estimate heavy-duty transportation use, which includes freight and truck traffic, although data on energy demand in the medium and heavy-duty transportation sectors was included in the updated LEAP data if regions are interested in working with this data. Non-industrial buildings include commercial buildings, as generally identifiable with the North American Industry Classification System (NAICS codes).

The Department suggests (but does not require) that planners calculate current regional energy use from the "bottom-up," as an aggregation of each municipality's individually estimated consumption.[34] This requires planners to make unique municipal-specific assumptions about the average or typical amount of energy consumed for building heat and transportation within that municipality (electricity consumption can be measured directly). Estimating current consumption in this way provides a useful check on the accuracy of the updated LEAP data and would likely make for more informed target-setting as well (per regional Standard 4B, municipal standard 5B).

Regardless of the estimation method chosen planners should organize their calculations so that each municipality's contribution to each type of energy use (heat and transportation) is made explicit. This information will help planners to know they are setting appropriate weatherization and fuel-switching targets for individual municipalities (per regional Standard 4B, municipal standard 5B).

General Guidance for Developing Consumption Targets

Planners are encouraged to view the LEAP Data (baseline and CAP Central Mitigation Scenarios) as a first approximation of regional targets. Ideally the future year results of these scenarios should be checked against the current reality of each region's or municipality's individual circumstances and modified if necessary.

The Department's *Analysis_&_Targets_Aid_Regions_Bottom_Up* provides one pre-formulated method of doing this. It guides planners through a series of steps which result in a restatement of the Btu quantities in the LEAP Data into more practical terms (e.g., percentage of households with heat pumps, or percentage of light-duty vehicles at least partially powered by electricity). If modifying the LEAP Data (which regions and municipalities may do if they believe they have more local information), it is expected that the rationale for the modification will be fully explained in the plan.

Ultimately, energy plans should state their final targets in practical terms. Thermal and electric efficiency targets can be expressed as the number and percentage of buildings in the region or municipality that will be weatherized or improved by each target year. Targets to increase the use of renewable energy can be expressed as the number and percentage of buildings or vehicles in the region or municipality that have adopted the fuel/technology by each target year.

Regional plans should identify targets for each municipality within the region as well as for the region as a whole. This will be easier to do if regions have taken the "bottom up" approach to estimating current energy use (Standard 4A).

4B. Does the plan establish targets for 2025, 2035, and 2050 for thermal efficiency improvements and use of renewable energy for heating and evaluate the amount of thermal-sector conservation, efficiency, and conversion to alternative heating fuels needed to achieve these targets?
To satisfy these standards, regions should set transparently calculated targets for residential and commercial buildings backed up with an evaluation of the level of effort required to meet them. Targets for *industrial* energy use are not required. However, plans should discuss the possibilities for transitioning industrial energy users onto renewable energy sources.

Note, the revised LEAP Data now provide planners with estimates for number of residential retrofits and residential and commercial heat pump adoption from the CAP Central Mitigation Scenario, which is consistent with meeting the GWSA greenhouse gas reduction requirements. The *Analysis and Targets Aid* further helps identify targets for commercial weatherization and conversion to alternative heating fuels.

Regional plans should express the heat energy targets they adopt so that each municipality is assigned its own target. This can be done by several methods. One option, consistent with the "bottom up" approach to calculating current regional consumption, is to use a given municipality's estimated share of regional residential and commercial heat energy use (per Standards 4A [regions] and 5A [municipalities]) as that municipality's share of the target quantity set for the region. Options consistent with a top-down approach (where consumption is estimated for the region as a whole and then apportioned to towns) include taking each municipality's share of the regional residential/commercial building stock or each municipality's share of regional population. Regions should consult with municipalities to determine the most appropriate and equitable way to collectively meet the regional target, and the means of allocating targets across municipalities will reflect these conversations.

4C. Does the plan establish targets for 2025, 2035, and 2050 for use of renewable energy for transportation and evaluate transportation system changes and land use strategies needed to achieve these targets?

To satisfy this standard, regions should set transparently calculated targets for passenger transportation energy use. Targets for heavy-duty, mass transit, rail and other transportation energy uses are not required to satisfy this standard (even though the updated LEAP Data contain results for heavy duty transportation use). Plans should discuss the role that increased use of public transportation, rail ridership and compact land use strategies could play in helping regions reach their transportation targets.

Regional plans should express the transportation energy targets they adopt in such a way that each municipality is assigned its own target, which can be done a number of ways, as described in Section 4B above.

4D. Does the plan establish 2025, 2035, and 2050 targets for electric efficiency improvements and use of renewable energy for electricity and evaluate electric-sector conservation and efficiency needed to achieve these targets?

To satisfy this standard, regions should set transparently calculated targets for residential buildings. Targets for commercial or industrial electricity consumption are not required. However, plans should discuss the possibilities for transitioning industrial energy users onto renewable energy sources.

Generation Targets: Municipalities and regions should consider developing generation targets complementary to State energy goals, by examining future generation needs, population (as a proxy for load) and, land area, energy resource potential, grid hosting capacity, and other factors. These targets can be used as a tool to understand the potential land use requirements (see guidance for Standard 9C) and approximate grid upgrade costs associated with different scenarios. Generation targets for renewable electricity by region or municipality should depict the amount of *new* generation capacity – that is, capacity beyond what's already permitted or installed (evaluated under standard 9A) and needed to reach the target. The Department has developed a tool (**the *Generation Scenarios Tool*[6]***)* to support the regions and municipalities in this effort. As described previously, the tool helps regions and municipalities develop customized generation targets based on resource potential, desired share of future required renewables hosted locally, and grid constraints.

Regional plans should express the electric energy targets they adopt in such a way that each municipality is assigned its own target, which can be done a number of ways, as described in Section 4B and 4C above.

[6] Finalized in April of 2023 and available here: https://publicservice.vermont.gov/document/generation-scenarios-planning-tool

Section 2: Pathways (Implementation Actions)

Pathways (or implementation actions) are steps that regions and communities need to take to reach the targets they established in Section 1. Municipalities and regions will have different needs and abilities in this area, which means they can select different combinations of actions to reach those targets. For example, more compact communities, where buildings are closer together, may focus more on improving bike and pedestrian infrastructure in order to meet transportation targets; whereas small rural communities may focus more on electrification of the vehicle fleet. Below are many ideas about what communities can do to implement their plans and achieve targets established for efficiency, transportation, compact land use, and renewable generation. Communities can select ideas that fit and come up with their own; though all plans seeking determination need to meet the standards, the actions below are not required steps that all plans must include.

Regions and municipalities must demonstrate a commitment to achieving each standard by adopting both policies and implementation pathways that contain clear, action-oriented language.

Pathways Standard 6

Does your plan's energy element contain policies or objectives on the conservation and efficient use of energy in buildings?

6A. Does the plan encourage conservation by individuals and organizations?

While municipalities and regions cannot control the use of energy by individuals and organizations, they can serve as a resource for information and expertise, lead by example, and encourage individuals and organizations to conserve and use energy efficiently. Through the Energy Efficiency Utilities, there are many programs and incentives available to reduce energy use. Municipalities and regions should identify and promote the resources available to individuals, businesses, and organizations. Examples of programs and resources that could be incorporated into plans include:

- Coordinate with and promote Energy Efficiency Utility (EEU) programs and the State Weatherization Assistance Program for low-income households and encourage residents to participate.
- Co-sponsor and organize weatherization workshops for homes and businesses with EEUs.
- Identify available electric, natural gas, and deliverable fuel (oil, propane) Energy Efficiency Utility program resources and make web links available on municipal/regional websites.
    - Electric EEU – Efficiency Vermont (statewide) and City of Burlington Electric Department (funded through the electric energy efficiency charge)
    - Natural Gas EEU – Vermont Gas Systems (funded through the natural gas energy efficiency charge)
    - Unregulated Fuels – Thermal Energy and Process Fuel programs
- Work with partner organizations and EEUs to offer workshops and educational opportunities to businesses on efficiency in new construction, retrofits, and conservation practices.
- Identify large energy usage customers (including large businesses, manufacturing facilities, and schools) as a target audience and encourage participation in commercial and industrial EEU programs.
- Facilitate a workshop and/or conduct building walk-throughs for owners of rental housing (including farm labor housing) to encourage implementation of energy efficiency.

- Encourage residents to hire Efficiency Excellence Network (EEN) contractors when completing energy efficiency projects by including links to the EEN on municipal/regional websites[7].
- **Municipalities**: form or continue to support a local energy committee or coordinator.
- Facilitate strategic tree planting to maximize energy benefits.[8]

6B. Does the plan promote efficient and climate resilient buildings?

Thermal and process energy use – i.e, heat --in Vermont's residential, commercial, and industrial buildings accounts for approximately 50% of Vermont's total site energy consumption and 34% of its greenhouse gas emissions, making it the second largest contributor to greenhouse gas emissions in the State. This energy is largely provided by burning fossil fuels, although biomass and bioheat provide a small portion of Vermont's thermal energy use. The residential sector accounts for 60% of Vermont's thermal fuel consumption, commercial 28%, and industrial 12%[9].In addition to reducing greenhouse gas emissions, weatherization and fuel-switching can save money and create local jobs. Both the 2022 CEP and 2021 CAP call for a significant scaling up of weatherization efforts to support achieving State GHG and energy related goals. To support these efforts, in the FY23 budget the legislature appropriated $80 million of American Rescue Plan Act (ARPA) money to support enhanced weatherization efforts in low- to moderate-income households.

Regions and municipalities can play a vital role in helping to achieve weatherization-related goals as well as encouraging efficiency in commercial and industrial buildings. Specific actions are included below.

- Promote the use of Vermont's residential building energy label/score.
- Promote the use of the residential and commercial building energy standards by distributing code information to permit applicants and ensuring code compliance[10].
- Promote benchmarking (using the free EPA Portfolio Manager tool and/or with assistance from the EEUs) for commercial buildings.
- Include policies that promote or require residential projects to follow the residential stretch energy code.
- Promote the construction of net-zero-ready buildings by including a discussion of such buildings in the plan and identifying educational opportunities as an implementation action.
- **Municipalities**:
    - Provide energy code and energy efficiency program information when residents apply for municipal land use permits that include alterations or construction of a building.
    - Require that energy code certificates be submitted to the town for all new building construction as well as for existing buildings (additions, alterations, renovations and repairs).
    - Review and consider adoption of the state's stretch energy code as the baseline energy code.

---

[7] Information about EEN is here: https://www.efficiencyvermont.com/tips-tools/questions-answers/what-is-een
[8] Information on Arbor Day Foundation's Energy-Saving Trees program is available at http://arbordayest.org/
[9] 2022 Comprehensive Energy Plan; https://publicservice.vermont.gov/sites/dps/files/documents/2022VermontComprehensiveEnergyPlan_0.pdf
[10] Residential standards available at http://publicservice.vermont.gov/energy_efficiency/rbes. Commercial standards available at http://publicservice.vermont.gov/energy_efficiency/cbes.

    - Provide incentives (e.g. density bonuses) to developments located in an area identified as appropriate for growth that exceed the state's stretch energy code.
- Promote the use of landscaping for energy efficiency.
- Hold an informational forum at the Town Hall and invite residents to speak about the energy improvements that they have made to their homes. Present data that demonstrates why these improvements make sense for residents (e.g. estimated return on investment, case studies). Assess the life cycle costs of potential energy improvements during design and construction planning. For example, investment in a new, efficient heating system may be more expensive up front, but more economical to operate over time.

Municipal Energy Resilience Program: Act 172 of 2022 (H. 518)[11] expanded the role of the State Energy Management Program to include the assistance of regional planning commissions in helping municipalities improve the resilience of town buildings and reduce fossil fuel consumption. With the resources allocated through Act 172, regional planning commissions may now receive funding to work with muncipalities via the expanded State Energy Management Program operated by the Department of Buildings and General Services to assess buildings and facilities in covered municipalities and provide technical assistance leading to improvements that reduce energy usage and develop renewable energy heating systems[12].

In addition to promoting efficient buildings, the 2022 update to the standards now ask regions and municipalities to promote climate resilient buildings. The 2022 CEP defines resilience broadly as "the ability to withstand and reduce the magnitude and/or duration of disruptive events, which includes the capability to anticipate, absorb, adapt to, and/or rapidly recover from such an event."[13] As applied to buildings specifically, this could encompass the ability to provide building occupants a safe and comfortable space to meet their needs regardless of shifting outdoor conditions.[14] It could also extend to considerations of where to site buildings, in relation to potential threats or opportunities. The U.S Climate Resilience Toolkit provides a number of helpful resources to support planning to enhance resilience in regional and municipal plans, including resources specific to buildings and structures in the built environment. The Rural Resilience and Adaptation Subcommittee of the Vermont Climate Council is also in the process of developing a Vermont Climate Toolkit (VCT)[15] to support municipalities. Once completed, the Department expects it will also provide a valuable resource to support aspects of enhanced energy planning.

[11] Act 172 of 2022. https://legislature.vermont.gov/Documents/2022/Docs/ACTS/ACT172/ACT172%20As%20Enacted.pdf
[12] Information on the Municipal Energy Resilience Program is available here.
[13] See pg 91 of the 2022 Comprehensive Energy Plan(https://publicservice.vermont.gov/sites/dps/files/documents/2022VermontComprehensiveEnergyPlan_0.pdf) siting NARUC (2020): Advancing Electric System Resilience with Distributed Energy Resources: A review of state policies. Available from: https://pubs.naruc.org/pub/ECD7FAA5-155D-0A36-3105-5CE60957C305
[14] UN Environment Programme 1972-2022 (2021): A practical guide to climate-resilient buildings & communities. Available from: https://wedocs.unep.org/xmlui/bitstream/handle/20.500.11822/36405/Adapbuild.pdf
[15] A project scope for the VCT can be reviewed here: https://climatechange.vermont.gov/sites/climatecouncilsandbox/files/2022-04/Climate%20Toolkit%20Scope.pdf

6C. Does the plan promote decreased use of fossil fuels for heating?

Thermal energy use accounts for approximately 30% of all energy consumed by Vermont's end users, is primarily fossil-fuel based (oil, kerosene, natural gas, and propane), and is the second-largest contributor to greenhouse gas emissions. Municipalities and regions must promote actions that decrease the use of fossil fuels for heating and increase the use of electricity and alternative energy sources to provide more efficient space heating and cooling and reduce carbon dioxide emissions. Increased efficiency will save individuals and organizations money on their heating and cooling bills. A variety of possible actions are discussed below and are divided into the type of fuel or system. Communities should not feel constrained by the list below. Different communities will find certain strategies better suited to meet their individual needs than offers.

Heat Pumps:

- Promote the use of cold climate heat pumps with education/presentations in coordination with the EEUs/electric utilities.
- Support the use of ground-source heat pump heating and cooling systems for new construction.
- **Municipalities:** Identify muncipal buildings that would be good candidates for cold climate heat pumps and develop a plan and schedule to add the heat pumps to those buildings.

Energy Transformation In the Renewable Energy Standard

- The Renewable Energy Standard requires utilities to help reduce customer fossil fuel use through "energy transformation projects" such as weatherization, and incentives for heat pumps and electric vehicles. Communities can seek to coordinate with their utilities to deliver these services in the most effective way, particularly for municipal-owned utilities.

District Wood Heating

- Identify potential locations for wood-fired district heating. [16] For example, locations with a high concentration of buildings (two or more buildings) with space for a central heat plant and/or where there is a large building that could be an anchor for an district heating system that also supplies heat to neighboring buildings.
- Provide examples of model ordinances related to district heating projects that require access to town and/or State wrights-of-way.
- Provide examples of municipal-owned district heating systems including sample documents needed for setting up a district heating service.
- Identify businesses that make, sell, and/or transport wood chips and/or wood pellets to the region/town that could be used in a district heat system.

Wood Heating for Individual Homes and Businesses

[16] District heating is a system for distributing heat generated in a centralized location for two or more homes and/or buildings' heating requirements.

- Encourage, promote, and incentivize advanced wood heating[17] by: supporting the conversion of existing fossil fuel heating systems to wood; encouraging local manufacturing of advanced wood heat technology; supporting development of wood fuel delivery infrastructure; encourage local permitting and ordinances that provide flexible timing of deliveries to and from wood fuel processing facilities; supporting development of sustainable forestry and procurement services; expanding wood fuel processing facilities, encouraging bulk wood pellet delivery systems; and providing training and education on the benefits of heating with efficient, clean wood energy systems.
- Promote wood stove change-out programs that take older non-EPA certfied stoves out of service and replace them with more efficient and lower emitting cordwood and pellet stoves.
- Encourage new construction to install advanced wood heating equipment.
- Participate in education campaigns to provide best practices on cordwood and wood pellet selection, storage, and combustion to promote the most efficient, clean, and cost-effective use of wood heating technology while protecting human and environmental health.
- Identify any businesses that have a need year-round need for process heat. Encourage these businesses to look into woodfired combined heat and power.
- **Municipalities:** Identify muncipal buildings that would be good candidates for wood pellet or chip heating and develop a plan and schedule to convert those buildings to wood heat.

Biogas: Farm, Non-Farm, and Landfill Methane

- **Municipalities** that are remodeling their waste treatment facilities should consider including anaerobic digestion with methane capture as part of their treatment systems.
- In 2018 Vermont Gas launched a voluntary green pricing program for Renewable Natural Gas (RNG)[18]. Regions and municipalities can promote the enrollment in the program among large users in your community, for example at food-processing facilities.
- Encourage the development of the biomethane sector by supporting proposals for appropriately sited, cost-effective biomethane production facilities and related infrastructure.
- Identify potential producers of food and farm waste (farms, food processors, restaurants/schools/institutions with food waste) that could potentially host a farm or food waste digester.

Biofuels: Use of Biodiesel for Heating

- Identify potential opportunities to substitute biodiesel (BD) in oil-fired furnaces or boilers in muncipalities
- Identify local fuel dealers that supply biodiesel and help residents and businesses learn how to substitute biodiesel blended heating fuels in their systems

***Municipalities Only!* 6D. Does the plan demonstrate the municipality's leadership by example with respect to the efficiency of municipal buildings?**

[17] Advanced wood heating denotes wood heating that: 1) utilizes highly efficient combustion technology, 2) produces low levels of emissions, 3) supports healthy forest ecosystems, and 4) consumes local wood.
[18] More information on RNG and Vermont Gas is available at https://vermontgas.com/innovation/renewable-natural-gas/.

Municipalities should lead by example and demonstrate to individuals and organizations the benefits of building efficiency. Support for municipalities wishing to improve the efficiency of their own buildings is available through Efficiency Vermont (except in Burlington, where the Burlington Electric Department provides efficiency services)[19]. Municipalities leading by example can consider the actions identified below:

Implement Energy Efficiency in Municipal Buildings

- Conduct a baseline energy study of how much energy municipal buildings (including schools) use.
- Conduct building energy audits of municipal structures.
- For example, investment in a new, efficient heating system may be more expensive up front, but more economical to operate over time[20].
- Incorporate weatherization/energy efficiency projects into the municipal Capital Budget and Program.
- Implement weatherization/energy efficiency projects in municipal buildings.
- Enroll municipal buildings into energy certification programs.
- Develop policies for evaluating investments in infrastructure that consider energy efficiency, for example making purchasing decisions with life cycle analysis and building operation guidelines in mind.
- Implement low-impact development and/or green infrastructure practices/strategic landscaping to shade buildings and reduce temperatures, thereby increasing overall efficiency.
- Develop policies so that if investing in new municipal buildings, municipalities strongly consider locations that will give people the option to get to those buildings without driving – for example, by putting a new town hall near the post office or school or other village/downtown location instead of distant from the town center.

Increase the Use of Renewable Sources for Heating in Municipal Buildings

- Municipalities should continue to replace older fossil-fired heating systems with high-efficiency, cold-climate heat pumps, geothermal heat, or advanced wood heating systems (including wood-fired district heat). They should survey municipally owned buildings and target the largest fossil fuel-consuming locations, and locations that use the most fossil fuel per square foot, and should prepare life-cycle cost-benefit analysis studies that consider the cost of replacement relative to energy savings and environmental benefits. The age and useful life of the existing heating systems should also be weighted when determining which projects to undertake first.

6D (regional standards) and 6E (municipal standards). Other

Please use the notes section to describe additional approaches that your municipality or region is taking.

[19] For support in assessments, financing, rebates, and education, visit https://www.efficiencyvermont.com/services.

[20] The National Institute of Standards and Technologies' Building Life Cycle Cost Program offers free calculation tools to help analyze potential capital investments in buildings.

If your municipality or region is implementing additional approaches that meet the intent of Standard 6, but are not covered under the other standards in this section, please describe them further in the notes section.

Pathways Standard 7 - Transportation

Does your plan's energy element contain policies and objectives on reducing transportation energy demand and single-occupancy vehicle use, and encouraging use of renewable or lower-emission energy sources for transportation?

Transportation fuels have historically accounted for the largest portion of energy use in the State and in 2020 were the second largest contributor to the State's total greenhouse gas emissions, at 35.6%[21]. Transportation is both a tremendous challenge and a tremendous opportunity for reducing greenhouse gas emissions.

The State has established ambitious goals to reduce transportation emissions by increasing renewable energy use for transportation (including renewably sourced electricity) by increasing electric vehicle (EV) adoption, by increasing transportation mode choice, and by supporting land use[22] decisions that increase transportation efficiency. Beyond emissions, these goals have implications for the health and financial well-being of Vermonters by advancing active transportation (such as walking and biking) and using lower-cost transportation fuels (such as electricity).

In addition to these goals, communities articulate their own goals and targets through the analysis and target-setting process in Standard 4. Local planners have powerful tools at their disposal to reduce demand for transportation and to plan for adequate infrastructure for options such as public transit, carpooling, biking, and walking, and the switch to renewable fuels.

Transportation planning has long been a part of local and regional planning, so it is very likely that much of local planning work already touches on the areas of public transit, transportation choices like walking or biking, and electrification. When submitting your plan, please list the page numbers where these items appear even if they are in the transportation rather than the energy section. To meet State energy goals, communities and regions must both reduce the number of vehicle-miles-traveled and switch to renewable, non-fossil-fuel transportation options.

7A. Does the plan promote a shift away from single-occupancy vehicle trips through strategies appropriate to the region?

The rural character of Vermont presents unique challenges to successfully implementing a variety of transportation modes and creating alternatives for single occupancy vehicles. Public transit provides one opportunity to support this shift, and includes bus routes, car and van pools, school bus routes, and services for elderly and disabled people. Carbon reduction and efficient energy use relies on making the most of transit vehicles in operation; maximizing ridership should be a major priority for regions and

[21] Vermont Greenhouse Gas Emissions Inventory and Forecast: 1990-2020; https://outside.vermont.gov/agency/anr/climatecouncil/Shared%20Documents/_Vermont_Greenhouse_Gas_Emissions_Inventory_Update_1990-2020_Final.pdf

[22] Developing strategies for creating compact, mixed-use development centers – which is closely tied to the need for transportation – is discussed in more detail in Pathways Standard 8, below.

municipalities. While public transit can meet the needs of some commuters, communities that work to provide and coordinate a range of options and alternatives to single-occupancy vehicles will be most successful in cutting emissions in the transportation sector. For example, very small communities which are far from rail need not consider rail but should consider bus or public transit connections to passenger rail outside the region.

Communities could consider a variety of issues in their plans to meet the standards. Communities and regions need not include every one of these elements to meet the standard but should select those more applicable to their needs.

- Present an overview of public transit available in your municipality or region including information about regional transit providers and the major routes they offer.
- Identify challenges and opportunities for public transit, particularly focusing on a review of routes and route schedules to ensure that they are addressing needs of the community.
- Provide an assessment of potential ridership in rural and urban or village areas, access to maintenance facilities, cross-regional coordination between schedules, and marketing.
- Assess the need for inter-city routes (such as Vermont Translines and Greyhound) connecting the community or region with other metropolitan areas.
- Present strategies that respond to needs and opportunities identified in the analysis, such as:
    - Maximize ridership for public school buses and minimize use of private vehicles for student transport.
    - Work with public transit providers in your region to promote full utilization of existing routes and where necessary, identify and develop new public transit routes.
    - Integrate park-and-ride locations with transit routes.
    - Plan and advocate for access to public transit, especially during for Act 250 proceedings for larger developments.
- Provide an assessment of the number of park-and-ride spaces in the community, and explore opportunities to expand the number of spaces and provide greater connectivity between public transit and park-and-ride locations.
- Identify any structural barriers to telecommuting such as internet connectivity and speed.
- Assess current rail connectivity and whether there are opportunities to provide connections to rail or rail service expansion.
- Promote the Go Vermont service, which provides ride share, vanpool, public transit, and park-and-ride options.
- Support employer programs to encourage telecommuting, carpooling, vanpooling, walking, and biking for employees' commute trips. Encourage employers to offer such programs and provide information on tax benefits that may be available for doing so.
- Seek to provide employees with the necessary equipment and training to facilitate conference calls, webinars, and other virtual meetings and information sharing.
- Municipalities should consider installing Automatic Vehicle Location (AVL) equipment in school buses, plows and other vehicles, to reduce idling and milage across their own vehicles.
- Educational initiatives or grants related to any of the above strategies.

7B. Does the plan promote a shift away from gas and diesel vehicles to electric or other non-fossil fuel transportation options through strategies appropriate to the region or municipality?

The transition to electric vehicles requires planners to consider where vehicles will charge. On average, 80% of EV charging occurs at home. Residents of multiunit dwellings (also called multifamily housing) face challenges when parking spaces lack access to electricity outlets or Level 2 charging equipment. Communities should address where and how EV charging is sited, focusing on multiunit dwellings including apartment buildings and manufactured home parks, as appropriate for each community.

Long-distance travelers typically rely on DC (direct current) fast chargers, which can offer more than a hundred miles of range in 40 minute or less. Vermont has adopted goals to ensure that DC fast charging is available near interstate exits and along the State highway network. Ideal fast charging installations provide access to amenities (such as restrooms or food stores), are well-lighted, and are located along major travel routes.

The State has adopted specific goals for getting more electric vehicles (EVs) on Vermont's roads. Agencies are working to promote EVs and related infrastructure, and alternative fuels such as biofuel. For EVs, major barriers to adoption by consumers include a lack of awareness, the need for charging infrastructure, and the need to make vehicles more available through dealers. Regional and municipal planners have unique tools to address these barriers because of their ability to lead by example, connect with local employers and vehicle dealers, and identify prime locations for charging stations.

For alternative fuels, particularly biodiesel, regions and communities can promote their use through consumer education and through encourging local fueling stations to offer biofuel blends. Communities and regions should consider any of the following pathways that are relevant to them.

Promoting Consumer Awareness of the Benefits of and Access to EVs and Alternative-Fuel Vehicles

- Work with local employers and nonprofit partners such as the Vermont Energy and Climate Action Network and Vermont League of Cities and Towns to encourage broader implementation of EV incentives, such as free or reduced parking costs for EV and fuel-efficient vehicle owners and preferential access to parking spaces limited in supply.

Encouraging EV Adoption and Deploying EV Infrastructure at Workplaces and Key Public Locations

- Promote the Drive Electric Vermont webpage, which connects users to financial incentives, dealers, and charging stations for EVs.
- **Municipalities:**
    - Contact local vehicle dealers to encourage them to offer EV and fuel-efficient vehicles by both sale and lease. Encourage local media and chambers of commerce to provide positive visibility for supplying EVs.
    - Partner with Drive Electric Vermont, nonprofit organizations, vehicle dealers, and/or state agencies to organize high-visibility events where people can see and test drive EVs, such as county fairs, energy fairs, and summer festivals. Events should also leverage local newpaper and public access coverage to showcase local residents and organizations that are helping to propel the transition to EVs.

    - Lead by example by replacing some of the municipalities publicly owned vehicles with plug-in hybrid or plug-in all-electric vehicles, which often have a lower "total cost of ownership" than conventional vehicles..
    - Encourage major employers in your municipality that operate private fleets (for example garbarge collection, public transit, colleges and universities, or milk transportation) to switch some of their vehicles to electric or biodiesel-fueled vehicles. Help build awareness of related grant opportunities.
    - Municipalities should provide charging stations at prominent publicly owned locations such as municipal or school parking lots. Municipalities may develop their own charging stations, or work with private companies, such as ChargePoint, Green Mountain Power's EVgo program, SemaCharge or Greenlots, to develop stations at public facilities. Make charging stations accessible to the public where possible.
    - Promote existing EV charging infrastructure in town, for example by including a map on the municipal website.
    - Host a "show and tell" day featuring different kinds of EVs and giving people interested in purchasing them an opportunity to talk with fellow community members who own them.
- Assess current access to public and workplace charging in the community or region and identify strategic locations in busy areas (large employers or areas of high visitation in downtowns) where charging stations should be added or expanded.
- Partner with Drive Electric Vermont, the Vermont Clean Cities Coalition, and other organizations to promote the expansion of workplace charging, in particular by continuing funding for incentives that help employers cover the costs of installing charging stations.
- Collaborate with electric utilities operating in the region or municipality to determine where to invest in charging infrastructure and to build awareness of charging opportunities as part of the utilities' strategies for complying with the State's Renewable Energy Standard.
- Promote and plan for the installation of DC fast-charging infrastructure at strategic locations along major travel corridors, in downtowns and village centers, at businesses, and in transit hubs such as park-and-ride locations.
- Plan, advocate for, and consider requiring the installation of Electric Vehicle charging infrastructure as part of new or redevelopment, especially for developments subject to Act 250.

7C. Does the plan facilitate the development of walking and biking infrastructure through strategies appropriate to the municipality or region?

Active transportation (biking and walking) offers significant health benefits and is energy efficient. Many short trips that currently require a vehicle can be completed by walking or biking. Research has shown that people walk and bicycle more often when safe and convenient infrastructure, such as bicycle lanes, safe crossings, pedestrian paths, and sidewalks, is available ("complete streets"). When transportation projects are proposed, the needs of pedestrians, bicyclists, and users of all ages and abilities should be evaluated as part of project planning. Regional planning commissions play a key role in promoting complete streets among the municipalities they serve through the transportation element of their regional plan, by participating in corridor planning with VTrans, and by reviewing Act 250 development requests to ensure that they include adequate consideration of the needs of pedestrians and cyclists. As implementers of transportation projects, municipalities are also uniquely positioned to put "complete

streets" concepts into effect. However, there is much more education and training needed at both the state and local level to ensure that the complete streets concept is well implemented.

- Complete streets principles are integral to Vermont transportation policies, and – by law – all levels of Vermont government must implement complete streets practices on all paved roads and streets. Adoption of complete streets principles can be demonstrated in regional or municipality plans, bylaws, and standards, including land use bylaws and municipal road standards. The policies can also address winter snow removal for pedestrian facilities.
- **Regions** could with municipalities to build the abilities of local planners, public works departments, road foremen, etc. to implement complete streets concepts and provide sample language to include in municipal bylaws to ensure that site plan reviews include pedestrian and bicycle access as well as safety and traffic-calming measures.
- Review transportation and development projects to ensure that complete streets are implemented. This includes roadway design, driveway and parking layout, and access management decisions made by municipalities and the Agency of Transportation, with a focus on providing direct and safe pathways for pedestrians and bicyclists, reducing or combining driveways intersecting public roads.
- Use the Act 250 hearing process to ensure that site plans include adequate bike and pedestrian infrastructure and safety measures.
- Identify key areas where improvements to bike and pedestrian access would be beneficial (in downtown and suburban areas for example) and work to improve access and infrastructure in those areas. Focus on closing gaps in the transportation network, for example by providing corridors between important school and work destinations and nearby housing or between schools/colleges and downtowns or village centers.
- **Municipalities** should apply for state grants including the VTrans Local Projects section grants and Vermont Department of Health grants for active transportation projects including bike and pedestrian infrastructure, improved signage, bike racks, and crosswalk improvements. Update municipal road standards (for maintenance and new construction) to reflect complete streets principles.
-

Municipalities Only! 7D. Does the plan demonstrate the municipality's leadership by example with respect to the efficiency of municipal transportation?

Municipalities should lead by example and demonstrate to individuals and organizations the benefits of energy efficiency in transportation. This could be accomplished through some of the actions listed above, and those below.

- Allowing certain employees to telecommute through municipal policies.
- Installing electric vehicle charging infrastructure on municipal properties.
- Purchasing plug-in hybrid or plug-in all-electric municipal and fleet vehicles when possible, and choosing the most fuel-efficient models if EVs are not practicable.
- Establishing minimum fuel efficiency standards for the purchase of new vehicles.
- Provide incentives for employees who commute using methods alternative to single occupancy vehicles, e.g. walking, biking, public-transit, and carpooling.

7D (regions) or 7E (municipalities) 7E. Other

Please use the notes section to describe additional approaches that your municipality or region is taking.

If your municipality or region is implementing additional approaches that meet the intent of Standard 7, but are not covered under the other standards in this section, please describe them further in the notes section.

Pathways Standard 8

Does your plan's energy element contain policies and objectives on patterns and densities of land use likely to result in conservation of energy and climate resilience?

Vermont has a long-standing goal of maintaining the historic settlement pattern of compact village and urban centers surrounded by rural countryside. Although this standard is aimed at promoting the efficient use of energy in heating, transportation, and shared infrastructure, compact development has a number of other benefits, including reduced development pressures on agricultural lands, continued productivity of forests, preserved habitat areas, increased housing options, the preservation of historic buildings, a strong Vermont brand, economic efficiency, and more physically active and healthy communities. There are several ways in which density is promoted through existing statute and State, regional, and local programs and policies. This standard is intended to work in concert with those existing structures which include, but are not limited to the following:

- Municipal and regional planning in accordance with 24 V.S.A. § 4302(c)(1)
- Adoption of municipal zoning bylaws in accordance with 24 V.S.A. § 4411
- State designation of centers in accordance with 24 V.S.A. Chapter 76A.The Vermont Agency of Commerce and Community Development's Designation Program administers the Downtown, Village Center, New Town Center, Neighborhood Development Area, and Growth Center designations.
- Municipal and regional participation in Act 250, specifically with respect to Criteria 10 and 9L

Regions and communities that actively participate in these statutory community planning frameworks may meet this standard without changes to their plans. However, planners should provide the Department with a description (including page references) of how plans support these goals, how outcomes are tracked, and which enforcement mechanisms have been or are being used.

8A. Does the plan include land use policies (and descriptions of current and future land use categories) that demonstrate a commitment to reducing sprawl and minimizing low-density development?

The reduction of sprawl and low-density development not only reduces energy consumption but also maintains open space and can improve the local and regional economy. Municipalities and regions should clearly identify in their plans and future land use maps those areas where growth and development of compact centers are encouraged and where surrounding communities may want to remain more rural, relying on neighboring communities for shopping and services. Areas identified for development areas should not extend significantly beyond existing walkable settlements. Regional and municipal plans could:

- Prepare a physical plan for infill and new development in locations where growth is encouraged to show the desired pattern and character of development, networks of streets and passageways, and any proposed public parks and buildings.
- Adopt regulatory tools to support walkable development including access management, design review, required multiple stories in downtowns, eliminate or reduce parking requirements, requiring parking to be located on the side or back of buildings, or limiting building sizes along highways which can facilitate walkable connections between buildings and to existing settlements.
- Adopt local policies and ordinances to limit water and sewer services to those areas of town where additional development will not contribute to sprawl.
- Investigate the feasibility of developing or expanding centralized or clustered wastewater treatment systems necessary to increase density in growth centers.
- Prepare a plan for improving pedestrian and bike connections.
- Implement the local bike/pedestrian plan through ongoing investments structured through a capital budget and program.
- Update local bylaws to require that new development include pedestrian and bike-friendly infrastructure (including indoor or covered secure bike storage) and connect to the existing and planned pedestrian and bike networks.
- Review and update zoning and development regulations to reflect the vision and goals of the municipal plan.
- Promote working and natural landscapes, outside of designated growth and residential areas, that sequester and store carbon, e.g., by working with land trusts and landowners of farm and forest tracts to conserve key parcels of land.
- Promote low-impact development and green infrastructure practices to reduce local temperatures and shade building surfaces.

8B. Does the plan strongly prioritize development in compact, mixed-use centers when physically feasible and appropriate to the use of the development, or identify steps to make such compact development more feasible?

The authority to manage the development of village and urban centers rests primarily with municipalities and regions through local planning and land use regulation. There are many well-documented strategies that communities can employ to realize this goal.

Households within a compact, mixed-use center typically use less energy than those located in outlying areas. The energy savings are realized through reduced vehicle-miles-traveled and generally smaller homes, which require less energy to heat and cool. Transportation energy use can be further reduced by locating services such as shopping or daycare within walking or biking distances to the places that people work and live. This enables people to either choose an alternative to driving a single-occupancy vehicle or to significantly reduce the length of their drive.

- Adopt a capital budget and program based on long-term public facility needs to ensure the infrastructure necessary for compact development, e.g., sewer and water, pedestrian and biking facilities, parking, etc., envisioned in the municipal plan is provided in an orderly way.
- Identify a compact center in the municipal plan and contact the Department of Housing and Community Development for assistance in applying for State designation.

- Explore water and sewer options to enable compact development in growth centers.
- Tourism-based communities where transportation energy use is due to travel to the community from elsewhere should discuss options to reduce energy from transportation that are specific to them. For example, expanding rail or mass-transit access, installing EV charging, and promoting car-sharing.

8C. Other

Please use the notes section to describe additional approaches that your municipality or region is taking.

If your municipality or region is implementing additional approaches that meet the intent of Standard 8, but are not covered under 8A-B, please describe them further in the notes section.

Pathways Standard 9

Does your plan's energy element contain policies and objectives on the development and siting of renewable energy, storage, and transmission and distribution resources?

The following standards are interrelated with the mapping exercise under standards 10-14 below. It will be helpful to read through and complete the mapping exercise first, even if you are a municipality obtaining and using maps from your regional planning commission.

9A. Does the plan evaluate (estimates of or actual) generation from existing renewable energy generation in the region, [and for regions only: break this information out by municipality]?

This standard, and Mapping Standard 11, requires regions and municipalities to gather information on existing renewable generators in the municipality (this information will be provided to municipalities by regional planning commissions) or region. Information on existing renewable generation in Vermont is currently available in spreadsheet form from the Department of Public Service by request[23]. The Department's information will provide estimates of installed capacity, but further calculations will need to be made to understand potential production from those generators. Larger generators (> 500 kW) are likely to have provided actual production information to the Department, which can be provided upon request. The table below provides sample calculations for solar, wind, and hydro resources[24].

Solar	MWh of energy = (number of MW) * (8760 hours per year) * (0.14 to 0.25 capacity factor)
Wind	MWh of energy = (number of MW) * (8760 hours per year) * (0.25 to 0.35 capacity factor)

[23] The Vermont Energy Atlas allows for searching of generator information by size, type, and location, all of which can be exported to spreadsheets that can then be used to sort and summarize generator information however, it has largely not been updated since late 2019 (with some exceptions), and while the information on distributed generation is now out of date, the information on larger systems should still be relatively accurate until the Department can make an updated map available.

[24] Capacity factors in this table derived from Lawrence Berkely National Labs *PV Capacity Factors* and ISO New England *Final 2022 PV Forecast*, and National Renewable Energy Laboratory *Utility-Scale Energy Technology Capacity Factors,* and Vermont Distribution Utility Integrated Resource Plans. Example capacity factors for additional technologies are available in this resource, developed in 2023 by the Department of Public Service in collaboration with the Regional Planning Commissions to support discussions around the Renewable Energy Standard.

Hydro	MWh of energy = (number of MW) * (8760 hours per year) * (0.40 capacity factor)

Regions and municipalities should include information in their plans on installed renewable generation capacity, along with estimates of, or actual production from in-region or in-municipality generators. This information will also be shown by town in regional plans.

9B. Does the plan analyze generation potential, through the mapping exercise (see Mapping standards, below), from potentially suitable areas in the region? [and for regions, break this information down by municipality?]

Planners should use the mapping exercise (see Section 3) to estimate the potential for renewable generation from different sources.

Solar: Planners should begin by estimating the generation potential from rooftop solar. One methodology for estimating rooftop potential is to multiply the number of residential and commercial structures that could host a roof-mounted solar system by an average system size for each type of structure. In Bennington County's 2017 Enhanced Energy Plan, for example, the following methodology was used:

Type of structure	**# of structures suitable for rooftop solar**	**Average size of rooftop system**	**Total capacity**
Residential	3,500 (25% of total)	4 kW	14 MW
Small Commercial (<40K sf)	500 (25% of total)	20 kW	10 MW
Large Commercial (>40K sf)	50 (50% of total)	200 kW	10 MW

Similarly, in their 2018 Energy Plan, NVDA estimated rooftop solar potential based on 10% of residential and small commercial structures and 3% of large commercial structures, using the same average rooftop system size as Bennington County.

The number of structures with solar-compatible rooftops will vary based upon the physical characteristics of the rooftops (age, roof pitch and direction, structural issues, shading) as well as ownership considerations. A more detailed discussion of considerations, as well as updated potential estimates by state, is available here: http://www.nrel.gov/docs/fy16osti/65298.pdf.

For ground-mounted solar, municipalities and regions should estimate the amount of solar that could be developed in their preferred and potentially suitable areas. One methodology for estimating ground-mounted solar potential is to divide the number of acres available in these types of locations (from the Mapping exercise in Section 3) by the amount of acreage required for a solar facility (8 acres per MW). Once you have that figure, you can multiply it by the number of hours in the year and the capacity factor of solar in Vermont to estimate the amount of production from solar in these areas, as follows:

Ground-mounted solar potential	
Capacity (megawatts, or MW)	= acres available in preferred and potentially suitable areas / 8 acres per MW of solar

Generation (megawatt-hours, or MWh)	=MW of solar potential capacity from above x 8760 hours per year x 0.14 (to 0.25) solar capacity factor

Wind: The area occupied by a wind project depends upon its scale. Projects involving single residential- or commercial-scale turbines (See Figure 5 under Standard 13) may only directly impact the ground under the area of the foundation, particularly if access roads are not required. These projects are generally located on-site at homes, farms, businesses, and institutions, so the land area needed is often just correlated to the size of the parcel on which they are sited.

Utility-scale projects involving multiple large wind turbines generally entail 0.75-4 acres per MW of direct impact area (temporarily and permanently disturbed area due to physical infrastructure development), or 14-75 acres of total area (land associated with the complete wind project).

One way of estimating wind potential is to divide the number of acres identified in preferred and potentially suitable locations for wind (from the Mapping exercise in Section 3) by the amount of acreage needed to site a wind facility (4 acres per MW of direct impact area). Once that figure has been calculated, it can be multiplied by the number of hours in the year and the capacity factor of wind in Vermont to estimate the amount of production from wind in these areas, as follows:

Wind potential	
Capacity (megawatts, or MW)	= acres available in preferred and potentially suitable areas / 4 acres per MW of wind
Generation (megawatt-hours, or MWh)	=MW of wind potential capacity from above x 8760 hours per year x 0.35 wind capacity factor

Wind potential is also very site-specific, so other approaches for estimating wind potential may be suitable, depending on municipal and regional preferences.

Hydro: For hydropower, identify existing, non-powered dam sites where a generator could be installed – or existing hydropower sites where equipment could be upgraded or expanded to provide additional generation – and the potential nameplate capacity and potential production.[25] In performing this exercise, it is important to gain a familiarity with the relative time and expense involved with permitting hydropower projects, which are reviewed at the federal level.[26]

[25] The Undeveloped Hydroelectric Potential of Vermont, Appendix A, and Potential Sites: Lori Barg, Community Hydro, 2008; see also The Development of Small Hydroelectric Projects in Vermont: VT Agency of Natural Resources

[26] Act 165 Report: A Report to the Vermont General Assembly on Progress Toward an MOU Program for Expediting Development of Small and Micro Hydroelectric Projects: VT Department of Public Service (2014)

Biomass and Methane: Production estimates for biomass combined heat and power,[27] biomass district heat, and methane generators will be extremely site specific. Rather than estimate production potential from these resources, it may be most useful for planners to identify potential sites (large institutional users of heat, clusters of buildings that could be connected by steam or hot water pipes, medium and large farm operations, food waste processors and large sources of institutional food waste, landfills, and wastewater treatment plants) and discuss the relative availability of such feed stocks/sites in the municipality and region.

This information should be presented in tabular format broken down by municipality.

9C. Does the plan identify sufficient land in the municipality or region for renewable energy development to reasonably reach 2050 targets for renewable electric generation, based on population and energy resource potential (from potential resources identified in the Mapping exercise, below), accounting for the fact that land may not be available due to private property constraints, site-specific constraints, or grid-related constraints?

For municipalities: If N/A, please describe how you are working with your regional planning commission to ensure overall regional objectives are achieved.

In order for Vermont to reach its long-term energy targets, a variety of generation resources will be needed, including wind, solar, hydro, and biomass (either imported or domestically produced). These sources all generate energy at different times of day and times of year, and can balance one another, to some extent. Building the grid sufficient to meet Vermont's needs with only one resource type would be far more expensive than building a grid that can rely on diverse resources, including storage and other flexible loads.

Sufficient Land for Solar: In Standard 9B, above, municipalities and regions identified solar and wind resource potential from preferred and potentially suitable areas. For ground-mounted solar, an estimate of potential was based on an average of 8 acres/MW. To account for the fact that land in the preferred and potentially suitable areas may not ultimately be available or suitable for siting solar, municipalities and regions should build a contingency into their calculations of whether they have identified sufficient land in these areas to meet targets. One method to determine sufficient land for ground-mounted solar is to adopt a contingency figure of 60 acres per MW of target generation. By substituting "60" for "8" in the ground-mounted solar potential calculation above, you will be able to determine whether you have identified enough land in preferred and suitable areas to meet your selected targets. This allows for the fact that some property owners may not be interested in hosting solar, that interconnection costs may be high in some locations, that competition between possible sites will encourage low-cost and thoughtful siting, that some suitable areas may be small or awkwardly shaped, etc.

Sufficient Land for Wind: For municipal and regionally identified wind targets, sufficient land is defined as 25 acres per MW of target generation. For example, if a municipality and region has selected a target

[27] New electric generation from wood should include combined heat and power technology to maximize efficiency. Electric-led wood generation should be avoided.

of 1 MW of new wind, at least 25 acres should be identified in preferred and potentially suitable areas. In this example, only around 3-4 acres would actually be needed to accommodate 1 MW of wind, but by planning based on 25 acres/MW, municipalities and regions will be accounting for contingencies such as property owners not interested in leasing their land, interconnection costs that may be too high in some locations, and unsuitability of certain sites after site-specific evaluation.

9D. Does the plan ensure that any regional or local constraints (regionally or locally designated resources or critical resources, from 12B and 12C under Mapping, below) do not prohibit or have the effect of prohibiting the provision of sufficient renewable energy to meet state, regional, or municipal targets?

Municipalities only: If N/A, please describe how you are working with your regional planning commission to ensure overall regional objectives are achieved.

Municipalities and regions may add regionally and locally designated resources or critical resources to the known and possible constraint layers in the Mapping Standards (see Regional Mapping Standards 12B and 12C/Municipal Mapping Standards 13B and 13C). These will ultimately flow through to the Primary and Secondary Resource Potential maps, and can have the effect of designating areas as possibly or likely unsuitable for renewable energy development. However, if the constraints would have the effect of preventing the State, region, or town from reaching its selected targets, the plan will not meet this standard. Providing maps, narratives, and even supporting documentation (like natural or scenic resource inventories) describing regionally and locally designated resources and the analysis of generation potential (Standard 9B) is critical for this criteria. A municipality or region may restrict development in certain areas, but there must be sufficient land left in the preferred and potentially suitable areas to meet selected targets.

For example, if a municipality or region were to seek to elevate agricultural soils from a possible to a known constraint based on plan policies – resulting in such areas disappearing not only from the Primary Resource Potential but also the Secondary Resource Potential maps – it would be incumbent upon the municipality or region to prove that there are sufficient preferred or potential areas elsewhere to accommodate enough solar to reach the municipality's or region's solar targets.

9E. Does the plan include policies and objectives to accompany maps (could include general siting guidelines), including policies and objectives to accompany any preferred, potential, and unsuitable areas for siting generation (see Regional/Municipal Mapping Standards 12/13 and 13/14 under Mapping , below)?

Land Conservation Measures: While the maps are extremely important to show where resources, constraints, and unsuitable areas exist, it is also necessary to include text in the plan that describes these mapped elements. Specifically, plans must include descriptions of land conservation measures as well as specific policies that say where development should and shouldn't happen, and why. These are what the Public Utility Commission will review when they are looking to understand whether a project will interfere with orderly development of the region, which is one of the criteria reviewed during the Section 248 process. Moreover, it is essential that such land conservation measures and policies are not only specific but also written in clear and unqualified language, articulating mandatory terms, for example by using the terms *shall* (not *should*) and *must* (not *may*). Both the locations and the reasoning

behind their selection (for either preferred, potential, or unsuitable areas) should be described in the plan and reflected in the policies.

Unsuitable Areas: When municipalities or regions designate areas as unsuitable (*i.e.*, "no go"; see Regional / Municipal Mapping Standard 13/14 and *Figure 4*) for certain types and scales of renewable energy generation, having clear policies becomes particularly important. Municipalities and regions must treat renewable energy generation facilities in a similar manner to other types and scales of development, in terms of allowable land uses in particular areas. This will not be reflected in the maps, but must be articulated in the policies. For example, if a plan designated certain land as unsuitable for all development because it is above 1,700' and within priority forest blocks necessary for landscape-scale connectivity, it would therefore be acceptable to designate as unsuitable for a type and/or scale of renewable energy technology.

Preferred Locations: Municipalities and regions are encouraged to designate preferred areas for siting particular types and/or scales of renewable generation, for example, former gravel pits or brownfields (see Regional/Municipal Mapping Standard 12/13E) may choose to encourage certain design or other guidelines for how they would like to see projects developed in these locations, keeping in mind that some of these locations might already be challenging to cost-effectively develop, particularly if remediation of the site is required. Such guidelines should be written into the policies of the plan. In addition to guidelines for development of renewable generation in preferred areas, plans could similarly require renewable energy be incorporated when certain types of parcels or facilities are being developed or redeveloped. For example, a policy could encourage or require the examination of the potential for a solar array when redevelopment of a brownfields site is proposed.

9F. Does the plan prioritize maximizing the potential for renewable generation on preferred locations (such as the categories outlined under Regional / Municipal Standard 12/13E in the Mapping standards, below)?

Municipalities and regions are strongly encouraged to identify preferred locations for the siting of renewable energy generation facilities. By clearly identifying types of locations that are preferred (see examples under Regional/Municipal Mapping Standard 12/13E below) and especially by mapping specific locations, regions and municipalities are sending a message to potential developers that these are the locations where they would like to see development occur. The identification of both preferred and unsuitable – along with the middle ground of "potential" – areas also lays out a vision for future energy development in your area that can be understood and applied in a regulatory proceeding.

Furthermore, municipalities and regions are being asked under this standard to demonstrate a commitment to prioritizing renewable generation in preferred locations. This can be done not only by identifying preferred locations (generally as well as specific parcels), but also by having a discussion in the plan of the relative amount of the municipality's or region's renewable generation targets that could potentially be sited in such locations, alleviating siting pressure on the unsuitable and even the potential (but not preferred) locations.

There are several additional actions a municipality or region may take to ensure that the potential of those preferred areas is maximized. Municipalities and regions can:

- Support siting solar generation systems on the built environment by participating in Section 248 proceedings when appropriate projects are being proposed for preferred areas.
- Promote and/or structure policies and incentive programs to promote installation of solar projects where there is electric demand, and on locations where the land has already been impacted (e.g. roofs, parking lots, landfills).
- Support updates to municipal building standards and energy codes that promote incorporation of solar photovoltaics for new construction and major renovations. (This policy is applicable if preferred locations include rooftops.)
- Promote or adopt building code requirements that require passive solar design and siting principles to be incorporated into new buildings that have a large hot water load (i.e. laundromats, hotels).
- Develop guidelines for developers seeking preferred siting letters for net-metering projects.

9G. (Municipalities Only) Does the plan demonstrate the municipality's leadership by example with respect to the deployment of renewable energy?

Municipalities are required to lead by example and demonstrate their commitment to the development of renewable energy generation facilities, though this can vary depending on their capacity to undertake such initiatives. Actions that towns could take to show such commitment include:

- The installation of solar thermal or photovoltaic systems on town buildings or parcels, where practicable, to offset municipal electric use.
- Facilitation of the development of community-led projects.
- Engagement of the community in the planning, design, and benefits of a community-based project.
- Entering into a net metering credit purchase agreement with a renewable generation facility.

Please note that this list is not exhaustive, it merely gives a few possible options.

9H (Municipalities) / 9G (Regions). Other

Please use the notes section to describe additional approaches that your municipality or region is taking.

If your municipality or region is implementing additional approaches that meet the intent of Standard 9, but are not covered under the previous standards in this section, please describe them further in the notes section. See below for examples of additional approaches.

- Encourage the development of locally controlled renewable energy projects as a way to strengthen community support for otherwise challenging-to-site projects.
- Encourage utilities to offer customers the option of making renewable energy project loan payments on their utility bills.
- Provide firefighters with basic training in fighting fires on structures that have solar installed.
- Provide training to solar installers on the latest fire and electric safety codes, to increase safety and help to secure solar generation.
- Establish construction practices for project-related roads and other practices that facilitate low-cost decommissioning and effective soil and site reclamation.

(New Standard) Pathways Standard 10

Does your plan's energy element assess the potential equity impacts of the policies and objectives included to meet standards 6-9?

As regions and municipalities develop enhanced energy plans, Act 174 now requires that they assess the potential equity impacts of the policies and objectives included under standards 6-9 to help ensure the transitions required to meet Vermont's renewable energy goals and GHG requirements work to make energy more accessible and democratically managed for all Vermont communities.[28] Such assessments should consider several different issues such as:

- Who are the relevant stakeholders, target populations, and/or impacted and frontline communities related to the policy or objective? Were they or will they be consulted in the development of the policy or objective?
- What are the intended outcomes of the policy or objective and how will their benefits and burdens be distributed across focus populations?
- Are efforts being taken to mitigate or redress any adverse impacts that might occur?
- What data and/or metrics might be required to assess such implications? Does the region have access to such data or the ability to collect it?

The Department understands that discussions of policies and objectives in regional or municipal plans may at times be broad, speaking to future initiatives or frameworks to utilize. In this case, regions or municipalities might describe tools they will use to evaluate these future initiatives or frameworks, such as a set of questions and a process through which to transparently evaluate them.

Separate from assessments of specific policies or objectives, regions and municipalities may also want to consider developing a Community Engagement Plan to indicate when and how they plan to engage with their communities to help inform the assessment they will undertake to meet this standard.

Example of Meeting Standard 10 in a Regional or Municipal Plan

In 2023, Northeastern Vermont Development Association readopted their regional plan, in the process developing an Assessment and Report which addressed new requirements under Act 174 Standards including Standard 10. The Assessment & Report offers one example of how regions or municipalities might approach addressing this standard, highlighting specific goals for the region related to advancing equity and environmental justice (pages 1-4) and interweaving conversations around equity throughout the sector-specific analyses.

Useful Resources

There are several resources regions can reference when considering equity impact assessments including:

- Chapter 3 of the Comprehensive Energy Plan, which provides foundational definitions of and dimensions related to energy equity and context on how the Department aims to enhance such considerations moving forward.

[28] See Chapter 3 of the 2022 Comprehensive Energy Plan, citing the *Initiative for Energy Justice*

- The Guiding Principles for a Just Transition and related assessment tools and questions adopted by the Vermont Climate Council to guide their work. This includes definitions and examples of frontline and impacted communities.
- *The State of Equity Measurement: A Review of Practices in the Clean Energy Industry* report by VEIC
- *ACEEE's Leading with Equity Initiative: Key Findings and Next Steps,* which includes proposed metrics
- Work of and references shared by the Energy Equity Project (including the 2022 Energy Equity Project Report) or Initiative for Energy Justice
- Forthcoming rules, guidance, and tools to effectuate environmental justice in Vermont pursuant to Act 154 of 2022 (see https://anr.vermont.gov/about-us/civil-rights-and-environmental-justice/vermont-ej-law, particularly the Environmental Justice Learning Library).
    - *Connecting People to Power - Community Engagement Pilot Report – Presents the results of a recent community engagement pilot done by the Agency of Natural Resources Department of Environmental Conservation and includes suggested best practices and lessons learned*
- Guidance released by the Department of Energy on implementation of the Justice40 initiative.
- Efficiency Vermont Energy Burden Report (the 2019 Energy Burden Report currently available; an update is in progress)
- Data from a variety of different state and federal tools including:
    - Climate and Economic Justice Screening Tool
    - Vermont Department of Health Vulnerability Indicators, including the Heat and Social Vulnerability Indices
    - Department of Energy Low-income Energy Affordability Data (LEAD) Tool LEAD
    - Microdata from the Residential Energy Consumption Survey (RECs) conducted by the Energy Information Administration
    - Vermont Agency of Transportation Transportation Equity Framework (broadly, and the online mapping tool)
    - *Forthcoming* Municipal Vulnerability Index – a tool being developed in the Vermont Climate Council Rural Resilience and Adaptation Subcommittee

Identifying Focus Populations

A critical part of equity impact analysis involves identifying communities how have historically faced inequities around a particular issue (ex. barriers to access benefits or bearing disproportionate burdens) or are on the frontlines of issues like the climate crisis or clean energy transition. In Vermont, there are several different ways these communities can be identified. Here, we highlight three definitions in particular:

Environmental Justice Focus Populations (EJFP)

Act 154 of 2022 sets the environmental justice policy for Vermont. The policies sets a definition of "environmental justice focus populations", which are any cencus block group meeting the following criteria:

- Annual median household income is not more than 80% of the state median income;
- Persons of Color and Indigenous Peoples comprise at least 6% of more of the population; or
- At least one percent or more of households have limited English proficiency.

Under Act 154, the Agency of Natural Resources will be developing a tool to help identify these communities in Vermont. You can stay up to date on those efforts on this website.

Impacted and Frontline Communities

The *Guiding Principles for a Just Transition*, developed to informed work of the Vermont Climate Council, defines frontline & impacted communities according to four criteria:

- Are highly exposed to climate risks, such as health impacts, flooding, and extreme temperatures;
- Experience oppression and racism, are excluded from opportunities, or have less resources to adapt to climate and economic change;
- Bear the brunt of pollution and negative effects from today's fossil fuel and extractive economies; and
- Are more likely to experience a job transition as Vermont addresses climate change.

These is no tool that specifically identifies these communities, but the *Guiding Principles for a Just Transition* provides examples of communities that might experience one or more of the criteria.

Justice40 Disadvantaged Communities (DACs)

The Justice40 initiative is a goal established by the Federal Government that 40 percent of overall benefits from certain federal investments will "flow to disadvantage communities that are marginalized, underserved, or overburdened by pollution" (source). The Climate and Economic Justice Screening Tool (CEJST) identifies census tracts that qualify as DACs based on several different criteria.

Section 3: Mapping

Act 174 requires plans to identify potential areas for the development and siting of renewable energy resources and areas that are unsuitable for siting those resources or particular categories or sizes of those resources. It also requires that the standards address the potential generation from these areas. Lastly, it requires that – in order to receive an affirmative determination – regional plans (or municipal plans not using their region's maps) allow for the siting in the region of all types of renewable generation technologies.

The *Mapping* standards lay out a sequence of steps for planners to:

1) examine existing renewable resources and identify potential (and preferred) areas for renewable energy development, and
2) identify areas less suitable for development, by layering constraint map layers on to raw energy resource potential map layers.

The maps should help regions visualize and calculate the potential generation from potential areas, and compare it with the 2025, 2035, and 2050 targets from the *Analysis and Targets* standards to get a sense of the scale and scope of generation that could be produced within the region to meet the region's needs.

Plans must include maps that address all of the standards below, unless N/A is provided as an option. If N/A is selected, regions (or municipalities not using their region's maps) must provide a compelling reason why the standard is not applicable or relevant in the Notes column. Regions must develop their own maps, and then break out the maps for their municipalities.

Municipalities can use their region-provided maps to meet the municipal *Mapping* standards. For municipalities interested in developing their own maps or adding additional constraint layers to the maps developed by the regional planning commissions please utilize the guidance provided for regions in this section. It is important to note that municipalities seeking a determination of energy compliance and not using the maps provided by their regional planning commission must ensure that its approach, if applied regionally, would not have the effect of prohibiting any type of renewable generation technology in all locations, i.e. they must plan for all types of renewable generation facilities. Types in this case means categories of renewable generation (e.g. solar, wind, biomass, hydro), and does not require that all scales of a given technology be accommodated.

The map, any text related to how the maps were constructed, and the text describing specific policies applicable to map features, should all be complementary. This will help ensure that any "land conservation measures and specific policies" that might be given substantial deference in the context of a particular project review under 30 V.S.A. § 248 are clearly identifiable in the text, should a map lack sufficient clarity or granularity regarding the area in which a project is proposed.

Updates to Mapping Tools

In 2022 and 2023, the Department of Public Service collaborated with Vermont Center for Geographic Information (VCGI) to update a number of the mapping layers including:

- Known & Possible Constraints Data
- Renewable Wind & Solar Energy Potential
- Rooftop Solar Data

The data release page for these data is located at https://vcgi.vermont.gov/data-release/act-174-statewide-energy-planning-data-updated-known-and-possible-constraints

VCGI has also updated the Planning Atlas with these layers, which can be viewed by selecting "Act 174 – "Energy Planning" from the dropdown menu. GIS practitioners may also wish to visit the Open Geodata Portal (Search for 'act 174' | Vermont Open Geodata Portal Your source for geospatial data) and/or the Geocortex Viewer for HTML5 (vermont.gov).

A video training on the updated mapping tools is available at https://www.youtube.com/watch?v=zTg-b_myJy0.

Mapping Standard 11 (Municipalities Only)

Does your plan contain one or more maps that address 12-14 below, as provided by your Regional Planning Commission or as developed by your municipality?

For municipalities utilizing the maps provided by their regional planning commission, please check "Yes – Region" and skip Mapping Standards 12-14. Otherwise please check "Yes – Custom" and address Municipal Mapping Standards 12-14 as instructed in the following sections.

Regional Mapping Standard 11 / Municipal Mapping Standard 12

Does the plan identify and map existing electric generation sources?
Maps may depict generators of all sizes or just those larger than 15 kW, as long as information on generators smaller than 15 kW is summarized and provided or referenced elsewhere. It is expected that the best available information at the time of plan creation will be used. This information is available from the Department.

The Department maintains a sortable spreadsheet of permitted and interconnected generators that includes type and size of generation and the town and utility service territory the generator is located in. This spreadsheet is currently available to regions and municipalities by request and the Department is also working to establish a data portal through which it can make this information regularly available on its website, both as a CSV file and a map layer.[29]

[29] Historically, the Department had provided this spreadsheet to the Energy Action Network on a quarterly basis, where it was used to underpin the Energy Atlas, an online mapping tool. The Energy Atlas allows for easy visualization of different types and sizes of renewable energy generators by municipality and region. The Atlas also allows users to export the list of sites from the maps that have been created; the exported spreadsheets can then be used to sort and summarize generator information. The Energy Atlas still provides an easy to access source for this information, and likely still includes up to date information on larger systems, but has not been updated since 2019. Address data is not required for systems <15 kW (so long as information on generators that size is summarized elsewhere) and locations for generators newer than 2019 can often be pulled from Certificate of Public Good (CPG) information from Public Utility Commission ePUC site (https://epuc.vermont.gov/?q=node/120).

Regional Mapping Standard 12 / Municipal Mapping Standard 13

Does the plan identify potential areas for the development and siting of renewable energy resources and the potential generation from such generators in the identified areas, taking into account factors including resource availability, environmental constraints, and the location and capacity of electric grid infrastructure?

Maps should include the following (map layers available from VCGI), and the resulting Prime and Secondary Resource Map (A, B, and C below will likely be shown on a single map) will together comprise "potential areas":

12A / 13A. Raw renewable potential analysis (wind and solar), using best available data layers (including LiDAR as appropriate).

Unlike the more comprehensive consideration of potential renewable generation sources in the Pathways standards, the Mapping standards only entail a review of solar and wind potential. Wind and especially solar resources tend to be more prevalent in distribution across the landscape, whereas hydroelectric, combined heat and power, and biogas are much more geographically restricted (hydroelectric in terms of existing dams, combined heat and power in terms of a user for the heat and possibly biomass availability, and biogas in terms of manure, food, etc. waste availability).

Under this standard, solar and wind potential should be looked at strictly from a resource (solar insolation, wind speed) perspective. The assessment is made later, and separately, of potential natural resource and other constraints to harnessing solar radiation or blowing wind for renewable power production.

The "base layers" for wind and solar potential created for the initial round of Act 174 enhanced energy plans were updated in 2022 by VCGI. The existing solar resource layer represents solar ground-mounted potential. It considers incoming solar potential (with a lower value cutoff of 1,000 kWh/m^2), slope (anything ≤ 14°), and direction (90° due east clockwise to 270° due west). It should only be used to estimate ground-mounted – not rooftop – solar resource potential. Since the initial round of mapping was completed, the State has collected statewide high-resolution LiDAR data. The Department is currently working with VCGI and representatives of the RPCs to consider how such data could be used to estimate rooftop solar potential. Results of these efforts, once complete, will be shared publicly for the regions to use to enhance their analysis of solar potential, with supporting documentation. In the meantime, or if this data cannot be used effectively to estimate rooftop solar potential, roof-mounted solar potential can be separately estimated using the methodology offered in Standard 9B, above.

The wind resource layers utilized data from the National Renewable Energy Laboratory (NREL)[30] and comprise three sets:

[30] https://www.nrel.gov/gis/wind.html

Scale	Residential	Commercial/Community	Utility
•Hub Height •Lower Wind Speed Cutoff	•30 Meter •4.5 m/s	•50 Meter •5.5 m/s	•70 Meter •6.5 m/s

Figure 1: Wind Resources Layer Detail

Generally, wind speeds increase with elevation; however, there may be sites at lower elevations suitable for the development of wind power projects, particularly at the residential and commercial or community scales (≤ 100 kW), but also at the utility scale (≥ 1 MW), given recent advancements in wind turbine technologies.[31] As with solar, wind as a resource is only one factor in the consideration of whether a site is viable for the deployment of a particular technology. In the pyramid below, the wind and solar resource maps primarily represent "resource potential." The constraint layers that the standards ask planners to consider next help narrow the field to "technical potential." Economic and market potential are based on real-time factors and the decisions of landowners and developers based on site-specific considerations and project economics, and are therefore addressed outside of the context of the standards and the plans (although planners are encouraged to consider and discuss these limitations on deployment potential).

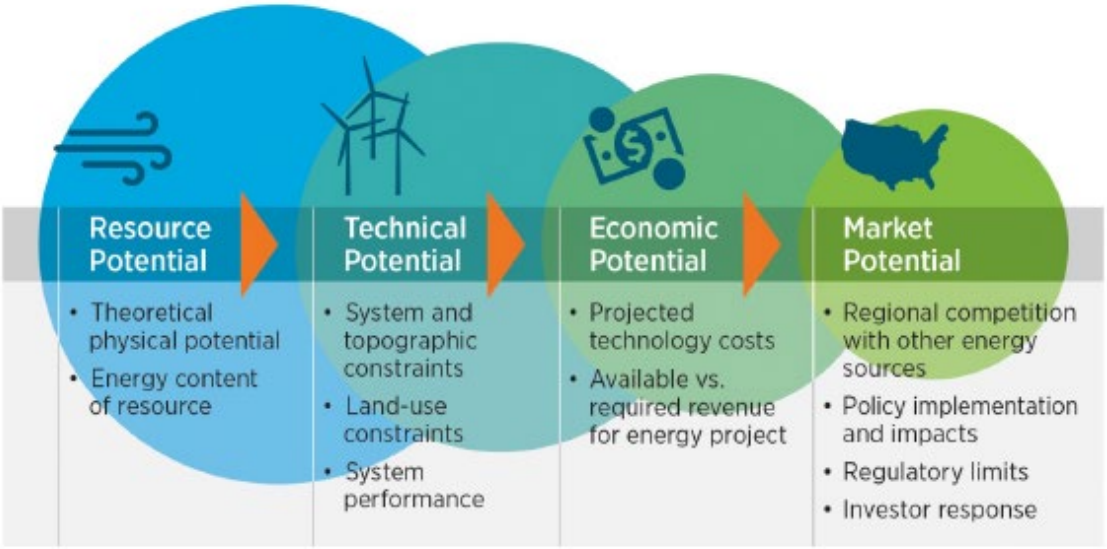

Figure 2: Types of Renewable Generation Potential
Source: National Renewable Energy Laboratory

[31] https://www.energy.gov/sites/prod/files/2015/05/f22/Enabling-Wind-Power-Nationwide_18MAY2015_FINAL.pdf

12B / 13B. Known constraints (signals likely, though not absolute, unsuitability for development based on statewide or local regulations or designated critical resources)

"Known constraints" are high-priority constraints that limit where energy can be generated. Energy generation facilities are not very likely to be developed in these areas due to the presence of natural resources that are regulated at the federal, State, or local level. Removing these constraints from the raw resource potential layers described in Standard 12A will produce "Secondary Resource Maps," which can be used to demonstrate areas that have good renewable resource potential without high-priority constraints. Site-specific study would be required to ascertain whether one of the mapped constraints truly exists on the site; and some sites not captured by the Known constraints map layers may indeed have such high-priority constraints, again depending on the results of site-specific study. The maps are thus good indicators, but not definitive siting tools. It is important for plans to articulate their policies regarding each of the constraints below, to help guide developers and regulators in understanding the region's policies with respect to each constraint, and to help guide decision making.

In the update to the standards in 2022 many of the known constraint layers remained the same. Changes that were made are highlighted where relevant. As noted above, the Department worked with VCGI to update the Act 174 known constraints shapefile to align with the new standards.

Known Constraints:

- Confirmed Vernal Pools from Vermont Center for Ecostudies– *updated in 2022 standards update Note: Vernal Pools (unconfirmed layers) have been moved to standard 12C under possible constraints.* A vernal pool is a small wetland in a shallow natural depression that typically fills with water during the spring and/or fall and may dry during the summer. Vernal pools have no permanent inlet stream and no viable populations of fish. Vernal pools are typically sparsely vegetated with herbaceous plants and are shaded by trees from the surrounding upland forest. Many vernal pools provide critical breeding habitat for amphibians.

  This dataset is derived from a project of the Vermont Center for Ecostudies (VCE) and Arrowwood Environmental (AE) to map vernal pools throughout Vermont. VCE provided VCGI a snapshot of the data in July 2022 for use in enhanced energy planning. More recent data may be available from VCE. The "confirmed" dataset represents only those pools which have been field-verified and meet physical and biological criteria as vernal pools. . Additional information on the Vernal Pool Mapping Project and Vernal Pool Atlas may be found at: https://val.vtecostudies.org/projects/vermont-vernal-pool-atlas/.

- DEC River Corridors
  River corridors encompass an area around and adjacent to the present channel where fluvial erosion, channel evolution and down-valley meander migration are most likely to occur. River corridor widths are calculated to represent the narrowest band of valley bottom and riparian land necessary to accommodate the least erosive channel and floodplain geometry (i.e. equilibrium conditions) that would be created and maintained naturally within a given valley setting. River corridors are developed to facilitate ANR's responsibilities in providing municipalities, regional planning commissions, Act 250 District Commissions, and the Public Utility Commission with technical assistance and information concerning river sensitivity and fluvial erosion hazards. Vermont river corridors include areas where active, potentially hazardous river erosion and deposition process have occurred or are likely to occur. These

delineations do NOT indicate that areas outside river corridors, particularly those immediately abutting the river or river corridor are free from fluvial erosion hazards. River corridors are delineated to provide for the least erosive meandering and floodplain geometry toward which a river will evolve over time. River corridor maps guide State actions to protect, restore, and maintain naturally stable meanders and riparian areas to minimize erosion hazards. Land within and immediately abutting a river corridor may be at higher risk to fluvial erosion during floods. For a thorough discussion of the purpose, design and management of the Vermont River Corridors dataset, please see the "Vermont DEC Flood Hazard Area and River Corridor Protection Procedures December 5, 2014" http://www.vtwaterquality.org/rivers/docs/FHARCP_12.5.14.pdf.

This dataset is part of the “applicable maps” used in conjunction with other best available stream geomorphic data to implement both the Flood Hazard Area and River Corridor “Rule” and “Protection Procedure.” The data will be updated over time as described in the Procedure. The date of the version posted on the Vermont Natural Resource Atlas indicates the most recent update. Users should cite the Creation Date for the version. Data processing was done using ArcGIS 10.x, Spatial Analyst, and Arc Hydro Tools 2.0. Source and digitized data included VT Meander Centerlines (MCLs), VT Reach Break points, VT Hydrography streams, VT 10-meter DEM, VTHYDRODEM, HUC 8 Basins, and VT Roads and Railroads. Major derived datasets include raster and vector valley walls, catchments per stream reach, variable-width MCL buffers, and the final River Corridor. A Frequently-Asked Questions page is available at: http://floodready.vermont.gov/rcfaq

- FEMA Floodways
  The channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot at any point. Flood hazard areas and floodways may be shown on separate map panels.

  The entire Vermont extent of the National Flood Hazard Layer (NFHL) as acquired 12/15/15 from the FEMA Map Service Center msc.fema.gov upon publication 12/2/2015 and converted to VSP. The FEMA DFIRM NFHL database compiles all available officially digitized Digital Flood Insurance Rate Maps. This extract from the FEMA Map Service Center includes all of such data in Vermont including counties and a few municipalities. This data includes the most recent map update for Bennington County effective 12/2/2015. DFIRM - Letter of Map Revision (LOMR) DFIRM X-Sections DFIRM Floodways Special Flood Hazard Areas (All Available).

  FEMA is in the process of updating maps across Vermont. Once complete, these updates may provide better resolution for certain areas of the state. Final maps are estimated to be available between 2023-2025 depending on location, which may affect constraint areas for Regional Planning Commissions and municipalities updating their plans after that time. More information is available at https://floodtraining.vermont.gov/protection-tools/get-ready-new-fema-flood-insurance-rate-maps.
- State-significant Natural Communities and Rare, Threatened, and Endangered Species

The Vermont Fish and Wildlife Department's Natural Heritage Inventory (NHI) maintains a database of rare, threatened and endangered species and natural (plant) communities in Vermont. The database is split into two different geographic datasets—one for Significant Natural Communities and one for Rare, Threatened, and Endangered Species. The Department is a member of the network of Natural Heritage Programs and Conservation Data Centers network that collaborates with NatureServe, which is the umbrella organization. The Element Occurrence (EO) records that form the core of the Natural Heritage Inventory database include information on the location, status, characteristics, numbers, condition, and distribution of elements of biological diversity using established Natural Heritage Methodology developed by NatureServe and The Nature Conservancy. An Element Occurrence (EO) is an area of land and/or water in which a species or natural community is, or was, present. An EO should have practical conservation value for the Element as evidenced by potential continued (or historical) presence and/or regular recurrence at a given location. For species Elements, the EO often corresponds with the local population, but when appropriate may be a portion of a population or a group of nearby populations (e.g., metapopulation). For community Elements, the EO may represent a stand or patch of a natural community, or a cluster of stands or patches of a natural community. Because they are defined on the basis of biological information, EOs may cross jurisdictional boundaries. An Element Occurrence record is a data management tool that has both spatial and tabular components including a mappable feature and its supporting database. EOs are typically represented by bounded, mapped areas of land and/or water or, at small scales, the centroid point of this area. EO records are most commonly created for current or historically known occurrences of natural communities or native species of conservation interest.

- National Wilderness Areas
  Federally owned land that is preserved in its natural condition, where mechanized recreation or development is typically prohibited.

- Class 1 and Class 2 Wetlands (VSWI and advisory layers)
  This dataset represents wetlands included in Vermont's Significant Wetlands Inventory (WaterWetlands_VSWI). Questions about wetland location and use should be referred to the ANR DEC Wetlands section, 802-244-6951. NWI maps were used by the State of Vermont Agency of Natural resources as a means of creating this data layer in conjunction with the VSWI. The NWI and VSWI were joined by a union, to create the new 2010 Vermont Significant Wetland Inventory data layer, representing Vermont's regulatory wetlands. The VSWI prior to 2010 was created by hand digitizing nearly two-thirds of Vermont's wetlands from RF 24000 scale NWI mylars. The remainder of the State was scanned from RF 24000 or RF 25000 scale mylars. These mylars were created by transferring wetland polygon boundaries from RF 62500 scale NWI mylars to RF 24000 scale base maps.

- Regionally or Locally Identified Critical Resources
  If areas are constrained for the development of renewable energy due to the desire to protect a locally designated critical resource (whether a natural resource or a community-identified resource), then the land use policies applicable to other forms of development in this area must be similarly restrictive; for this category, policies must prohibit all permanent development (and should be listed in the Notes column).

These areas should be subtracted from raw renewable energy resource potential maps to form Secondary Resource Maps.

12C / 13C. Possible constraints (signals conditions that would likely require mitigation, and which may prove a site unsuitable after site-specific study, based on statewide or regional/local policies that are currently adopted or in effect).

"Possible constraints" are lower-priority constraints. These constraints can impact the siting process for generation facilities, and should always be considered in planning for these facilities, but do not necessarily preclude placement in corresponding areas. Site-specific solutions are often possible when one of these conditions exists. Removing these constraints from the Secondary Resource Maps developed in Standard 12B produces "Prime Resource Maps," which can be used to demonstrate areas that have good renewable resource potential without any mapped constraints whatsoever. As with the Known constraints, site-specific study would be required to ascertain whether one of the mapped constraints truly exists on the site; and some sites not captured by the possible constraints map layers may indeed have such lower-priority constraints, again depending on the results of site-specific study. As discussed above, the maps are thus good indicators, but not detailed enough to use for siting individual projects. It is therefore similarly important for plans to articulate their policies regarding each of the constraints below, to help guide developers and regulators in understanding the region's policies with respect to each constraint, and to help guide decision making.

Including but not limited to:

- Unconfirmed Vernal Pools from VCE (potential and probable layers) – *updated in 2022 standards update*
  As noted under standard 12B, the Vernal Pools dataset is derived from a project by the Vermont Center for Ecostudies (VCE) and Arrowwood Environmental (AE) to map vernal pools throughout the State of Vermont. This 'unconfirmed' dataset represents "potential" and "probable" vernal pools which have not yet been field-visited or otherwise verified. ("Potential" vernal pools were remotely mapped from color infrared imagery but have not been field-verified; "probable" vernal pools were field-verified but lack other qualifying attributes at the time of field visit necessary to designate them as a confirmed vernal pool.) Field visits to confirm vernal pools continue. Find more information on the project at: https://val.vtecostudies.org/projects/vermont-vernal-pool-atlas/.

- Agricultural Soils
  Agricultural Soils are those Natural Resources Conservation Service (NRCS) mapped soils including Prime Farmland, Additional Farmland of Statewide Importance, and Additional Farmland of Local Importance that are used to help identify soil map units that represent the best land for producing food, feed, fiber, forage, and oilseed crops. An Important Farmland classification of Prime, Statewide, and Local is assigned to soil map units based on the characteristics of the

Mitigation

Mitigation in this context means compensating for potential impacts to the natural resource located in the project area.

For example, if a proposed project contained infrastructure in the 50' wetlands buffer, and it was demonstrated by the applicant that no other location was feasible, the applicant may be able to work with the permitting agency to agree to mitigation. In this case it could include additional wetland protection elsewhere on the project site.

dominant soils in the soil map unit. Accompanying each soil unit is a Vermont Soil Fact Sheet which was developed to organize a variety of data about a particular soil map unit on one page. The purpose of this layer is to provide a pre-selected, Vermont specific, subset of the Soil Survey Geographic Database (SSURGO) soil data depicting Prime Farmland, Additional Farmland of Statewide Importance, and Additional Farmland of Local Importance and excluding water, not rated or NPSL (Not Prime, Statewide, or Local) soils.

For more information:
https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_010210.pdf

- FEMA Special Flood Hazard Areas
  The floodplain within a community subject to a one percent or greater chance of flooding in any given year. This area is usually labeled Zone A, AO, AH, AE, or A1-30 in the most current flood insurance studies and on the maps published by FEMA. Base flood elevations have not been determined in Zone A where the flood risk has been mapped by approximate methods. Base flood elevations are shown at selected intervals on maps of special flood hazard areas that are determined by detailed methods. Please note, where floodways have been determined they may be shown on separate map panels from the Flood Insurance Rate Maps. All zones with a 0.2% chance or higher of flooding annually. Only True special flood hazard areas were used.

  The entire Vermont extent of the National Flood Hazard Layer (NFHL) as acquired 12/15/15 from the FEMA Map Service Center msc.fema.gov upon publication 12/2/2015 and converted to VSP. The FEMA DFIRM NFHL database compiles all available officially-digitized Digital Flood Insurance Rate Maps. This extract from the FEMA Map Service Center includes all of such data in Vermont including counties and a few municipalities. This data includes the most recent map update for Bennington County effective 12/2/2015. DFIRM - Letter of Map Revision (LOMR) DFIRM X-Sections DFIRM Floodways Special Flood Hazard Areas (All Available)

- Protected Lands (State fee lands and private conservation lands)
  Lands owned in fee by the State for conservation or recreation purposes and lands conserved via easement or other legal encumbrance by private conservation organizations, such as land trusts. Conservation restrictions may prevent or otherwise restrict development of these lands, including for energy generation or transmission facilities.

- Act 250 Agricultural Soil Mitigation areas
  This layer shows land protected by an Act 250 permit condition for the purposes of agricultural use. The mitigation area was required due to a reduction in agricultural potential of other primary agricultural soils caused by development or subdivision. This data is for planning and informational purposes only. Contact the NRB District Office for additional information and precise mapping.

- Deer Wintering Areas
  Deer winter habitat is critical to the long term survival of white-tailed deer in Vermont. Being near the northern extreme of the white-tailed deer's range, functional winter habitats are

essential to maintain stable populations of deer in many years when and where yarding conditions occur. Consequently, deer wintering areas are considered under Act 250 and other local, state, and federal regulations that require the protection of important wildlife habitats. DWAs are generally characterized by rather dense softwood (conifer) cover, such as hemlock, balsam fir, red spruce, or white pine. Occasionally DWAs are found in mixed forest with a strong softwood component or even on found west facing hardwood slopes in conjunction with softwood cover. In this mapping exercise no minimum area is defined, however, most areas less than 20 acres were not delineated, nor were areas above 2,000 feet elevation (approximate). In 2008, the boundaries of deer winter areas where refined using black and white leaf-off 1:5,000 scale orthophotography (1990-1999) and was cross referenced with 1:24,000 scale 2003 NAIP (color, leaf-on) imagery to better delineate fields and open wetlands. Some of the areas were also marked as 'not likely wintering area' based on not having softwood characteristic. The areas were reviewed by VFWD District Biologists in 2009 to 2010 for their concurrence from their knowledge of the site. The 2008 mapping project did not involve any field work, but was based on aerial photography. Potential areas were identified, but they have not been included in this map layer because they have not been field verified. The original DWA mapping was done in the 1970s and early 1980s and was based on field visits and interviews with wildlife biologists and game wardens. The DWA were mapped on mylar overlays on topographic maps and based on small scale aerial photos.

- The following features from ANR's Vermont Conservation Design:
    - Interior Forest Blocks – Highest Priority
    - Connectivity Blocks - Highest Priority
    - Physical Landscape Blocks – Highest Priority
    - Surface Water and Riparian Areas - Highest Priority

  Vermont Conservation Design (VCD) is a scientifically grounded, landscape-level conservation design by the Vermont Fish and Wildlife Department aimed at protecting and enhancing ecological function in Vermont into the future. It identifies four landscape features that are the foundation for ecological function and ranks such features as "Highest Priority" or "Priority" for conservation and management. Highest Priority Interior Forest Blocks are the largest and/or highest ranked forest blocks from all biophysical regions that provide the foundation for interior forest habitat and associated ecological functions. Highest Priority Connectivity Blocks are the most critical network of forest blocks that together provide terrestrial connectivity at the regional scale and connectivity between all Vermont biophysical regions. Highest Priority Surface Water and Riparian Areas are the entire undeveloped network of surface waters and riparian areas; riparian areas vary from 100 feet or less on some small streams (50 feet each side) to 600 feet or more (300 feet on each side) for larger rivers. Highest Priority Physical Landscape Blocks are the most important forest blocks and other areas of natural vegetation that include physical landscape diversity features that are either rare in Vermont or under-represented in the land and water areas identified as Highest Priority Interior Forest Blocks, Highest Priority Connectivity Blocks, and Highest Priority Surface Waters and Riparian Areas. Detailed descriptions of each landscape type are contained in the VCD *Summary Report* and *Landscape Features Technical Report*. VCD data is viewable using the web mapping tool *BioFinder* and is available for download at the *Vermont Open GeoData Portal*.

- Hydric Soils
  Areas of hydric soil have a high potential to support significant, unmapped wetlands and require field investigation to determine if significant wetlands are present. Hydric soils means soils that are saturated, flooded or ponded long enough during the growing season to develop anaerobic conditions in the upper part (U.S.D.A. Soil Conservation Service 1987), leading to biological conditions similar to wetlands.

- Regionally or Locally Identified Resources
  If locations are constrained for the development of renewable energy due to the desire to protect a locally designated resource (whether a natural resource, like forests (see Standard 12F) or community-identified resource, like a view), then the land use policies applicable to other forms of development must be similarly restrictive (and should be listed in the Notes column).

  These areas should be subtracted from Secondary Resource Maps to form Prime Resource Maps.

12D / 13D. Transmission and distribution resources and constraints, as well as transportation infrastructure.

(Including three-phase distribution lines, known constraints from resources such as Green Mountain Power's solar map, known areas of high electric load, etc.)

When identifying suitable, unsuitable, and preferred sites, regions are encouraged to take grid and load proximity, as well as grid hosting capacity, into account. Larger generators generally require access to three-phase power lines to carry the power they generate, and generators are responsible for the costs of upgrades to interconnect to the grid, so proximity to such lines (e.g., within ¼ or ½ mile) is of significant value. Regions could include lack of proximity as a possible constraint for larger projects. In Vermont today, distribution-level (< 115 kV) lines generally interconnect projects up to 5 MW, while larger projects would interconnect to transmission or sub-transmission at a substation (either using an existing substation or building a new one). If regions or municipalities have questions about what sizes of projects will require three-phase lines, they may want to consult with the distribution utility or relevant developer for a specific project.

Generation that is located near places where electricity is used (town centers, industrial facilities, etc.) is generally preferred from a purely electrical perspective, because the power generated needs to use less infrastructure to reach users. This reduces losses and can reduce the size of necessary electrical equipment. In some places, storage resources can be paired with generation resources to power local microgrids, increasing resilience for buildings within the microgrid, or even to mitigate grid impacts. For this reason, planners should identify and consider known areas of high electric load when identifying suitable or preferred sites. Planners may also wish to consider areas where they would like to evaluate microgrid potential – for instance, by identifying locations of local emergency shelters and essential services such as hospitals, police and fire stations, gas stations, etc., and working with their serving electric utility to ascertain distribution grid characteristics and the potential for creating a microgrid with renewable generation and battery storage.

At the same time, Vermont's current transmission system is not built to accommodate the more than 1 GW of new generation capacity envisioned by the Comprehensive Energy Plan by 2050. Furthermore, the necessary distribution grid upgrades are unknown. Grid hosting capacity depends on many factors, including the location and type of interconnecting generation, the ability to curtail production in some instances, the timing and location of beneficial electrification, and the evolution of flexible load technology (such as storage, EVs, and other distributed resources) and related control platforms. Additionally, grid hosting capacity depends on engineering analysis. While it may be possible in some cases to determine hosting capacity by arithmetic of load, equipment ratings, and existing generation, in many other cases specific analysis is required to ascertain the system's capability due to the nonlinear nature of grid performance. VELCO and Vermont distribution utilities conduct such analyses and publish the results – VELCO's 2021 Long-Range Transmission Plan calculated the hosting capacity for each region[32], and the Department has collected preliminary distribution level data in the *Generation Scenarios Planning Tool.*

Future State policy will shape where, when, and how many distributed energy resources are proposed to be interconnected to the grid, which will in turn influence how and when the grid is upgraded to accommodate these generation and load resources. Therefore, regions should not feel unduly constrained to identify only promising sites that are near power lines presently having capacity for interconnection. Rather, understanding of grid constraints (and potential upgrade costs) should help regions prioritize where to focus near- and longer-term strategies for achieving their targets. Regions facing constraints to additional generation may wish to focus their implementation efforts on electrification of heating and transportation in the current planning cycle, while continuing generation siting mapping to identify sites to host potential future generation potentially unlocked by the addition of these loads. In consideration of the possible limitations to connection of new generation resources, natural resource constraints should be considered as the most binding; distribution and transmission capacity may be increased with the future upgrade of electrical facilities. When reviewing maps, the Department will look for a mix of suitable or preferred sites that are accessible to the grid as it exists today, and other sites.

Regions may acquire maps of the local electric grid from their local utility, with the assistance of the Department. (Under Act 174, utilities are required to make maps available to the Department for the assistance of towns and regions.) Several utilities have made solar or distributed generation maps publicly available. These maps include information regarding the ease of interconnection for new solar PV on each line segment. These include:

- Green Mountain Power's solar map: https://greenmountainpower.com/maps/
- Burlington Electric Department's distributed generation map: https://www.burlingtonelectric.com/distributed-generation/
- Vermont Electric Cooperative's grid constraints map: https://vermontelectric.coop/electric-system/distributed-generation

[32] 2021 Vermont Long-Range Transmission Plan, pg. 44; available at: https://www.velco.com/assets/documents/2021%20VLRTP%20to%20PUC_FINAL.pdf

12E / 13E. Preferred locations (specific areas or parcels) for siting a generator or a specific size or type of generator, accompanied by any specific siting criteria for these locations

Narrative descriptions of the types of preferred areas in accompanying plan text are acceptable, though mapping of areas and especially specific parcels (to the extent they are known) is highly encouraged, to signal preferences to developers, particularly for locally preferred areas and specific parcels that do not qualify as a statewide preferred location under i. below. When identifying specific parcels, regions may choose to engage landowners in a discussion regarding their land and its suitability for energy generation.

The locations identified as preferred must not be impractical for developing a technology with regard to the presence of the renewable resource and access to transmission/distribution infrastructure.

i. Statewide preferred locations such as rooftops (and other structures), parking lots, previously developed sites, brownfields, gravel pits, quarries, and Superfund sites

ii. Other potential locally preferred locations, such as where multiple technologies could be co-located (ex. solar and storage).
For example, customer on- or near-site generation, economic development areas, unranked and not currently farmed agricultural soils, unused land near already developed infrastructure, locations suitable for large-scale biomass district heat or thermal-led cogeneration, potential locations for biogas heating and digesters, etc.

These are particularly important to map if possible (with the input of municipalities), as "a specific location in a duly adopted municipal plan" is one way for a net-metering project to qualify as being on a preferred site. Another way is for project developers to seek letters from the region and municipality designating their site as preferred. Having preferred sites identified in the municipal and regional plans – or at least the criteria by which a site will be evaluated – can help facilitate this process.

The Town of Colchester's Preferred Sites' policy provides one example of how a region or municipality might select preferred sites.

The figure below illustrates the concept of increasingly smaller land area as you move from raw renewable resource potential to secondary resource potential areas, primary resource potential areas, and preferred locations. Preferred locations should have the raw renewable resource potential to deploy the type or scale of technology in question, and should not have any mapped known or possible constraints (unless the region has a rationale for determining that such a constraint doesn't actually exist on the ground or the location is preferred to such an extent that the constraint in question is encouraged to be, and is able to be, mitigated).

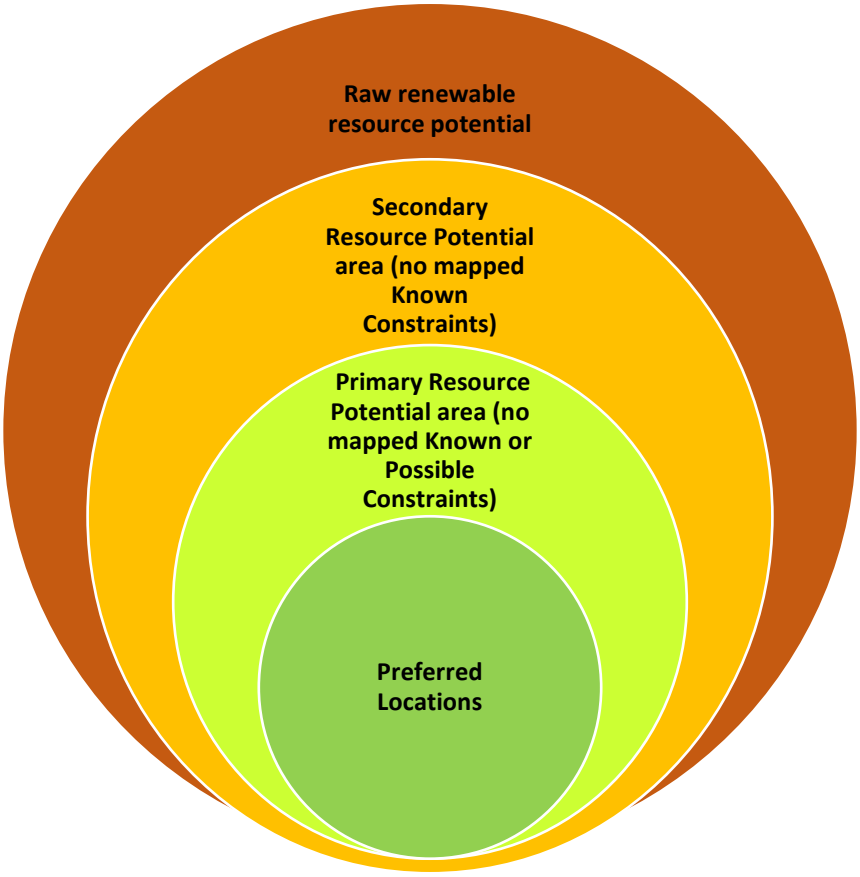

Figure 3: Moving from Raw Resource Potential to Preferred Locations

Types of locations that a region or muncipality might wish to consider as preferred can include – but are not limited to – the concepts in i and ii, above. The examples listed under i come from the Public Utility's Commission's definitions for preferred sites in the current net-metering rule which took effect January 1, 2017[33]; projects in such sites would receive either higher financial incentives or are able to take advantage of the net-metering program at larger sizes. Those definitions in turn are drawn from Act 174's definitions for preferred sites, which were specified for use in a Standard Offer program (for projects of up to 2.2 MW in size) pilot in 2017. Communities and developers looking to deploy projects will be seeking out such locations, which are simultaneously more cost-effective and more appealing to communities. Planners may also wish to consider other types of preferred locations or particular sites; some ideas are provided in ii above, but it is by no means an exhaustive list.

It is acceptable to simply list types of preferred locations in plans, but to the extent regions and municipalities are able to actually identify particular locations, it will be vastly more useful in terms of directing deployment of renewables to the places that make the most sense to the community. This may require more of an effort to reach out to and involve landowners in identifying particular rooftops, parcels, etc., given that the land under municipal control is limited.

[33] Vermont Public Utility Commission, 5.100 Rule Pertaining to Construction and Operation of Net-Metering Systems; Available from https://puc.vermont.gov/sites/psbnew/files/doc_library/5100-PUC-nm-effective-07-01-2017_0.pdf

Regions also have an opportunity to signal to developers the design and other guidelines for how they wish to see renewable energy projects deployed in such locations (this applies to all potential areas, including those captured in the primary and secondary resource maps). For example, a community may wish to encourage solar projects over a certain size to explore multiple uses and co-benefits, if conditions allow, such as grazing and recreation, or parking in conjunction with solar arrays.

At the same time, it is important to recognize that it may not be possible for renewable energy projects to be cost-effectively deployed in all preferred locations, particulary if such locations are far from adequate electric infrastructure, or if the locations require a great deal of up-front investment in remediation, stabilization, etc. Asking such projects to perform additional screening, install amenities, etc. could actually result in *discouraging* projects from seeking out or vetting such locations.

12F / 13F. Does the plan (a) evaluate whether forest blocks or habitat connectors identified pursuant to 24 V.S.A. § 4348a(a)(2)(F) [for regional plans] and 24 V.S.A. § 4382(a)(2)(D) [for municipal plans] should be treated as possible constraints, and (b) ensure that land conservation measures and specific policies established for the development and siting of renewable energy resources incorporates consideration of the evaluation undertaken in part (a)?

Act 171 of 2016 amended Vermont's planning statutes to allow and, in part, require regions to plan for the management of forest and wildlife resources. As a result of Act 171, regional plans adopted after January 1, 2018, must include a map and statement of current and future uses of forest blocks and habitat connectors and may include policies that help maintain their functions and values.

The 2021 Climate Action Plan places significant emphasis on land use patterns as a pathway to achieving greenhouse gas emissions reductions and carbon sequestration goals. It also identifies forest conservation – specifically, implementation of plans to protect forest blocks and habitat connectors – as a key strategy to do so.

To satisfy part (a) of Standard 12F, enhanced energy plans should demonstrate that regional planning commissions considered whether it would be appropriate to treat forests not otherwise constrained or deemed unsuitable for energy development as possible constraints (and thus less suitable for energy development) rather than "prime" for wind or solar development. Factors that should be considered include the multiple functions and values forest provide, including carbon sequestration and storage, and the availability of non-forested sites sufficient to meet renewable generation targets. The standard does not require treatment of forests as possible constraints; rather it requires that regional planning commissions deliberately consider whether they can and should treat them as such. Evidence of such deliberation (*i.e.*, the "evaluation" required by this standard) can be in the form of a written description. Though not required, calculations showing the impact of treating forests as possible constraints on the region's ability to meet renewable energy generation targets are encouraged.

To satisfy part (b) of Standard 12F, regional planning commissions should demonstrate that any land conservation measures or renewable energy generation siting policies adopted in the enhanced energy plan reflect the evaluation completed under part (a). So, if regional planning commissions elect to treat forests as possible constraints based on the part (a) evaluation, the plan should contain land conservation measures or siting policies that effectively steer renewable energy development away from, or minimize impacts to, forests. To evince compliance with part (b), regional planning commissions

can cite the relevant land conservation measures or siting policies. Examples of such measures or policies might be:

- Work with member municipalities to develop renewable energy generation siting standards that prohibit clearing more than *X* acres of forest per project or MW of installed capacity.
- Ensure guidelines for preferred siting letters require submission of information from developers about project impacts on forests.
- Siting standards that priotize retention of core (i.e., interior) forest over fragmented patches of forest or forest edge habitat.
- Measures, such as equipment cleaning, to minimize the spread of non-native invasive plant species in forests.
- A siting standard that ensures renewable energy generation projects will not close access to or interfere with forest management activities on adjacent lands.

Unsuitable Areas: Scenic Viewsheds

The Towns of Essex and Jericho conducted a project to assess scenic views from public roadways, including views of specific mountain peaks and general rural character. These views were ranked on a four-point scale ranging from "Least Scenic" to "Most Scenic". This initial ranking effort lead to a mapping product and zoning regulations for the Scenic Resource Protection Overlay (SRPO) District which applies to all development, in addition to specific policies in the 2016 Essex Town Plan (p.79) and 2019 Enhanced Energy Plan (p. 6) that prohibited utility-scale (500kW+) solar installations from impacting identified scenic resources, but specifically allowed such installations in commercial and industrial areas. Smaller facilities must follow an avoid then minimize approach regarding impacting scenic resources, using the SRPO zoning standards as guidance.

See the "Views to the Mountain: A Scenic Protection Manual" report for more information.

Generally, policies set in regional plans for forest conservation should be consistent with the siting policies articulated in enhanced energy plans. Standard 12F provides an opportunity to evaluate consistency across these subject areas.

Regional Mapping Standard 13 / Municipal Mapping Standard 14

Does the plan identify areas that are unsuitable for siting renewable energy resources or particular categories or sizes of those resources?

Either Yes or No ("No" if the plan chooses not to designate any areas as unsuitable) is an acceptable answer here. "Resources" is synonymous with "generators."

Standard 12 was focused on identification of potential and preferred areas for siting generators, based on resource potential after a number of land use constraints and regional and local preferences were factored in. Standard 13 asks planners to consider whether there are specific areas where siting renewable generation – or particular categories or sizes of renewable generators – is unsuitable. The unsuitable areas identified by regions will be included in the constraint layers discussed above; however, it may not be possible to map all of the areas a region wishes to identify as a constraint (e.g., archeological resources). In the case of a local or regional constraint that cannot be mapped, it should be identified in the text of the plan with clearly written policies. Regions and municipalities may require applicants to conduct field verification of both mapped and unmapped constraints. If plans decide not to identify any areas as unsuitable, they should check "No" and will meet the standard. If plans choose to identify areas as unsuitable, they should check "Yes," and will meet the standard if they also answer "Yes" to 13A and 13B.

Unsuitable areas are those areas that a region has designated as unsuitable for a particular type or scale of energy development, or in some cases, all development (for the reasons listed above). It is important to bear in mind the distinction between known constraints, possible constraints, and unsuitable areas. Regions are allowed to add to the list of known and possible constraints, but also to designate unsuitable areas. It may be helpful to think of these designations in terms of a spectrum (see the figure below). Unsuitable areas are "no go" areas. Known constraints very likely represent an area where energy development does not make sense, pending a field verification of those resources or mitigation. Possible constraints are areas that might be developable, if certain constraints can be mitigated. Prime areas have no constraints, and preferred locations are those areas that a region has identified as where they would like to see development occur.

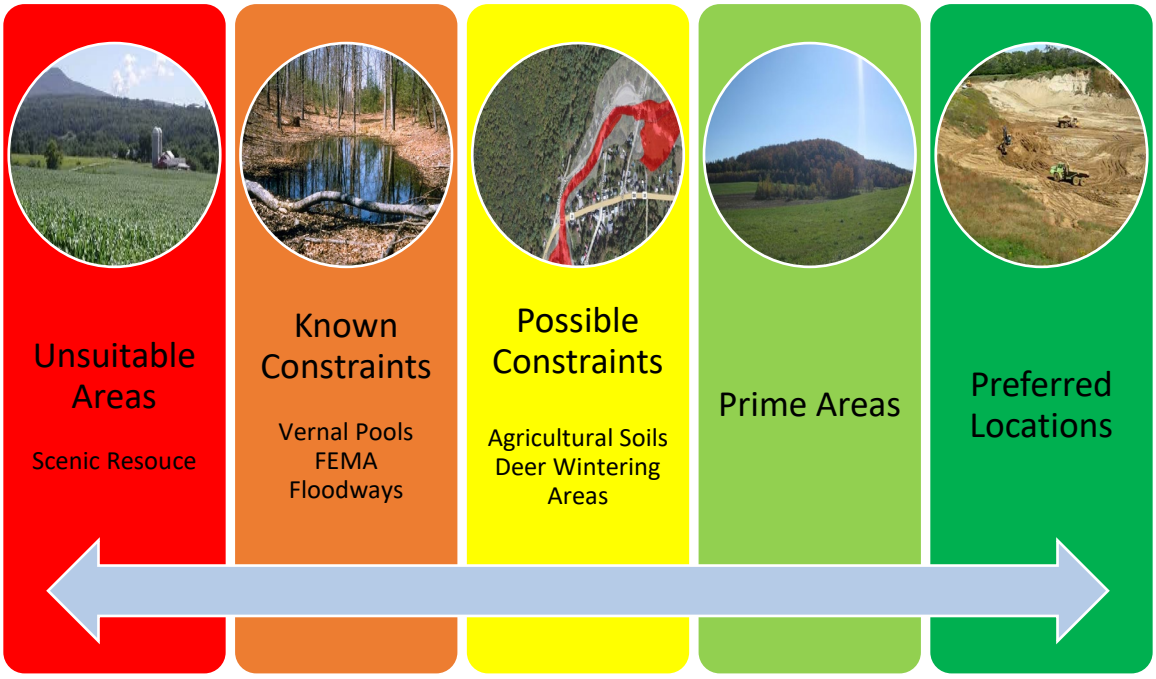

Figure 4: the Spectrum between Unsuitable Areas and Preferred Locations

When considering particular categories or sizes of resources, planners may wish to consider the technologies in these categories: solar, wind, hydropower, biomass thermal, and biomass combined heat and power; and the following scales in terms of sizes: residential, commercial, utility. See the figure below for a solar and wind size breakdown. For solar, it may be easier to think in terms of permitting categories, which tend to drive decisions about project sizes. Planners may also wish to consider solar in terms of whether it is roof-mounted or otherwise on the site of the primary off-taker (e.g., specific areas may be designated as unsuitable for solar > 5 MW, but suitable for all roof-mounted solar systems, etc.).

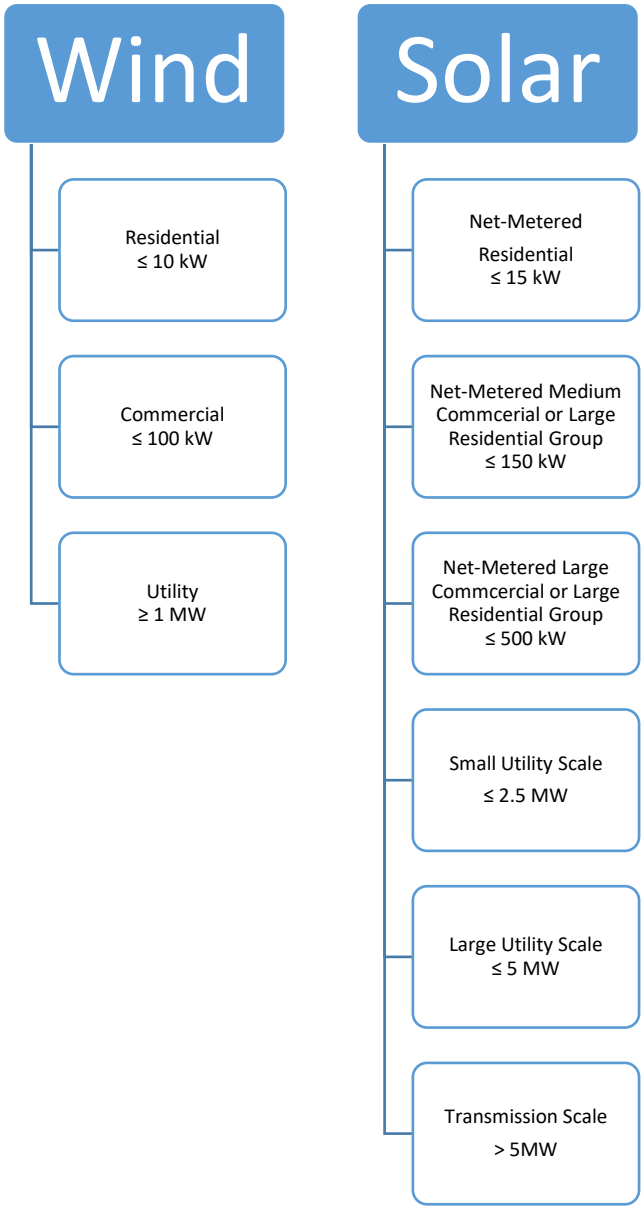

Figure 5: Wind and Solar Size Categories

13A / 14A. Are areas identified as unsuitable for particular categories or sizes of generators consistent with resource availability and/or land use policies in the regional or municipal plan applicable to other types of land development? (Answer only required if "Yes" selected above, indicating unsuitable areas have been identified)?
If areas are considered unsuitable for energy generation, then the land use policies applicable to other forms of development in this area must similarly prohibit other types of development. Please note these policies in the Notes column.

This standard is only applicable to plans that identify unsuitable areas. If no unsuitable areas are identified, regions would check "N/A" and still meet the standard. If a region chooses to identify unsuitable areas (if "Yes" is checked for Regional Standard 13 above), then the plan must meet this standard. The standard asks, essentially, whether plans have identified areas as unsuitable from a resource availability or a land use perspective. If an area simply doesn't have resource potential due to lack of raw renewable potential (adequate wind speed, solar insolation, etc.), then it would make sense to identify it as unsuitable for the corresponding category or size of generator (wind, utility-scale wind, solar, ground-mounted solar > 500 kW, etc.). Similarly, if an area contains known or (less likely) possible constraints that render it unsuitable for a category or size of generator, plans may choose to designate that area as unsuitable. Planners may even decide to differentiate degrees of unsuitability – for example, correlating areas with known constraints as "likely unsuitable," depending on site-specific conditions, and identifying a smaller subset of specific parcels as definitely "unsuitable."

It is essential, however, that plans consider impacts of all land uses, and treat like impacts in a like manner. That is to say, if areas are identified as unsuitable, the plan should say why the areas are unsuitable, and the policies must assess all land uses in those areas with uniformity and consistency, whether they are renewable energy generators or another form of development, like housing or commercial development, to minimize impacts on areas that are important. There is no formula for how these "like impacts, like treatment" policies should be described or applied, but planners should make an effort to explain their rationale. One example might be, if only low-density residential development is allowed in a specific area, it may be appropriate to similarly designate the same area as unsuitable for renewable generation larger than residential scale (> 15 kW, or perhaps > 150 kW or 500 kW if systems serving groups of residences are to be considered).

13B / 14B. Does the plan ensure that any regional or local constraints (regionally or locally designated resources or critical resources, from 12B-12C / 13B-13C above) identified are supported through data or studies, are consistent with the remainder of the plan, and do not include an arbitrary prohibition or interference with the intended function of any particular renewable resource size or type?
Please explain in the Notes column.

This standard asks that when planners are adding regional or local constraints to the lists of known and possible constraints in Regional Standards 12B-12C/Municipal Standards 13B-13C, they provide a reasonable justification for those constraints and ensure they are consistent with plan policies related to other, non-energy-generation land uses. An example of a reasonable justification for a natural resource constraint such as locally identified vernal pools might be a field or other scientific survey conducted by a qualified individual or organization (e.g., a wetlands scientist). If a resource is included on a map as a constraint, there must be a justification such as this. It is important to note that a town can state in its

clearly written policies that all vernal pools, even if not mapped, shall be protected; in this case, and their presence (or lack thereof) shall be field verified when projects are proposed.

An aesthetic constraint, such as a scenic viewshed, for example, might be supported through a viewshed analysis, again conducted by a qualified entity (e.g., a landscape architect). Again, any constraints related to this resource should figure into a region's plan-wide land use policies and strategies, rather than "singling out" renewable energy generation. This could be accomplished with policies restricting, for example, all development within a certain radius of locally identified vernal pools, or development over a certain scale within certain areas of the scenic viewshed. Such policies would apply not only to renewable energy development, but also to residential, commercial, industrial, and potentially even agricultural and other "working land" uses as well. Ultimately, plans that explain how their land use constraints are based in on-the-ground facts, inform well-articulated plan policies, and treat all development on equal terms, will be capable of meeting this standard.

Regional Mapping Standard 14 (Regions Only)

Does the plan allow for the siting in the region of all types of renewable generation technologies?

This standard, which only applies to regional plans, embodies the plan approval requirement in Act 174 that the regional plan "allows for the siting in the region of all types of renewable generation technologies."

The word "types" in this case means categories of renewable generation (e.g., solar, wind, biomass, hydro), and does not require that all scales of a given technology (see Figure 5) be accommodated. For example, including only residential-scale development of a specific renewable generation technology would be sufficient to satisfy the requirement.

Mapping Standard 15 (Regions Only)

Has your region provided (or do you have a plan to provide) a breakout of the map product(s) above to your municipalities?
Please explain your timeline for completing this task in the Notes column.

This standard simply asks regions to ensure that they are providing maps to each of their municipalities, as they update the regional maps.

Mapping Standard 15 (Municipalities Only)

Municipalities seeking a determination of energy compliance and not using their region's maps only: Does the plan ensure that its approach, if applied regionally, would not have the effect of prohibiting any type of renewable generation technology in all locations?

This standard only applies to municipalities if they are seeking a determination and *not using their region's maps*. If a municipality decides to use its own maps, they need to demonstrate that their approach to siting will not undermine the region's ability to meet its requirement to allow for the siting of all types of renewable generation technologies. That is, a municipality's approach, if applied in each

and every municipality in the region, would not ultimately result in a particular type of renewable generation technology being effectively excluded from the entire region. Types in this case means categories of renewable generation (e.g. solar, wind, biomass, hydro), and does not require that all scales of a given technology be accommodated.