CHITTENDEN COUNTY RPC
Communities Planning Together

Energy Sub-Committee

July 24, 2023
6:00 to 8:00 PM

Remote Access ONLY Meeting via Zoom

Please join the meeting by clicking: https://us02web.zoom.us/j/82493813385

For those who would prefer to join by phone or those without a microphone on your computer, please dial in using your phone.
(For supported devices, tap a one-touch number below to join instantly.)
Dial: 1 305 224 1968 US Meeting ID: 853 4472 6263
For supported devices, tap a one-touch number join instantly: +13052241968,, 85344726263

Agenda

1. **Welcome**

2. **Approve May 25, 2023 and July 10, 2023 Meeting Minutes**
   Please review the minutes of the May 25, 2023 Meeting here and July 10, 2023 Meeting here

3. **Energy Planning Standards for Regional Plans**
   Ann Janda, CCRPC Energy Project Manager, reviewed the ECOS Plan energy sections to ensure that the draft plan meets the Public Service Department's energy planning standards for regional plans. Please see the attached checklist which indicates how the plan meets each standard.

4. **Review ECOS Plan Energy Key Trends and Issues, Strategies and Actions, and Supplement 6 (Melanie Needle, Darren Schibler)**
   Please review the energy related sections of the ECOS Plan contained in the packet and come prepared with comments. The sections of the ECOS Plan included in the packet have been edited to include the sub-committee's comments to date.

5. **Motion to approve the ECOS Plan energy sections to the Long-Range Planning Committee**
   The sub-committee will consider a vote to forward the draft energy sections to the Long-Range Planning Committee for review before it goes to the CCRPC Board in the fall.

6. **Next Steps:**
   a. Long Range Planning Committee (LRPC) Meeting August 8, 2023

In accordance with provisions of the Americans with Disabilities Act (ADA) of 1990, the CCRPC will ensure public meeting sites are accessible to all people. Requests for free interpretive or translation services, assistive devices, or other requested accommodations, should be made to Emma Vaughn, CCRPC Title VI Coordinator, at 802-846-4490 ext. 121 or evaughn@ccrpcvt.org, no later than 3 business days prior to the meeting for which services are requested.

Energy Planning Standards for Regional Plans

Instructions

Before proceeding, please review the requirements of Parts I and II below, as well as the Overview document. Submitting a Regional Plan for review under the standards below is entirely voluntary, as enabled under Act 174, the Energy Development Improvement Act of 2016. If a Regional Plan meets the standards, it will be given an affirmative "determination of energy compliance," and its land conservation measures and specific policies will be given "substantial deference" in the Public Utility Commission's review of whether an energy project meets the orderly development criterion in the Section 248 process. Specifically, with respect to an in-state electric generation facility, the Commission:

> *[S]hall give substantial deference to the land conservation measures and specific policies contained in a duly adopted regional and municipal plan that has received an affirmative determination of energy compliance under 24 V.S.A. § 4352. In this subdivision (C), "substantial deference" means that a land conservation measure or specific policy shall be applied in accordance with its terms unless there is a clear and convincing demonstration that other factors affecting the general good of the State outweigh the application of the measure or policy. The term shall not include consideration of whether the determination of energy compliance should or should not have been affirmative under 24 V.S.A. § 4352*

Regional Plans may be submitted to the Department of Public Service (PSD) for a determination of energy compliance (determination), along with the completed checklist below. After a Regional Plan and completed checklist have been submitted to the PSD, the PSD will schedule a public hearing noticed at least 15 days in advance by direct mail to the requesting regional planning commission, on the PSD website, and in a newspaper of general publication in the region. The Commissioner of the PSD shall issue a determination in writing within two months of the receipt of a request. If the determination is negative, the Commissioner shall state the reasons for the denial in writing and, if appropriate, suggest acceptable modifications. Submissions for a new determination following a negative determination shall receive a new determination within 45 days.

The plans that Regions submit must:

- Be adopted
- Include the energy element as described in 24 V.S.A. § 4348a(a)(3)
- Be consistent with state energy policy (described below), in the manner described in 24 V.S.A. § 4302(f)(1)
- Meet all standards for issuing a determination of energy compliance (see below)

Regions are encouraged to consult with the PSD before undertaking the process of plan adoption, which may help in identifying any deficiencies or inconsistencies with the standards or other requirements that would be more difficult to remedy after a plan has gone through the formal adoption process.

The 2022 Comprehensive Energy Plan (CEP), published on January 14, 2022, includes several important updates to the Act 174 enhanced energy standards:

- A revised set of standards, presented in this document, updated to reflect current developments in state energy policy

- An updated suite of recommendations tailored specifically toward the work of the regions and municipalities. Unlike the set of recommendations published with the original standards, which were written prior to the passage of Act 174, these recommendations are included in the 2022 CEP itself.

In addition, a revised guidance document will be published within six months after the publication of the 2022 CEP to reflect new issues and best practices that have emerged from the regions and municipalities that have gone through an initial process of applying for a determination of energy compliance. This document will also include the recommendations for regions and municipalities outlined in the 2022 CEP.

Affirmative determinations are valid for the life cycle of a revision of the Regional and/or Municipal Plan. Plans submitted after the 2022 CEP is issued are expected to meet the updated Standards issued with the 2022 CEP, with the exception of plans for regions or municipalities who can demonstrate they had meaningfully initiated the planning process (ex. through proof of a publicly noticed meeting) before the 2022 CEP was published. Regions are encouraged to consult with the PSD regarding interim amendments that might affect any of the standards below, to discuss whether a new review is triggered. Plans approved under the previous Standards will not lose their existing determination of energy compliance as a result of new Standards being issued.

If you wish to submit your Regional Plan to the PSD for a determination, please read closely the specific instructions at the start of each section below, and attach your Regional Plan to this checklist.

Determination requests and any other questions should be submitted to: PSD.PlanningStandards@vermont.gov.

Part I: Applicant Information	
Applicant:	Chittenden County Regional Planning Commission
Contact person:	Melanie Needle
Contact information:	mneedle@ccrpcvt.org; 846-4490 ext. *27
Received by: Click or tap here to enter text.	**Date:** Click or tap here to enter text.

Part II: Determination Standards Checklist

The checklist below will be used to evaluate your plan's consistency with statutory requirements under Act 174, including the requirement to be adopted, contain an enhanced energy element, be consistent with state energy policy, and meet a set of standards designed to ensure consistency with state energy goals and policies.

Please review and attach your plan (or adopted energy element/plan, along with supporting documentation) and self-evaluate whether it contains the following components. Use the Notes column to briefly describe how your plan is consistent with the standard, including relevant page references (you may include additional pages to expand upon Notes). If you feel a standard is not relevant or attainable, please check N/A where it is available and use the Notes column to describe the situation, explaining why the standard is not relevant or attainable, and indicate what measures your region is taking instead to mitigate any adverse effects of not making substantial progress toward this standard. If N/A is not made available, the standard must be met (unless the instructions for that standard indicate otherwise) and checked "Yes" in order to receive an affirmative determination. There is no penalty for checking (or limit on the number of times you may check) N/A where it is available, as long as a reasonable justification is provided in the Notes column.

Plan Adoption Requirement

Act 174 requires that regional plans be adopted in order to qualify for a determination of energy compliance. The plan adoption requirement can be met through an amendment to an existing plan in the form of an energy element or energy plan, as long as the amendment or plan itself is duly adopted as part of the regional plan and incorporated by reference or appended to the underlying, full plan (i.e., is officially "in" the regional plan). If this route is chosen, regions should also provide a memo that discusses the internal consistency of the energy plan/element with other related elements of the underlying plan (particularly Transportation and Land Use), and/or whether the energy plan/element supersedes language in those other elements. Standards 1 and 2 below must be answered in the affirmative in order for a plan to receive an affirmative determination of energy compliance.

1. Has your plan been duly adopted?	☐Yes Adoption date: Click or tap here to enter text.	☐ No	Click or tap here to enter text.
2. Is a copy of the plan (or adopted energy element/plan, along with underlying plan and memo addressing consistency of energy element/plan with other elements of underlying plan) attached to this checklist?	☐Yes	☐No	Click or tap here to enter text.

Energy Element Requirement

To obtain a determination of energy compliance, Act 174 requires regions to include an "energy element," revised through Act 174 to explicitly address energy across all sectors and to identify potential and unsuitable areas for siting renewable energy resources, as described in 24 V.S.A. § 4348a(a)(3):

An energy element, which may include an analysis of resources, needs, scarcities, costs, and problems within the region across all energy sectors, including electric, thermal, and transportation; a statement of policy on the conservation and efficient use of energy and the development and siting of renewable energy resources; a statement of policy on patterns and densities of land use likely to result in conservation of energy; and an identification of 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.

The standards below are generally organized to integrate each component of the enhanced energy element with related determination standards that evaluate the plan's consistency with state goals and policies. **Energy element components are identified in bolded text.**

While regions may choose to primarily address energy used for heating, transportation, and electricity in the required energy element, they may also choose to address some of these components in related plan elements (e.g., Transportation and Land Use) and should indicate as much in the Notes column. To the extent an energy element is designed to comprehensively address energy, it should be complementary to and reference other relevant plan elements.

3. **Does the plan contain an energy element, as described in 24 V.S.A. § 4348a(a)(3)?** *Individual components of the energy element will be evaluated through the standards below.*	☐ Yes	☐ No	Page: Click or tap here to enter text. Paragraph: Click or tap here to enter text.

Consistency with State Goals and Policies Requirement

Act 174 states that regional and municipal plans must be consistent with the following state goals and policies:

- Greenhouse gas reduction requirements under 10 V.S.A. § 578(a) (26% from 2005 levels by 2025; 40% from 1990 levels by 2030; 80% from 1990 levels by 2050)
- The 25 x 25 goal for renewable energy under 10 V.S.A. § 580 (25% in-state renewables supply for all energy uses by 2025)
- Building efficiency goals under 10 V.S.A. § 581 (e.g., reduce fossil fuel consumption across all buildings by 10% by 2025)
- State energy policy under 30 V.S.A. § 202a and the recommendations for regional and municipal planning pertaining to the efficient use of energy and the siting and development of renewable energy resources contained in the State energy plans adopted pursuant to 30 V.S.A. §§ 202 and 202b
- The distributed renewable generation and energy transformation categories of resources to meet the requirements of the Renewable Energy Standard under 30 V.S.A. §§ 8004 and 8005

The standards in the checklist below will be used to determine whether a plan is consistent with these goals and policies. The standards are broken out by category. *Analysis and Targets* standards address how energy analyses are done within plans, and whether targets are established for energy conservation, efficiency, fuel switching, and use of renewable energy across sectors. *Pathways (Implementation Actions)* standards address the identification of actions to achieve the targets. *Mapping* standards address the identification of suitable and unsuitable areas for the development of renewable energy.

Regions may choose to incorporate the information necessary to meet the standards in their energy elements, and/or in other sections of their plans (many transportation items may fit best in the Transportation chapters of plans, for instance). However, plans must be internally consistent, and applicants should cross-reference wherever possible.

Analysis and Targets Standards

For the analysis determination standards below, regions are expected to develop or update their own analysis (which the PSD will support through regionalization of the modeling efforts conducted to support the 2022 CEP), and to then break out the analysis for their municipalities, who can use their region-provided analysis to meet the municipal *Analysis & Targets* standards. The PSD and regional planning commissions developed several guidance documents to explain the expected level of detail in and suggestions regarding data sources and methodologies available for meeting the *Analysis & Targets* standards below. These guidance documents can be retrieved from the following links:

- In 2017, the PSD developed two guidance documents, one for regional plans and one for municipal plans:
  - Guidance for Regional Plans
  - Guidance for Municipal Plans
- In addition, in 2019 the Northwest Regional Planning Commission, with input from all 11 RPCs in the state, created a best practices and resources guide for municipalities to use when undertaking enhanced energy planning.

The guidance developed by the PSD will be updated in 2022 to incorporate best practices that have emerged from the regions and municipalities who have completed an initial round of energy plans. Note that standards 4A-4E are all derived directly from requirements in Act 174 (with minor modifications to make them feasible) and must be met affirmatively in order for a regional plan to receive an affirmative determination of energy compliance. Standard 5 is also required and addresses "municipalization" of analysis and targets; regions should check "Yes" if they have or if they have a plan to supply this information to their municipalities.

Targets set by regions should be aligned with state energy policy (see the goals and policies listed above). Where targets (and efforts to reach them) depart significantly from state energy goals and policies, an explanation for how the plan otherwise achieves the intent of the state goal or policy should be provided. The guidance document also offers additional clarification on alignment with state goals and policies.

The analysis items below are intended to provide regions with an overview of their current energy use, and with a sense of the trajectories and pace of change needed to meet targets, which can be translated into concrete actions in the *Pathways* standards below. Targets provide regions with milestones or checkpoints along the way toward a path of meeting 90% of their total energy needs with renewable energy, and can be compared with the potential renewable energy generation from areas identified as potentially suitable in the *Mapping* standards exercise below to give regions a sense of their ability to accommodate renewable energy that would meet their needs.

4. **Does your plan's energy element contain an analysis of resources, needs, scarcities, costs, and problems within the region across all energy sectors (electric, thermal, transportation)?**	☒Yes	☐No	Page: Energy Goal and Key Issues Section Paragraph: Click or tap here to enter text. Notes: Click or tap here to enter text.

Note: You may want to reference the guidance document, developed by Northwest Regional Planning Commission, with input from all 11 regional planning commissions, on best practices for conducting such an analysis, including examples and suggested units to use when developing analyses.			
A. Does the plan estimate current energy use across transportation, heating, and electric sectors? *As noted in the Guidance Document, plans meet this standard by transparently calculating estimated energy consumption by region by 1) transportation, 2) building heat, and 3) electricity consumption. More detailed support is available in Appendix A of the Guidance developed by the PSD.*	☒ Yes	☐ No	Page: Supplemnt 6 Current Energy Use Paragraph: Click or tap here to enter text. Notes: Click or tap here to enter text.
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?	☒ Yes	☐ No	Page: Supplement 6 Thermal and Electric Energy Targets (see notes in document) Paragraph: Click or tap here to enter text. Notes: Click or tap here to enter text.
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?	☒ Yes	☐ No	Page: Supplement 6 Transportation Energy Targets Paragraph: Click or tap here to enter text. Notes: Click or tap here to enter text.
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?	☒ Yes	☐ No	Page: Supplement 6 Thermal and Electric Energy Targets Paragraph: Click or tap here to enter text. Notes: Click or tap here to enter text.
5. Has your region provided (or do you have a plan to provide) a breakout of the analyses and targets above to your municipalities? *Please explain your timeline for completing this task in the Notes column.*	☒ Yes	☐ No	Page: Click or tap here to enter text. Paragraph: Click or tap here to enter text. Notes: CCRPC will provide municipalities their targets in Winter 2023-2024

Pathways (Implementation Actions) Standards

This section examines whether plans meet the Act 174 expectation that they include pathways and recommended actions to achieve the targets identified through the *Analysis and Targets* section of the Standards (above). Plans are expected to include or otherwise address all of the pathways (implementation actions) below, unless N/A is provided as an option. There is no penalty for choosing N/A one or more times, as long as a reasonable justification is provided in the Notes column, preferably including an explanation of how the plan alternatively achieves attainment of the targets should be included. If N/A is not provided as an option, the plan must meet the standard, and "Yes" must be checked, in order for the plan to meet the requirements for a determination (unless the instructions particular to that standard indicate otherwise).

PSD will be updating its guidance documents in 2022 with potential implementation actions included in the 2022 Comprehensive Energy Plan, from existing regional plans that have received a determination of compliance, and from other sources. We also offer potential starting points for consideration as italicized text under each standard. Plans are encouraged to promote as diverse a portfolio of approaches as possible in each sector, or if not, to explain why they take a more targeted approach. Implementation actions may fit best in a holistic discussion contained within a plan's energy element, though cross-referencing to other relevant plan elements is also acceptable. Regions must demonstrate a commitment to achieving each standard in policies, objectives, and implementation actions in clear, action-oriented language. Definitions of policies, objectives, and actions can be found on p. 52 of the Vermont State Planning Manual Module 1.			
6. **Does your plan's energy element contain policies or objectives on the conservation and efficient use of energy in buildings?**	☒ Yes	☐ No	Page: Strategy 4, Climate/Energy Paragraph: 2.Municipal Assistance,4.Thermal Sector Partnerships 4a-e Notes: Click or tap here to enter text.
A. Does the plan encourage conservation by individuals and organizations? *(Actions, objectives, and policies could include educational activities and events such as convening or sponsoring weatherization workshops, supporting local energy committees, encouraging the use of existing utility and other efficiency and conservation programs and funding sources, etc.)*	☒ Yes	☐ No	Page: Strategy 4, Climate/Energy Paragraph: 4. Thermal Sector Partnerships a, b Notes: Click or tap here to enter text.
B. Does the plan promote efficient and climate resilient buildings? *(Actions, objectives, and policies could include education on and promotion of residential and commercial building energy standards for new construction and existing buildings, including additions, alterations, renovations and repairs; promoting the implementation of residential and commercial building efficiency ratings and labeling; assistance to municipalities considering adopting stretch codes; identification of buildings and facilities that serve critical community functions, etc.)*	☒ Yes	☐ No	Page: Strategy 4, Climate/Energy Paragraph: 4. Thermal Sector Partnerships d. Notes: Click or tap here to enter text.
C. Does the plan promote decreased use of fossil fuels for heating? *(Actions, objectives, and policies could promote switching to wood, liquid biofuels, biogas, geothermal, and/or electricity (e.g. beneficial electrification). Suitable devices include advanced wood heating systems and cold-climate heat pumps, as well as use of more energy efficient heating systems; and identifying potential locations for, and barriers to, deployment of biomass district heating and/or thermal-led combined heat and power systems in the region)*	☒ Yes	☐ No	Page: Strategy 4, Climate/Energy Paragraph: 4, Thermal Sector Partnerships a, b Notes: Click or tap here to enter text.

D. Other (please use the notes section to describe additional approaches that your region is taking)	☒ Yes	☐ No ☐ N/A	Page: Strategy 4, Climate/Energy Paragraph: 4. Thermal Sector Partnerships c. Notes: This strategy addresses CCRPC's Plans to work with the state, unitlities, and businesses to address the weatherization workforce challenges
7. **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?**	☒ Yes	☐ No	Page: Strategy 4, Climate/Energy Paragraph: 3. Transportation a,b Notes: CCRPC's Metropolitan Transportation Plan and Active Transportation Plans are also instrumental to meeting these goals. Projects related to these strategies are funded in the CCRPC Transportation Improvement Program and are referenced in the MTP and ECOS Plan.
A. Does the plan promote a shift away from single-occupancy vehicle trips through strategies appropriate to the region? *(Actions, objectives, or policies could include facilitation of rideshare, vanpool, car-sharing, or public transit initiatives; working with public transit providers and other stakeholders to identify and develop new public transit routes and promote full utilization of existing routes; efforts to develop or increase park-and-rides; enhancement of options such as rail and telecommuting; deployment of broadband to support remote services such as teleworking or telemedicine, education; intergovernmental cooperation; or assistance with grants related to any of the above, etc.)*	☒ Yes	☐ No	Page: Click or tap here to enter text. Paragraph: Click or tap here to enter text. Notes: Update once ECOS Plan Transporation section is drafted
B. Does the plan promote a shift away from gas/diesel vehicles to electric or other non-fossil fuel transportation options through strategies appropriate to the region? *(Actions, objectives, or policies could include developing a plan for preferred siting of charging infrastructure (ex. placement of fast or level two chargers), installing or promoting the installation of electric vehicle charging infrastructure, providing education and outreach to potential users, supporting electric and non-fossil fuel vehicle availability through outreach to vehicle dealers, etc.)*	☒ Yes	☐ No	Page: Click or tap here to enter text. Paragraph: Click or tap here to enter text. Notes: Update once ECOS Plan Transporation section is drafted

C. Does the plan facilitate the development of walking and biking infrastructure through strategies appropriate to the region? *(Actions, objectives, or policies could include studying, planning for, seeking funding for, or implementing improvements that encourage safe and convenient walking and biking; adopting a "Complete Streets" policy, etc.)*	☒ Yes	☐ No	Page: Click or tap here to enter text. Paragraph: Click or tap here to enter text. Notes: Update once ECOS Plan Transporation section is drafted
D. Other (please use the notes section to describe additional approaches that your region is taking)	☐ Yes	☐ No ☐ N/A	Page: Click or tap here to enter text. Paragraph: Click or tap here to enter text. Notes: Click or tap here to enter text.
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?**	☒ Yes	☐ No	Page: Strategy 2, Land Use, Strategy 3, Housing, and Strategy 4, Climate/Energy Paragraph: Click or tap here to enter text. Notes: As noted, Land use patterns and densities that result in conservation of energy and climate resilience are addressed in several sections of CCRPC's ECOS plan, not just in the energy element.
A. 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? *(Actions, objectives, or policies could include promoting wastewater infrastructure in planned growth areas, policies or zoning that require design features that minimize the characteristics of strip development [multiple stories, parking lot to the side or back of the store], requirements that development in those areas be connected by means other than roads and cars, policies or zoning that limits conversion and fragmentation of forest blocks and impacts to primary agricultural soils, etc.*)	☒ Yes	☐ No	Page: Strategy 2 Land Use, Strategy 4, Climate Energy Paragraph: 2. Municipal Assistance, c. and accompanying Land Use Map 2, Future Land Use Notes: Click or tap here to enter text.
B. 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? *(Actions, objectives, or policies could include promoting and assisting with municipal participation in the state designation programs; facilitating the exploration of water or sewage solutions that enable compact development; working with state agencies and local utilities to identify priority areas for EV charging, storage, and other resources to promote downtown economic and energy resilience; etc.)*	☒ Yes	☐ No	Page: Strategy 2 Land Use,Strategy 4, Climate/Energy Paragraph: 2. Municipal Assistance, c. and accompanying Land Use Map 2, Future Land Use c. Transportation a, b, Notes: Click or tap here to enter text.

C. Other (please use the notes section to describe additional approaches that your region is taking)	☒ Yes	☐ No ☐ N/A	Page: Click or tap here to enter text. Paragraph: Click or tap here to enter text. Notes: CCRPC developed guidance on how to address climate change in land use regulations, including increasing density in municipal centers planned for growth and partnered with VT Fish & Wildlife to provide state-wide educational presentations to planning and conservation commissions. CCRPC's Unified Planning Work Program regularly includes projects to assist municipalities with plans, studies, and regulatory changes to meet this goal.
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?**	☒ Yes	☐ No	Page: Strategy 4, Climate/Energy Paragraph: 6. Renewable Energy Generation Siting Policies Notes: Click or tap here to enter text.
A. Does the plan evaluate (estimates of or actual) generation from existing renewable energy generation in the region, and break this information out by municipality?	☒ Yes	☐ No	Page: Supplement 6, Existing Renewable Energy Generation Paragraph: Table 7, Existing Renewable Electricity Generation and Table 27 Municipal Renewable Energy Targets Notes: Click or tap here to enter text.
B. Does the plan analyze generation potential, through the mapping exercise (see *Mapping* standards, below), from potentially suitable areas in the region, and break this information down by municipality?	☒ Yes	☐ No	Page: Strategy 4, Climate/Energy Paragraph: Map 5 – State Preferred Sites for Solar Gneration and Existing Renewable Energy Generation Sites, Map 6 – Solar Generation Potential, Map 7 – Wind Generation Potential, and Table 27 Municipal Renewable Energy Targets Notes: Click or tap here to enter text.
C. Does the plan identify sufficient land in the 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?	☒ Yes	☐ No	Page: Supplement 6, Renewable Energy Generation Targets and Potential Paragraph: Paragraphs 2-4 Notes: Click or tap here to enter text.

D. 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?	☒ Yes	☐ No	Page: Supplement 6, Renewable Energy Generation Targets and Potential Paragraph: Paragraphs 2-4 Notes: The analysis incorporates regional and local constraints
E. 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 12 and 13 under *Mapping*, below)?	☒ Yes	☐ No	Page: Strategy 4. Climate/Energy Paragraph: 7. Renewable Energy Generation Siting and Suitability Policies b-j Notes: In addition, ther are notes embedding in each map
F. Does the plan prioritize maximizing renewable generation on preferred locations (such as the categories outlined under 12E in the *Mapping* standards, below)?	☒ Yes	☐ No ☐ N/A	Page: Strategy 4, Climate/Energy Paragraph: 7. Renewable Energy Generation Siting and Suitability Policies. b., f., g. Notes: Click or tap here to enter text.
G. Other (please use the notes section to describe additional approaches that your region is taking)	☒ Yes	☐ No ☐ N/A	Page: Strategy 4. Climate/Energy Paragraph: f. Statewide Renewable Energy Generation Regulation Notes: ensure burdens are shifted away from impacted communities
10. Does your plan's energy element assess the potential equity impacts of the policies and objectives included to meet standards 6-9? *Such an assessment could consider, for example, what communities will be most impacted by the policy or objective, the distribution of benefits and burdens related to specific actions, whether actions will address existing inequities, or the extent to which communities were or will be consulted in the development of any programs or actions.*	☒ Yes	☐ No	Page: Supplement 6, 1. Equity Assessment Paragraph: Paragraphs 2-6 Notes: Click or tap here to enter text.

Mapping Standards

Act 174 requires plans to identify potential areas for the development and siting of renewable energy, storage, transmission, and distribution resources and areas that are unsuitable for siting those resources or particular categories or sizes of those resources. It furthermore requires that the standards address the potential generation from the potential siting areas. Lastly, it requires that – in order to receive an affirmative determination – regional plans 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 examine existing renewable resources and to identify potential (and preferred) areas for renewable energy development, and to identify likely unsuitable areas 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. The PSD will provide additional guidance to accompany the standards that fleshes out the steps, layers, and standards more fully. Plans must include maps that address all of the standards below, unless N/A is provided as an option, in which case a compelling reason why the standard is not applicable or relevant should be provided in the Notes column. Regions must develop their own maps, and to then break out the maps for their municipalities, who can use their region-provided maps to meet the municipal *Mapping* standards. The map and the text describing the policies or rules used to construct the map, as well as the text describing specific policies applicable to map features, should be complementary. That should 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. Policy language must be clear, unqualified, and create no ambiguity in relation to the specific area and the type of permissible development. Consistent with the Climate Action Plan and Act 171 of 2016, the 2022 update to the Act 174 standards adds standard 12F to emphasize the value of forest lands in sequestering and storing carbon. By the 2028 update to the standards, the Department expects to incorporate Vermont Conservation Design priority interior forest and connectivity blocks into the possible constraints in standard 12C.			
11. 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 PSD.*	☒ Yes	☐ No	Page: Click or tap here to enter text. Paragraph: Map 5, State Preferred Sites for Solar Generation & Existing Renewable Energy Generation Sites Notes: Click or tap here to enter text.
12. **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 (available from VCGI and ANR), and the resulting Prime and Secondary Resource Maps will together comprise "potential areas"*:	☒ Yes	☐ No	Page: Click or tap here to enter text. Paragraph: Map 6, Solar Generation Potential and Map 7, Wind Generation Potential and Wind Energy Resource Areas Notes: Show raw renewable wind and solar potential, minus state and local known constraints
A. Raw renewable potential analysis (wind and solar), using best available data layers (including LiDAR as appropriate).	☒ Yes	☒ No	Page: Click or tap here to enter text. Paragraph: Map 6, Solar Generation Potential and Map 7, Wind Generation Potential and Wind Energy Resource Areas Notes: Show raw renewable wind and solar potential, minus state and local known constraints

B. Known constraints (signals likely, though not absolute, unsuitability for development based on statewide or local regulations or designated critical resources) to include: • Vernal Pools from Vermont Center for Ecostudies (VCE; confirmed layers) • DEC River Corridors • FEMA Floodways • State-significant Natural Communities • Rare, Threatened, and Endangered Species • National Wilderness Areas • Class 1 and Class 2 Wetlands (VSWI and advisory layers) • 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*	☒ Yes	☐ No	Page: Click or tap here to enter text. Paragraph: Map #, State and Local Development Constraints Notes: This map includes known and possible constraints
C. 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), including but not limited to: • Vernal Pools from VCE (potential and probable layers) • Agricultural Soils • FEMA Special Flood Hazard Areas • Protected Lands (State fee lands and private conservation lands) • Act 250 Agricultural Soil Mitigation areas • Deer Wintering Areas • The following features from ANR's Vermont Conservation Design: o Interior Forest Blocks – Highest Priority o Connectivity Blocks – Highest Priority o Physical Landscape Blocks – Highest Priority o Surface Water and Riparian Areas – Highest Priority	☒ Yes	☐ No	Page: Click or tap here to enter text. Paragraph: Map #, State and Local Development Constraints and Map # Forest Block Evaluation Notes: includes known and possible constraints

• Hydric Soils • 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 or community-identified resource, like a viewshed), 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.*			
D. 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.)*	☒ Yes	☐ No	Page: Click or tap here to enter text. Paragraph: Map 6, Solar Generation Potential, Map 7 Wind Energy Resource Areas, Map #, State and Local Development Constraints, and we also link to GMPs and BEDS maps showing resource constraints. See strategy 4.7.e Notes: Transmission and distribution infrastructure is shown in these maps
E. 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.* *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.*	☒ Yes	☐ No ☐ N/A	Page: Strategy 4, Climate/Energy Paragraph: Map 5, State Preferred Sites for Solar Generation & Existing Renewable Energy Generation Sites and g. Renewable Energy Generation Siting Policies Notes: Click or tap here to enter text.
i. Statewide preferred locations such as rooftops (and other structures), parking lots, previously developed sites, brownfields, gravel pits, quarries, and Superfund sites. *Note: These preferred locations align with the locations identified in the net metering rule 5.100. As of January 14, 2022 that rulemaking is currently active. Should the preferred locations identified in the rule*	☒ Yes	☐ No ☐ N/A	Page: Strategy 4, Climate/Energy Paragraph: Map 5, State Preferred Sites for Solar Generation & Existing Renewable Energy Generation Sites and g. Renewable Energy Generation Siting Policies Notes: Click or tap here to enter text.

change during that rulemaking, plans would be required to consider the updated preferred locations identified.			
ii. Other potential locally preferred locations *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.*	☒ Yes	☐ No ☐ N/A	Page: Strategy 4, Climate/Energy Paragraph: Map 5, State Preferred Sites for Solar Generation & Existing Renewable Energy Generation Sites and g. Renewable Energy Generation Siting Policies Notes: Click or tap here to enter text.
F. 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)?	☒ Yes	☐ No ☐ N/A	Page: Supplement 6, 4. Forest Block Evaluation Paragraph: Maps: Forest Block Evaluation and Woody Biomass Resource Areas Notes: Click or tap here to enter text.
13. **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."*	☒ Yes ("Yes" for A and B must also be selected below)	☐ No	Page: Click or tap here to enter text. Paragraph: Map #, State and Local Development Constraints Notes: Click or tap here to enter text.
A. 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)?	☒ Yes	☐ No ☐ N/A (if no unsuitable	Page: Click or tap here to enter text. Paragraph: Map #, State and Local Development Constraints and g. Renewable Energy Generation Siting Policies Notes: Ground mounted renewable energy generation is constrained in certain areas due to state and local restrictions on development in

If areas are considered unsuitable for energy generation, then the land use policies applicable to other forms of development in this area with similar impacts should similarly prohibit those other types of development. Please note these policies in the Notes column.		areas are identified)	those areas. Possible" Local Constraints are identified as needing mitigation because they represent locations or resources where development is partially restricted or allowed only conditionally per municipal policy.
B. Does the plan ensure that any regional or local constraints (regionally or locally designated resources or critical resources, from 12B-12C 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.*	☒ Yes	☐ No	Page: Click or tap here to enter text. Paragraph: Click or tap here to enter text. Notes: See above
14. Does the plan allow for the siting in the region of all types of renewable generation technologies?	☒ Yes	☐ No	Page: Click or tap here to enter text. Paragraph: Click or tap here to enter text. Notes: Energy generation is only limited by known or possible constraints, not by type or scale of generation.
15. 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.*	☐ Yes	☐ No	Page: Click or tap here to enter text. Paragraph: Click or tap here to enter text. Notes: Click or tap here to enter text.

X. ENERGY AND GREENHOUSE GAS EMISSIONS REDUCTION

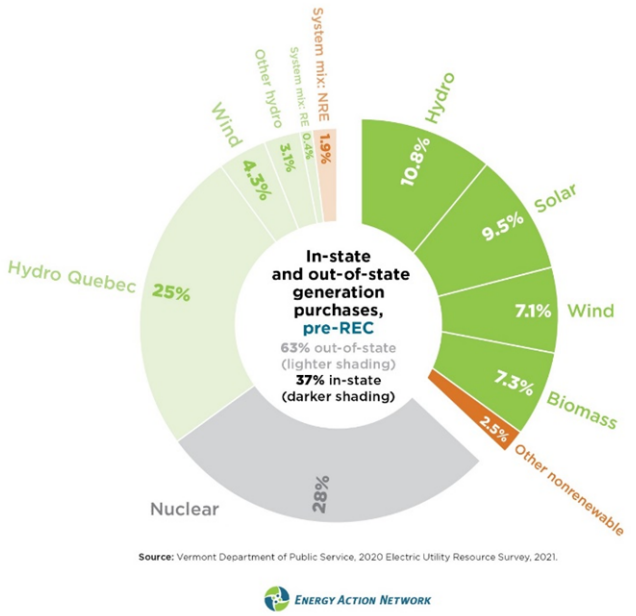
Energy Goal: In pursuit of an equitable transition for all communities, move Chittenden County's energy system toward cleaner, more efficient, and renewable sources in a manner that benefits public health, the natural environment, economic development, and the local/global climate in alignment with the State's Comprehensive Energy Plan goals and the Global Warming Solutions Act.

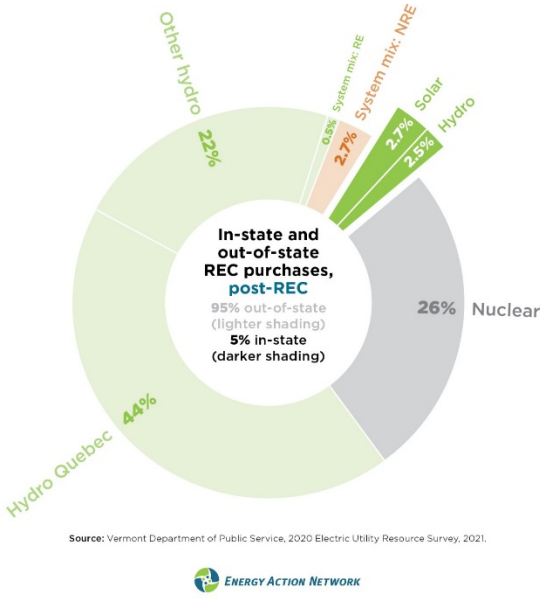
Key Issues/Trends/Insights

[Data for this section drawn from: Energy Analysis, Targets & Methodology in Supplement 6 of this Plan, Energy Analysis Report, the State of Vermont Comprehensive Energy Plan, and associated appendices and Climate Change Trends and Impacts Report].

Energy Overview

- As noted in the Climate section, fossil fuel combustion is a major cause for increases in the atmospheric concentration of carbon dioxide and other greenhouse gases, which are the causes of global climate change. Because fossil fuels drive our present-day economy, countries with higher gross domestic products and people with wealth have higher carbon footprints than poorer countries or individuals. Climate change will have profound impacts on the environment, public health, infrastructure, and economy of Chittenden County. However, just as the contribution to climate change is not distributed evenly, nor are the impacts of climate change.
- According to the State of Vermont's Climate Council's Guiding Principles for a Just Transition, studies continue to show that low-income communities, indigenous people, and Black and communities of color are among those who are particularly vulnerable to the impacts of climate change. Impacted populations also include older and chronically ill Vermonters, as well as people with disabilities. Additionally, the initial up-front cost of transitioning to electrification in the renewable energy generation, heating, and transportation sectors may be burdensome to these impacted communities. Therefore, investments, policies, administration, and oversight should tackle the needs of impacted people first by including targeted strategies for different groups that consider their specific histories, sociocultural, and economic realities.
- A transition to renewable energy will drive down carbon emissions to avoid more severe impacts of climate change. To meet the goals in the State of Vermont Comprehensive Energy Plan (CEP), the region is planning for a major shift away from fossil fuels in the transportation and heating sectors to renewable sources of energy, efficiency in all sectors, and an increase in renewable energy generation within the state and from outside the state.
- Vermont citizens, businesses, and industries spend about $1.9 billion a year to pay for imported fossil fuels (2022 Energy Action Network (EAN) Annual Report). About 75% of this money leaves the County and state immediately. This outflow of energy dollars acts as a drain on the local economy. The inverse is true for electricity: about 70% of spending on electricity recirculates within the state economy (regardless of how renewable energy credits are traded). Developing local renewable energy generation systems will provide more jobs and economic stimulation within the state in addition to advancing other energy-related goals.
- The 2022 Vermont Energy Action Network's Annual Progress Report documents the power mix physically delivered to the state (based on contractual, or ownership entitlements) as shown in the pie chart below. The power mix looks different after renewable energy credits are traded, but either approach shows that Vermont's electricity consumption is 96-97% carbon-free and less than 5% fossil fuel based. See the annual report for further information.





- The price of energy is forecasted to continue increasing in the future, which will result in an additional burden on the County's residents and businesses, especially for low- or fixed-income households. Reducing energy consumption and generating on-site renewable energy are ways to mitigate the increasing costs of energy.
- Vermont, and the County, rely heavily on gasoline and diesel for transportation. However, gasoline usage for transportation has decreased due to improved fuel economy standards and the adoption of electric vehicles in the light duty sector. According to the Energy Information Administration, between 2012 and 2021, motor gasoline consumption decreased by almost 11% or from 7,409 to 6,606 thousand barrels[44].
- Chittenden County is home to an international airport and a National Guard base. Transportation fuel consumption in the County not only includes gasoline, diesel, and compressed natural gas, but also aviation gasoline and jet fuel.

Weatherization and Energy Efficiency

- Weatherizing homes has an immediate impact on people's lives and promotes energy efficiency and a cleaner environment. Once a home is weatherized, there is an average annual energy savings of 31%[45], which puts much-needed money back into the pockets of people who need it the most. Weatherization is a critical anti-poverty program for low-income households that also promotes environmental justice and health equity. For example, weatherization programs reduce carbon emissions and assist in the removal of environmental hazards such as lead, asbestos, and vermiculite. These environmental hazards are typically found in older buildings located within Chittenden County's disadvantaged neighborhoods, as defined by the Federal Justice40 Initiative.
- The 2022 CEP and the State Climate Action Plan calls for an ambitious target to weatherize 120,000 homes by 2030 statewide to meet carbon reduction goals and to protect the health and financial security of Vermont's most impacted communities. According to the LEAP analysis, Chittenden County would need to weatherize 44% of homes by 2030 and 82% of homes by 2050 to advance this weatherization goal. According to the 2022 Vermont Energy Action Report, 31,338 homes have been weatherized statewide as of 2020. To meet the state's weatherization

goal, the Energy Action Network estimates that Vermont's qualified weatherization workforce needs to grow from 770 people working in weatherization as field workers, office staff, and energy auditors to 6,200 people by 2030[46]. To meet the weatherization goal, the State needs to address all the challenges affecting the weatherization workforce. These challenges include shortages of skilled workers willing to work in uncomfortable conditions, wage competition with less-strenuous working conditions, fluctuations in funding/incentives for weatherization projects, and affordable housing. As noted in the Comprehensive Economic Development Strategy (CEDS), a current workforce shortage in the weatherization industry represents a challenge to meeting these goals, but there is also an opportunity to address this by supporting reskilling and transitioning from the fossil fuel industry.

- Chittenden County has a long history of electrical and natural gas energy efficiency programs, dating back to 1990, these programs have provided significant energy savings and economic benefits to the state and County. These programs along with improvements in federal standards have led to a reduction in per household and per employee energy consumption of electricity and natural gas. Reduction in energy consumption directly results in a reduction in energy bills. The Home Performance with ENERGY STAR® guidelines and building/renovating to the State's Building Energy Code are two programs which assist Vermonters with reducing energy consumption from heating and electricity in homes and businesses.
- The Affordable Heat Act of 2023 will create a market mechanism to be implemented in 2026 that will incentivize the delivery of cleaner energy options so these options can become increasingly available and affordable for Vermonters. This is intended to accelerate weatherization and switching to clean fuels in the thermal sector.

Fuel Switching and Electrification

- **Electric Grid Evolution.** Vermont's energy future includes a transition to beneficial electrification in the heating and transportation sector. Beneficial electrification is a term for replacing fossil fuel powered appliances and vehicles with heat pumps, electric vehicles, energy storage and smart appliances to reduce emissions and energy costs. However, increased electricity demand coupled with renewable energy generation and storage may create challenges for the electric grid and for homes. Homes and businesses may need costly upgrades to electric service to ensure adequate amperage for increased electrical appliances like EV charging and cold climate heat pumps. Therefore, innovative programs and education are needed to ensure that low income and BIPOC communities are not particularly burdened by the transition to electrification, Smart Grid technology coupled with education, behavior change, price signaling (e.g., time of use rates), and load control technologies can help reduce peak demand and defer substation upgrades, which can result in substantial cost saving.
- **Transportation.** To prepare for electric / zero-emission vehicles accounting for 100% of light-duty vehicle sales by 2035, electric vehicle charging station equipment (EVSE) should be installed as part of new development or redevelopment to ensure charging is available. Most EV owners do their charging at home. However, public charging at key locations and workplace charging may offer benefits for businesses, employees, and customers.
    - Retrofitting existing residential multi-unit dwellings (MUDs) with EVSE and the necessary electric service amperage is imperative to ensure that electric vehicle adoption is equitable, and all drivers have adequate access to charging infrastructure. MUD residents in apartments and condominiums often have more challenges in gaining access to home EV charging due to parking issues and cost. Renters in MUDs have additional barriers to long-term investments in charging infrastructure for shorter-term housing. In addition, policies, and pricing structures to encourage off peak charging need to be considered to mitigate grid constraints associated with electric vehicle charging. Refer to the EV Charging Equipment Location Prioritization Technical Report for specific priority locations for EVSE.

- The 2023 Metropolitan Transportation Plan (MTP) anticipates increases in transit ridership, significant mode shift from driving to biking or walking, including the use of electric bikes (e-bikes) to reduce energy and emissions from transportation. See the MTP for additional information.

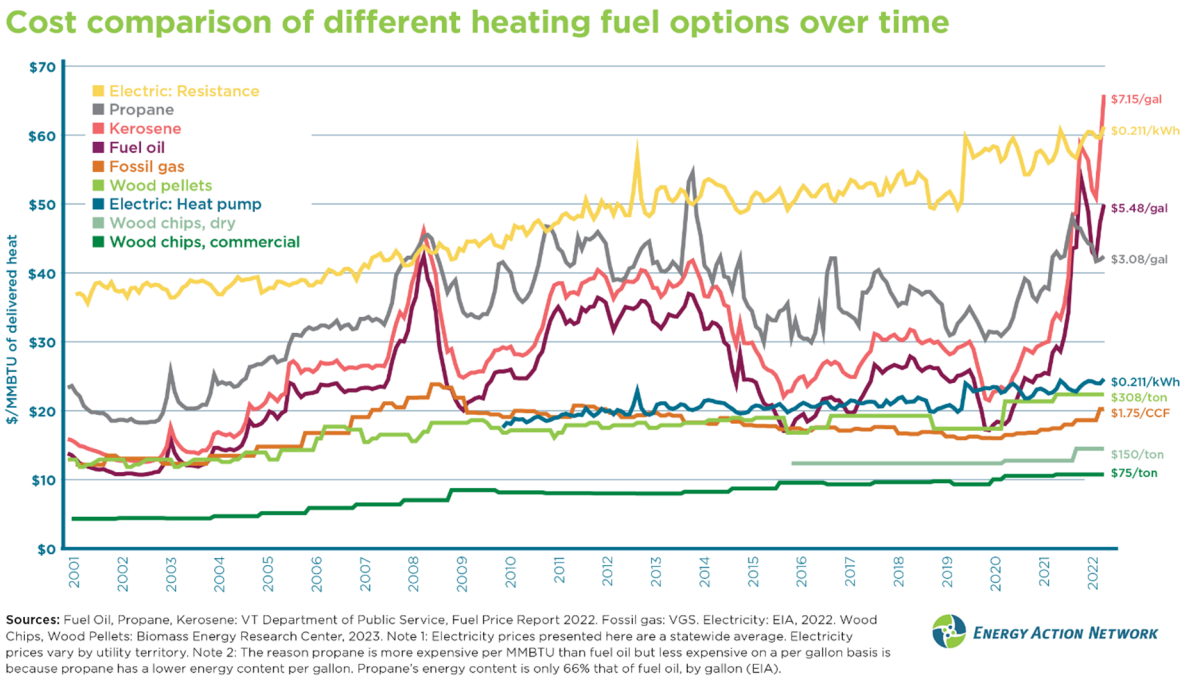


Figure sourced from 2022 Vermont Energy Action Network Annual Progress Report, page 27.

- **Heating.** With the passage of the Affordable Heat Act, the heating sector will shift away from fossil fuel use. Promoting air source and ground source heat pumps (powered by a renewable electric grid), in addition to using sustainably harvested wood/biomass systems, biogas and networked geothermal, are key steps to meeting the Global Warning Solutions Act requirements and the 2022 CEP goals. However, low income, BIPOC, and renter households are likely to experience barriers and be burdened by the cost of transitioning to heat pump technology or any technology because of the cost of upfront investments to retrofit buildings. Incentive programs specifically designed for impacted or burdened populations are necessary to ensure the transition to heat pumps is equitable and accessible. However as noted in the 2022 Vermont Energy Action Network Annual Report, natural gas costs less than electricity[1] so customers are not likely to save money on their energy bills by replacing existing natural gas heating systems with heat pumps. Buildings switching from fuel oil or propane to a heat pump system will save customers money and protect customers from price volatility as the cost of electricity is less than fuel oil or propane and is less susceptible to price fluctuations. Net-zero buildings and heat pumps as the primary fuel source in new buildings will help the region meet its goal of shifting the heating sector away from fossil fuels. Additionally, key partners in the energy transition are making progress towards becoming more renewable in the thermal sector. These are described in the bullets below.
  - The City of Burlington is pursuing a district heating system from McNeil Generation Station's waste heat to be a source of renewable thermal energy for University of

[1] The 2022 Vermont Annual Energy Report notes that as of November 2022, the residential effective cost of natural gas was $15.67 per Metric Million British thermal units (MMBTU) compared with $22.44 / MMBTU for air source heat pumps.

Vermont and University of Vermont Medical Center. When constructed, this heat source will replace natural gas demand and help the region meet its thermal energy targets. Additionally, the city has adopted a Net Zero Energy Roadmap to reduce and eliminate fossil fuel use from heating.

- VGS's comprehensive strategy for NetZero by 2050, with an immediate goal of reducing GHG emissions for customers by 30% by 2030, is critical to achieving the State's energy and climate goals. Expanding renewable natural gas to make up 20% of the supply mix by 2030 and is also part of VGS's strategy. Moreover, VGS is exploring networked geothermal for its customers with a priority focus on affordable housing and low to middle income communities which will ensure that lower income households have access to an equitable way to transition off fossil fuels for heating and the burden is not placed on them to bear the responsibility of making the transition.
- **Biomass for Heating.** Wood chips and pellets remain one of the most affordable sources of heating in Vermont, but as noted in other sections of this plan, their use must be balanced with the need to maintain ecological values and carbon sequestration and storage. In simple terms, harvesting of low-grade wood for electricity or heating is sustainable when it does not exceed the net growth rate of low-grade wood in forests. The state's Net Available Low-Grade (NALG) wood has increased since 2010; though NALG may decrease in the short-term due to fluctuations in the rates of forest growth and demand for low-grade wood, the long-term outlook allows for use of low-grade wood for both heating and electricity generation at current or slightly higher levels (see Supplement 6 for further analysis). Carefully planned harvesting of mature trees (particularly those useful for low-grade wood) through the practice of uneven-aged management will in fact increase overall tree growth and carbon sequestration rates while restoring the health and diversity of Vermont's forests. It will also provide an important source of local, renewable, and carbon-neutral fuel that provides economic value to retaining forests as they are rather than converting them to non-forest uses. Given this, CCRPC continues to support use of low-grade wood for both heating and electricity provided that is sourced through forest management practices that prioritize maintaining long-term ecological health, carbon sequestration and storage rates, and regenerative economic value from forests.

Renewable Electricity Generation

- As of 2022, Chittenden County generates 606,554 MWh (an 19% from 511,242 in 2017) of renewable energy from a range of non-fossil fuel based, renewable energy production sites owned by utilities, private parties, and municipalities. Reliable, cost effective, and environmentally sustainable energy availability is critical to support the economy and natural resources of Chittenden County.
- **Equitable Access to Renewables.** The environmental and cost saving benefits of renewable energy generation are not always equally accessible. Impacted communities may be left out or burdened by renewable energy generation programs because of not owning homes or living in multi-unit buildings that are not well suited for installing their own systems. Community solar is one way to increase ownership access to renewable energy generation because zero upfront financial investment is needed to install a community solar array. Community solar participation also provides savings on electricity expenses which is especially helpful for lower income households.
- **Peak Loads and Resilience.** Grid resilience is valued by both residents and business. Vermont's weather and landscape patterns make the state vulnerable to power outages. Therefore, coupling distributed energy generation with battery storage systems will help to improve grid resilience. Moreover, as the region electrifies the heating and transportation

sectors with solar and wind generation sources, energy storage systems will be necessary to manage peak loads and turn intermittent sources into relatively consistent sources of energy.

- **Renewable Electricity Standard.** Act 56 established a renewable energy standard (RES) which requires Vermont's electric utilities to source 55% of their retail electricity from renewable sources by 2017, 75% by 2032, and 90% by 2050.
    - Among the three electric utilities that operate within Chittenden County, Green Mountain Power's supply is now 100% carbon free post and 68% renewable now and will be 100% renewable by 2030. Burlington Electric Department's portfolio is also 100% renewable. Both utilities claim these achievements post renewable energy credit sales. Vermont Electric Co-op plans to meet or exceed its RES obligations by 2030.
    - While the region's baseline electricity consumption overwhelmingly comes from carbon-free and even renewable sources, during peak demand times that exceed renewables' capacity the demand must be met with imports from the New England (NE) System Mix. To meet the demand, peak electricity is mostly provided by natural gas generation, which is a source of greenhouse gas emissions.
- The RES requires electric utilities to work with customers to reduce fossil fuel use and decrease carbon emissions from transportation and thermal heating by offering new innovative programs and services to their customers. For example, electric utilities serving the region are offering incentives for electric vehicles, charging equipment and heat pumps to meet the statute and deliver innovation.
- Vermont's rural nature offers challenges for the transmission and distribution of energy. It is important to maintain and develop an energy production, transmission, and distribution infrastructure in Chittenden County that is efficient, reliable, cost-effective, and environmentally responsible. The Vermont Electricity Power Company (VELCO) is Vermont's electricity transmission utility. VELCO's 2021 Long-range Transmission Plan notes that the regional transmission system serving West Central Vermont adequately serves current needs, yet may require substantial upgrades in future years, particularly as more local electricity generation occurs. Several of the principal electricity distribution utilities serving the region, including Burlington Electric, Green Mountain Power, Washington Electric Coop, and Vermont Electric Coop, all have areas with significant system constraints where future system upgrades may be needed.
- The cost of electricity is impacted by the distance it travels. When electricity is transmitted over long distances a significant amount of electricity is lost. Locating generation near electric loads reduces transmission losses and may result in more cost-effective retail electricity rates.

Energy and Land-Use Planning

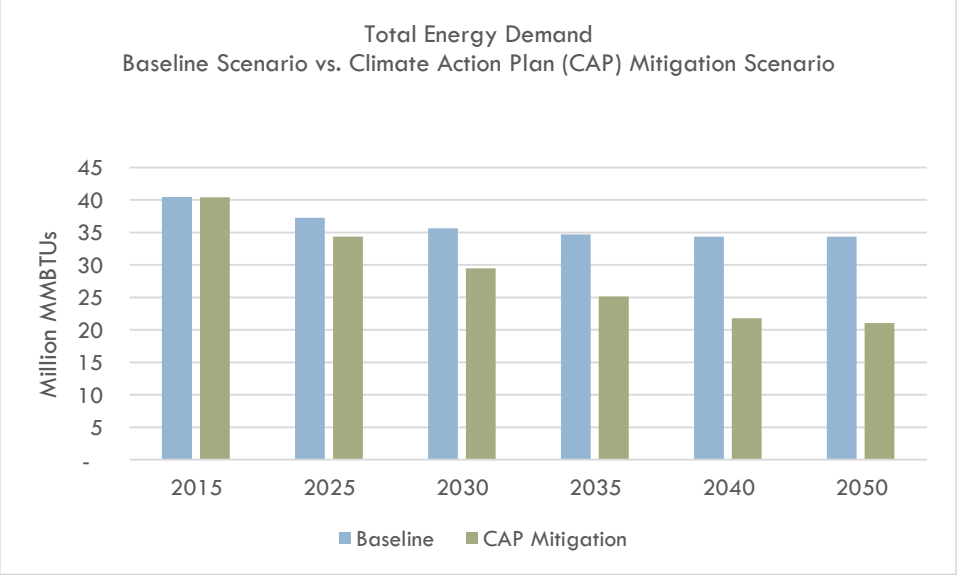
- **Compact Development Patterns.** The most impactful way to reduce greenhouse gas emissions is to enable more compact walkable neighborhoods in the region's areas planned for growth. Chittenden County, perhaps more so than other regions of the State, can achieve great energy efficiency and GHG benefits because of development density and infill development goals.
    - **Energy Efficiency**. Compact walkable neighborhoods encourage smaller building footprints with lower heating and cooling needs, promote efficient travel that is less dependent on cars and provide more opportunity for walking, biking, and transit.
    - **Conservation for Carbon.** Compact development also decreases development pressure on Vermont's working and natural landscapes. This preserves land for carbon sequestration and storage.

- **Electric Load Efficiency.** Dense population centers make distributed generation easier because energy can be produced near significant numbers of customers and load. Additionally, the county's dense land use pattern may enable innovative energy solutions, such as district heating and microgrids.

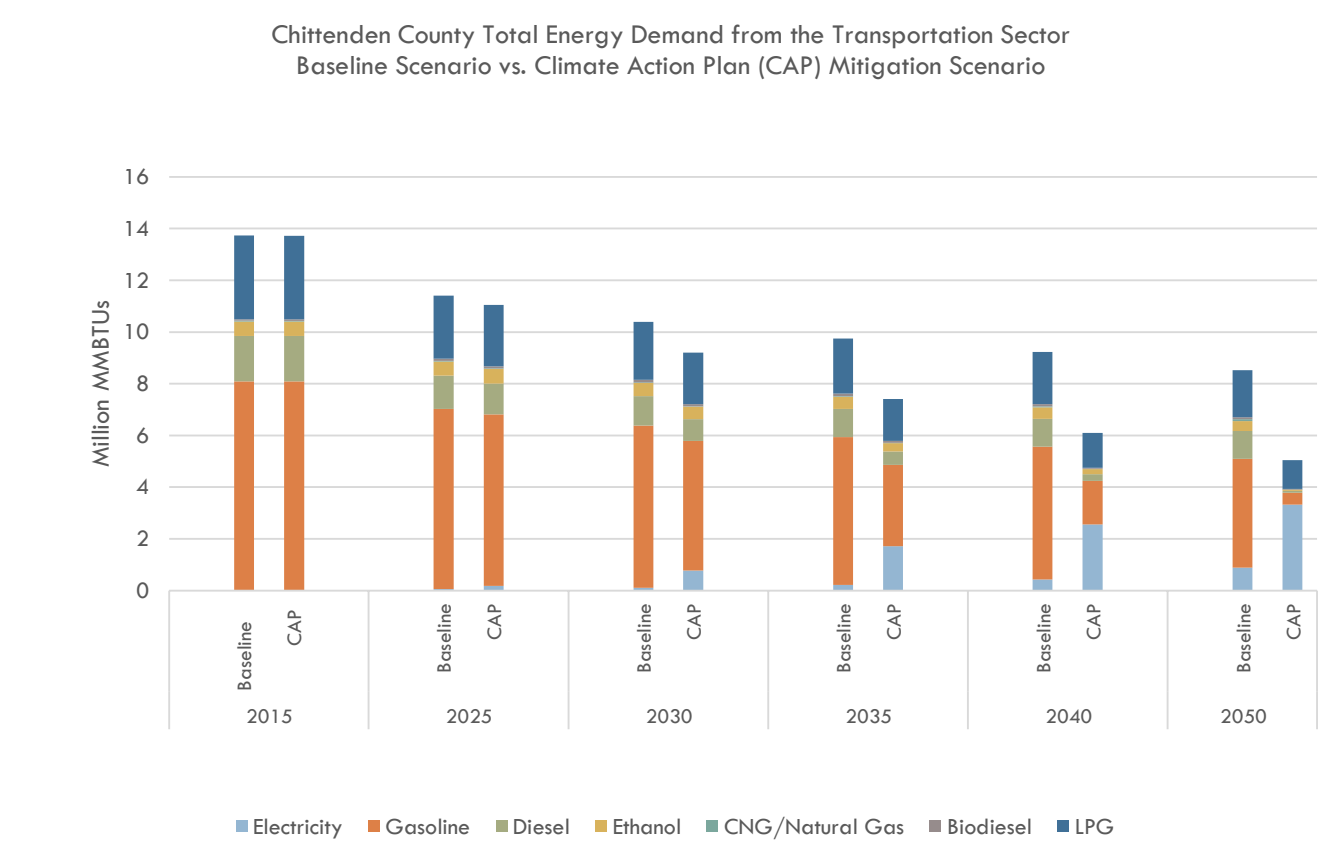
- **Enhanced Energy Planning.** In 2016, the Vermont Legislature enacted Act 174 to improve energy planning and to give town and regional plans greater weight or "substantial deference" in Public Utility Commission (PUC) proceedings. As of 2022, Bolton, Burlington, Charlotte, Colchester, Essex Junction, Hinesburg, Huntington, Jericho, Richmond, Shelburne, Underhill, Williston, Winooski, and Westford have adopted enhanced energy plans.
  - **Development Constraints.** The Act 174 enhanced energy planning standards involve identifying and mapping constraints to development. These constraints must be applied equally to renewable electricity generation projects as well as other forms of development. While this is generally good policy, there may be circumstances where renewable energy generation projects could be developed without creating negative impacts to some specific state-required constraints (e.g., wetlands). Further study and consideration of these policies is warranted to find workable solutions for responsibly siting renewables amidst these constraints. This will reduce competition between renewables and other forms of development which typically have greater impacts on protected resources.

Energy Analysis and Targets

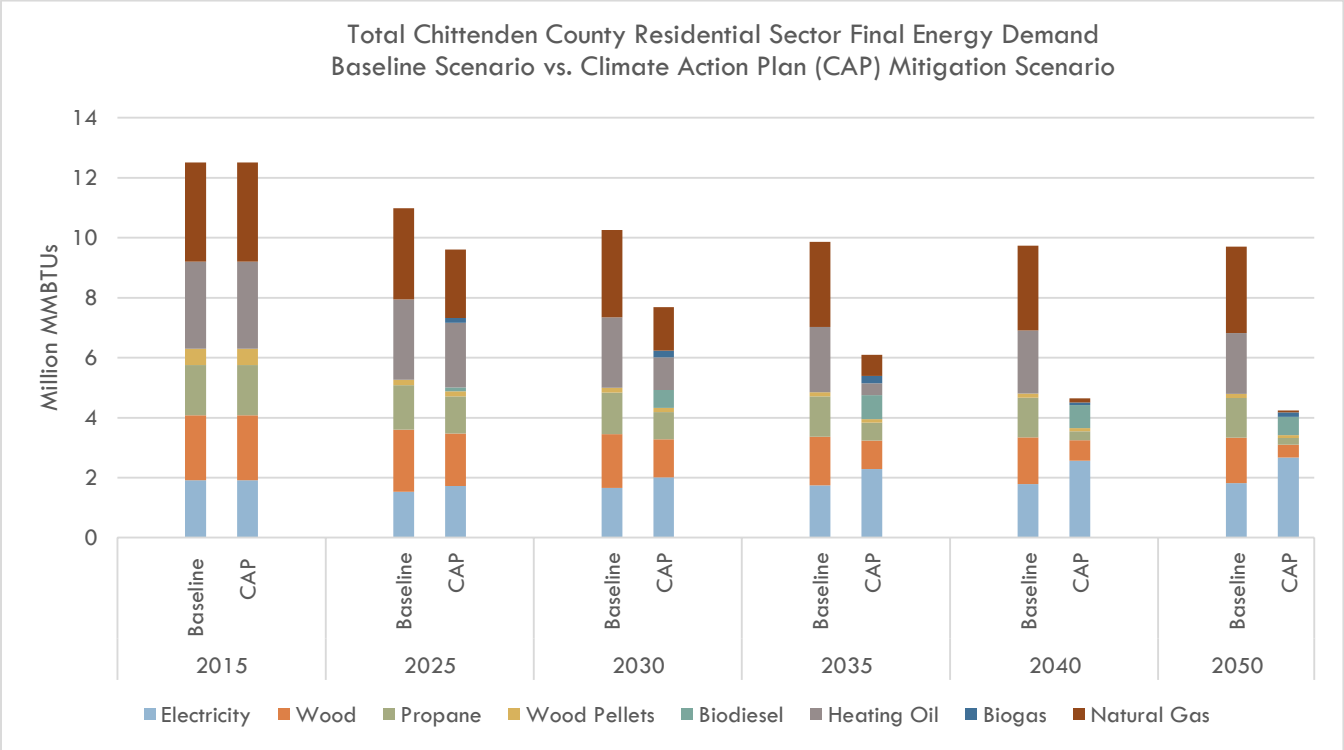
- The Department of Public Service developed a scenario model of Vermont's energy consumption to construct pathways to align with Vermont's Comprehensive Energy Plan (CEP) and Climate Action Plan (CAP) and to meet statutory greenhouse gas (GHG) reduction obligations under the state's Global Warming Solutions Act (GWSA). This scenario is referred to as the Central GWSA Mitigation or CAP Mitigation scenario. A second, baseline, scenario was also developed to estimate Vermont's energy demand given business as usual conditions. The model was built with the Low Emissions Analysis Platform (LEAP), a software tool for energy system modeling and emissions accounting. The following charts below represent the magnitude of change needed in the commercial, industrial and transportation sectors to meet state energy and climate goals in Chittenden County. The targets needed to meet the energy planning standards are derived from the CAP scenario and are contained in the ECOS Plan's supplement 6.
- As the region strives to meet renewable energy and decarbonization goals, the region will see a decrease in total energy demand (inclusive of the transportation sector) as buildings and vehicles become more efficient through weatherization and fuel switching. In addition, energy use will move away from fossil fuel consumption towards electricity from renewable sources (see chart below). Based on the comparison of total energy demand in the baseline scenario and the CAP mitigation scenario, Chittenden County's total energy demand will be 48% less in the year 2050 than it was in the year 2015 with the implementation of the policies that were modeled in the CAP mitigation scenario.



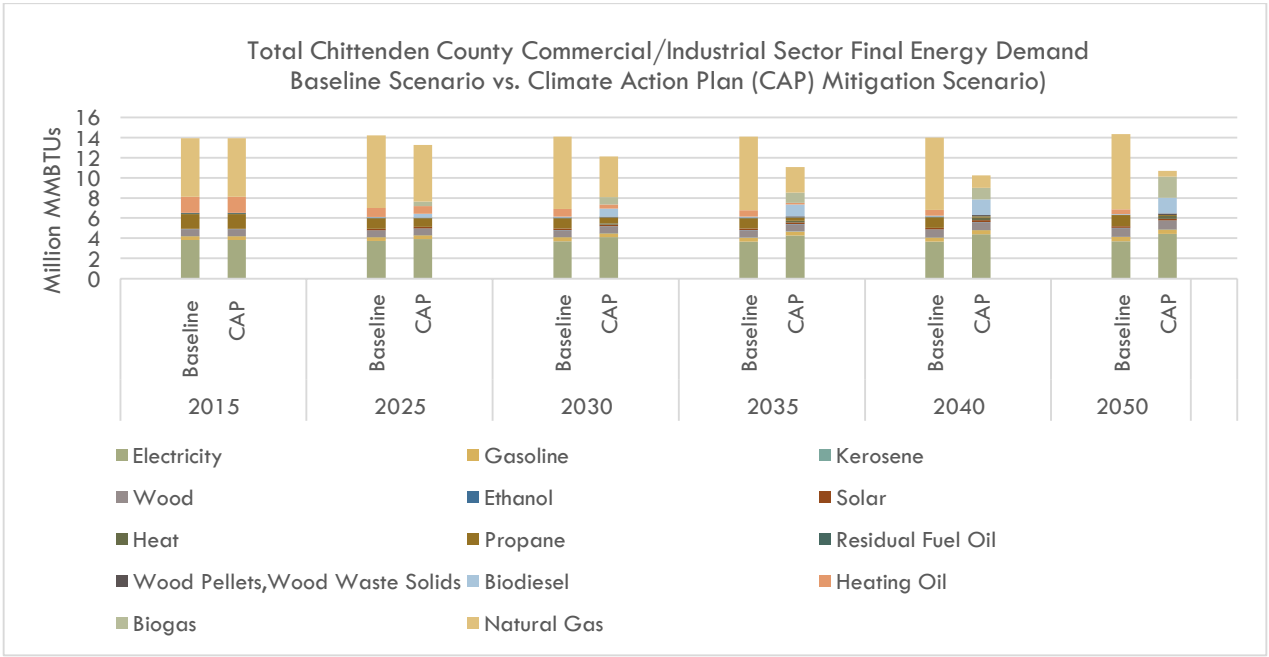
- The CEP includes a goal of having zero-emission vehicles account for 100% of light duty vehicle sales in Vermont by 2035 and calls for the transportation sector to meet 10% of energy needs from renewable energy by 2025, and 45% by 2040. As the county transforms the transportation sector to meet these goals, electricity as a fuel source in the transportation sector will increase (see chart below). As a result, it is estimated that Chittenden County will need to have 28,950 electric vehicles by 2030 and 145,754 electric vehicles by 2050 in the passenger and light duty sectors. In comparison, Chittenden County has 3,183 EVs registered as of 2022.



- Thermal energy use in Chittenden County homes is projected to decrease by 64% from 2025 to 2050. Electricity demand will need to increase by 140% between 2025 and 2050. Natural gas, fuel oil, and propane will virtually be eliminated, per the CAP scenario. Residential buildings will use less energy for space heating due to an increase in the percentage of buildings that are weatherized and the greater efficiency in heating technology.



- Chittenden County's energy demand in the thermal commercial/industrial sector will need to be reduced by 19% from 2025 levels to meet future energy, carbon reduction and renewable energy source goals. This will primarily be achieved through weatherization of commercial buildings and the use of more efficient heating technologies (e.g. cold climate heat pumps powered by renewable electrification). By 2050, the LEAP model targets the region to have 64,790 new heat pumps installed in commercial buildings. Natural gas demand is estimated to decrease by 63% from 2025 to 2050 and the demand for heating oil and propane will be eliminated.



- **Electricity Generation Targets.** CCRPC supports the generation of new renewable energy in the County to meet Vermont's Global Warming Solutions Act and Comprehensive Energy Plan's goal of using 90% renewable energy by 2050, in a manner that is equitable, cost effective and respects the natural environment.
    - Specifically, Chittenden County needs to generate a total of 954,833 MWh (Megawatt hours) of energy annually (a 57% increase over 2022) to meet state energy and climate goals. Table XX sets progressive milestones to reach this goal, including the amount of additional generation that must be brought into production after accounting for existing renewables. These targets are based on the average of the county's share of statewide population and land area. While the county has sufficient land to build new renewable electricity generation projects to reach the 2050 generation targets, the electric transmission and distribution system will likely need upgrades to be able to move electricity from generation to demand.
      The targets are technology neutral, meaning that they can be met with any mix of solar, wind, hydroelectric, biomass, or other sources of renewable electricity. CCRPC has completed an analysis of areas suitable for solar and wind energy generation to determine our ability to meet the 90% renewable by 2050 and decarbonization goals and has determined that the region has sufficient land to meet its targets by relying on wind and solar energy generation.
    - However, the current PUC's sound rule for wind generation makes developing new wind generation unfeasible because the PUC Rule 5.700 imposes standards and requirements on wind energy that have the effect of prohibiting its development. CCRPC supports regulatory changes to make wind power more viable for several reasons. First, it is complementary to solar in terms of its generation profile. Second, it can provide local low-cost electricity for Vermont rate payers. Host communities' benefit from increased property taxes and jobs. Wind generation in Vermont can also reduce Vermont's strong dependence on external electricity providers, such as Hydro Quebec, to supply our electric needs in an increasingly electrified world.
    - CCRPC's renewable energy generation facility siting policies are detailed in Strategy 4, Action 2 and will inform CCRPC's preferred sites policy.

TABLE XX: CHITTENDEN COUNTY RENEWABLE ELECTRICITY GENERATION & TARGETS (MWH / YEAR)

Year	2018*	2022	2032	2040	2050
Total Renewables Target	N/A	N/A	648,475	857,945	954,833
Existing Renewables	501,196	606,554	606,554	606,554	606,554
New Renewables Target	N/A	N/A	41,922	251,391	348,279
*As reported in 2018 ECOS Plan based on data from Vermont Community Energy Dashboard					

Key Indicators

Additional indicators can be found on the ECOS Scorecard.

Indicators	Location
Annual Natural Gas Consumption	Scorecard
Annual Electricity Consumption	Scorecard
Percent of Electricity Saved	Scorecard
Renewable Energy Capacity Sited in Chittenden County	Scorecard

See Supplement 6 for the complete Act 174 Energy Planning Analysis and Targets

2. LAND USE: STRIVE FOR 90% OF NEW DEVELOPMENT IN AREAS PLANNED FOR GROWTH, WHICH AMOUNTS TO 15% OF OUR LAND AREA.

The areas planned for growth are defined as the Center, Metro, Suburban, Village, and Enterprise Planning Areas (all but Rural) as displayed on the Future Land Use Map. This strategy mimics the development patterns we've seen in the recent past. A Transit Oriented Development (TOD) overlay planning area has been added to depict and encourage a higher concentration of growth within walking distance to bus routes to reduce transportation energy consumption, carbon emissions, and preserve our natural and working landscapes. This overlay is within the areas planned for growth.

Increasing investment in denser, mixed use growth areas will improve economic opportunities, housing options, transportation options and improve community health. Focusing growth in the appropriate planning areas is also a cost-effective approach to increasing the supply of affordable housing and using existing infrastructure efficiently. Also, this pattern of growth reduces energy consumption for transportation. Homes are in closer proximity to jobs and other services, making trips shorter and making travel by walking, biking, transit and carsharing more feasible.

Actions

1. **Invest in Areas Planned for Growth** -

    a. Invest in wastewater, water and stormwater infrastructure, energy systems (e.g. distribution, storage, and generation) and transportation infrastructure (prioritizing bicycles, pedestrians and public transit) in areas currently developed and/or planned for growth.
    b. Target reuse, rehabilitation, redevelopment, infill, and brownfield investments to -areas planned for growth.
    c. Retrofit existing buildings to reduce energy use and greenhouse gas emissions.
    d. Improve the walkability and streetscapes of high density areas, and allow flexibility for creative solutions to improve vibrancy and livability.

2. **Municipal Planning and Zoning** - Strengthen and direct development toward areas planned for growth through infill development and adaptive reuse of existing buildings through municipal plan and bylaw revisions and state designation programs.

    a. Municipal Development Review Regulations should be revised to improve the mix of uses, shared parking, support for transit, access to a variety of services (for example restaurants, grocery stores, parks, entertainment) via active transportation, energy efficiency, renewable energy and the affordability of housing. A particular emphasis is needed on providing for affordable rental housing.
    b. Integrate capital planning and budgeting in planning efforts to provide the right mix of infrastructure over time. Official maps can also be a useful tool to drive infrastructure improvements in the areas planned for growth.
    c. Health Impact Assessments (HIA) provide a tool to use at the regional, municipal, agency, and organizational level to assure that planning decisions maintain or improve the public health. Access can be improved by co-locating public facilities, in particular, medical and mental health facilities in areas with easy access via active transportation and public transit. Town health officers should be encouraged to participate in community planning efforts.

d. Empower local officials through trainings and education on strategies to achieve the above plan and bylaw amendments, and implementation of them during development review. This could include how to effectively analyze development costs and benefits, and select appropriate multi-modal congestion mitigation measures.

3. **Broadband** – Coordinate with the VT Community Broadband Board, municipalities and service providers to ensure all residents and businesses are served by fiber broadband service.

4. State/Local Permitting Coordination & Improvement

a. Support changes to the local and state permitting process to make the two more coordinated and effective. Participate in the Commission on Act 250 to improve the State's development review process, particularly to encourage development in appropriately planned places and discourage development outside of those areas. This could include expedited permitting processes for projects in areas that are: a) designated for growth; and b) where a community has a robust plan, regulations and staff capacity. In conjunction with a reduction of permit review redundancies in areas planned for growth it may be appropriate to develop more stringent standards and thresholds for development review in rural areas.
b. Collaborate with stakeholders to ensure local and state regulations, bylaws and plans encourage transparency, predictability and timely review of sustainable and environmentally sound development applications. Support the establishment of an ambassador position to help those wishing to start businesses in Vermont understand and navigate the state permitting process.
c. Develop a transportation assessment process that supports existing and planned land use densities and patterns in Center, Metro, Suburban, Village, and Enterprise Planning Areas to allow for more congestion and greater mode choice than allowed by current standards. The CCRPC will collaborate with the Vermont Agency of Transportation (VTrans), the Natural Resources Board, and other state and local stakeholders to develop a process that evaluates the transportation impact from a multi-modal perspective rather than just a traffic flow standpoint.
d. Policies and planning studies that are adopted as part of this ECOS Plan and subsequent amendments will guide CCRPC's position in permit proceedings.

5. **Housing Proximity** – The proportion of Chittenden County employees who live outside the county has increased since 2002; this increases greenhouse gas emissions as workers travel greater distances to work. While some may be living outside of the County by choice, others have no choice because they can't afford a home in the County. Reversing this trend to achieve 75% of Chittenden County workers living in the region will require two things: enough housing to accommodate more Chittenden County workers, and housing stock that is affordable and accessible to a wide variety of residents.

4. CLIMATE/ENERGY: TRANSFORM THE REGION'S ENERGY SYSTEM TO MEET VERMONT'S ENERGY AND GREENHOUSE GAS REDUCTION GOALS WHILE AVOIDING UNFAIR IMPACTS ON MARGINALIZED GROUPS AND MAINTAINING ECOLOGICAL HEALTH, ECONOMIC VITALITY, AND EQUITABLE ACCESS TO AFFORDABLE ENERGY.

1. **Energy and Climate Goals**
   a. Reduce energy consumption, increase renewable energy generation and decrease greenhouse gas emissions to support the State's energy goals in the 2022 Vermont Comprehensive Energy Plan and the Global Warming Solutions Act as incorporated by reference here.
   b. Greenhouse gas reduction requirements (26% from 2005 levels, 40 from 1990 levels by 2030, 80% from 1990 levels by 2050
   c. Weatherize 120,000 Vermont homes by 2030 (relative to the 2008 baseline)
   d. Meet 25% of energy needs from renewable sources by 2025, 45% by 2035, and 90% by 2050.
   e. In the transportation sector, 10% of energy needs from carbon-free resources by 2032, with at least 75% from renewable energy. Zero-emission vehicles account for 100% of light-duty sales in Vermont by 2035.
   f. In the thermal sector, 30% of energy needs will be from renewable energy by 2025, and 70% by 2042.
   g. In the electric sector, be 100% decarbonized and at least 75% renewable by 2032.
   h. Achieve net-zero ready construction for newly constructed buildings by 2030.

2. **Municipal Assistance**
   a. Provide assistance to municipalities when requested to enhance town plans to be consistent with Act 174 standards for the purpose of enabling municipalities the ability to gain substantial deference in the Certificate of Public Good Section 248 process. This assistance will include working with municipalities to identify natural, cultural, historic, or scenic resources to be protected from all development types, identify preferred locations for renewable energy generation facilities.
   b. Provide assistance to municipalities to implement their energy plans and encourage municipalities to lead by example with respect to energy efficiency for buildings and transportation and the deployment of renewable energy.
   c. Review municipal plans, ordinances, bylaws, and policies to identify best practices for meeting energy goals, including enabling more compact walkable neighborhoods in areas planned for growth, and share these with other municipalities and partners.

3. **Transportation**
   a. Reduce fossil fuel consumption in the transportation sector through transit-oriented development, particularly in bus and rail served locations, transportation demand

management (TDM) and electric vehicle promotion strategies outlined in Part 6 of this section and in the Metropolitan Transportation Plan (MTP) included in this plan.

b. **Renewable Transportation Fuels.** Work with municipalities and relevant stakeholders to plan for local renewable transportation refueling networks and infrastructure, such as Level 2 and Level 3 electric vehicle recharging and hydrogen refueling. Ensure that these support both commuting and regional destinations (e.g., downtowns, villages, resorts, tourist sites, transportation hubs, major employers and multi-unit housing) and that they are planned along major regional transportation routes per the National Electric Vehicle Infrastructure (NEVI) Plan.

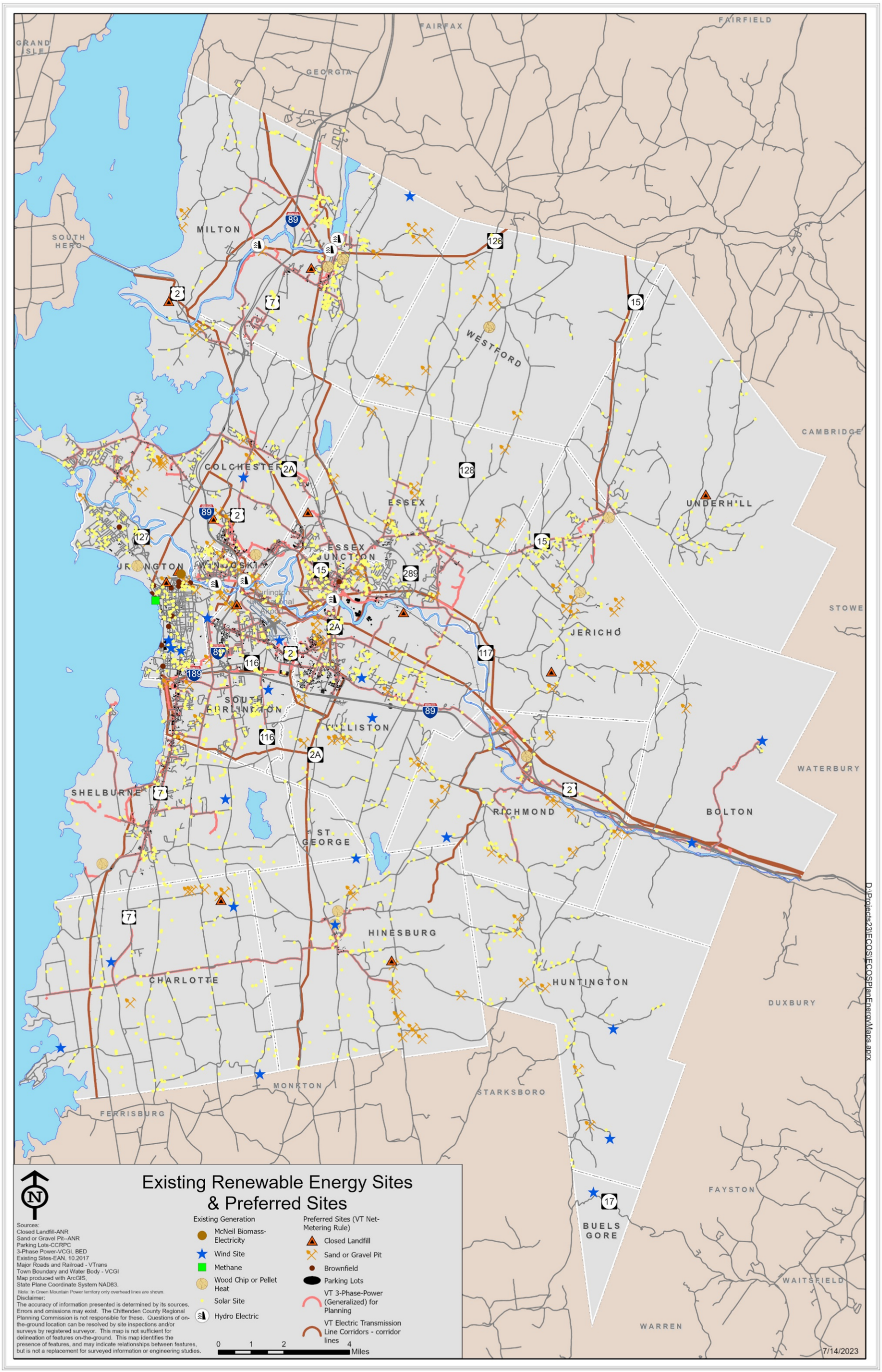
4. **Thermal Sector Partnerships**
   a. Continue partnerships with VGS, Burlington Electric Department, Efficiency Vermont and the Champlain Valley Office of Economic Opportunity Weatherization Assistance Program to promote weatherization and energy efficiency programs and incentives for homes and businesses.
   b. Decrease fossil fuel consumption in the thermal sector by working with partners such as Green Mountain Power, VGS, Efficiency Vermont, Burlington Electric Department, and other energy service providers to educate developers, businesses, and homeowners about cold climate heat pumps, heat pump hot water heaters, wood heating, biofuels, and geothermal systems.
   c. Advocate for the State, utilities, and workforce/business development organizations to address weatherization workforce challenges identified in the 2021 Weatherization Workforce Report. Promote the expansion of current workforce training programs that are effective, such as ReSOURCE's weatherization and HVAC 101 training programs.
   d. Encourage the State of Vermont to implement a single building energy code standard at least as high as the current stretch code for all new development and retrofits that accelerates net zero building practices and electric vehicle charging infrastructure. The code should be enforced at the state level. The state must ensure that energy efficient construction is accessible to and does not unfairly burden communities of color and lower income households.
   e. Support VGS's and other organizations in bringing networked geothermal to the region.
5. **Renewable and Resilient Electricity**
   a. Support a wide variety of renewable energy generation types, including storage, sustainable uses of biomass for heating, passive solar building design, bio-digesters for electricity generation, photovoltaic solar, wind turbines, and optimizing the energy potential for existing hydro-electric dams.
   b. Coordinate with transmission and distribution utilities to resolve electric grid constraints to enable the region to achieve Chittenden County's renewable energy generation target needed for the electrification of the heating and transportation sector.
   c. Support in-place upgrades of existing facilities, including existing renewable energy generation, storage, transmission lines, distribution lines, substations, and energy storage as needed to reliably serve municipalities and the region with a resilient and low-carbon electric grid that supports a growing renewable electricity economy and low electricity costs. The existing law (30 V.S.A. 218c and PUC Docket 7081) does not sufficiently enable VELCO with the authority needed to effectively plan for grid modernization that meets the state's energy and climate goals. To plan for the transmission constraints that our State and our region are facing, the state should enable VELCO to design and fund a transmission system to address grid constraints in an equitable and proactive manner.
   d.

6. **Statewide Renewable Energy Generation Regulation**
    a. Support changes in federal, state, and local policies to achieve the state of Vermont Comprehensive Energy Plan, Climate Action Plan goals, and to ensure burdens are shifted away from impacted communities. Support changes to the Renewable Energy Standard to prioritize in-state generation over electricity imports to avoid externalizing both environmental and societal costs and benefits.
    b. Increase the maximum size of net-metered projects and establish a tiered system for net-metering rates in which utilities pay a lower rate to facilities over a certain size (such as 500kW) to increase net-metering participation and reduce the energy burden for public and non-profit entities.
    c. Increase the maximum size of net-metered projects (currently 500kW) for public, and non-profit, and community ownership entities to encourage them to maximize development of renewable energy sources.
    d. Advocate for the Public Utility Commission to open the rule making process on Rule 5.700, Sound Levels from Wind Generation Facilities, to reassess existing sound standards with the intent of allowing all sizes and scales of wind energy generation possible in Chittenden County.
7. **Renewable Energy Generation Siting and Suitability Policies**
    a. CCRPC supports the generation of new renewable energy in the County to meet Vermont's Global Warming Solutions Act requirements and Comprehensive Energy Plan's goal of using 90% renewable energy by 2050, in a manner that is cost effective, respects the natural environment, and does not unfairly burden low-income communities with the impacts of development. Specifically, Chittenden County needs to generate a total of 954,833 MWh (Megawatt hours) of energy annually (a 57%increase). As 2022,Chittenden County generates 606,554 MWh of renewable energy. The targets are technology neutral, meaning that they can be met with any mix of technologies.
    b. The following statements are CCRPC's renewable energy generation facility siting policies that will inform CCRPC's preferred sites for net-metering policy. Ground mounted renewable energy generation is constrained in certain areas due to state and local restrictions on development. Site renewable energy generation to avoid state and local known constraints and to minimize impacts to state and local possible constraints, as defined in Strategy 3, Action 1.f, and Strategy 4, Action 1.f, and Action 2.e. Renewable energy generation sited on existing structures or parking lots complies with this policy.
    c. Site ground-mounted solar development in accordance with setback standards as defined in 30 V.S.A. §248(s) and municipal screening requirements adopted in accordance with 30 V.S.A. §248(b)(B). After considering the constraints referenced above and found in Supplement 3, different levels of suitability exist for different scales and types of renewable energy generation depending on location within the County.
    d. To determine an appropriate location for a facility, first review the constraints above and then look at the polices below to determine how and where CCRPC encourages renewable energy generation facilities. CCRPC recommends the location of renewable energy generation facilities in accordance with the relevant guidelines below. Inability to

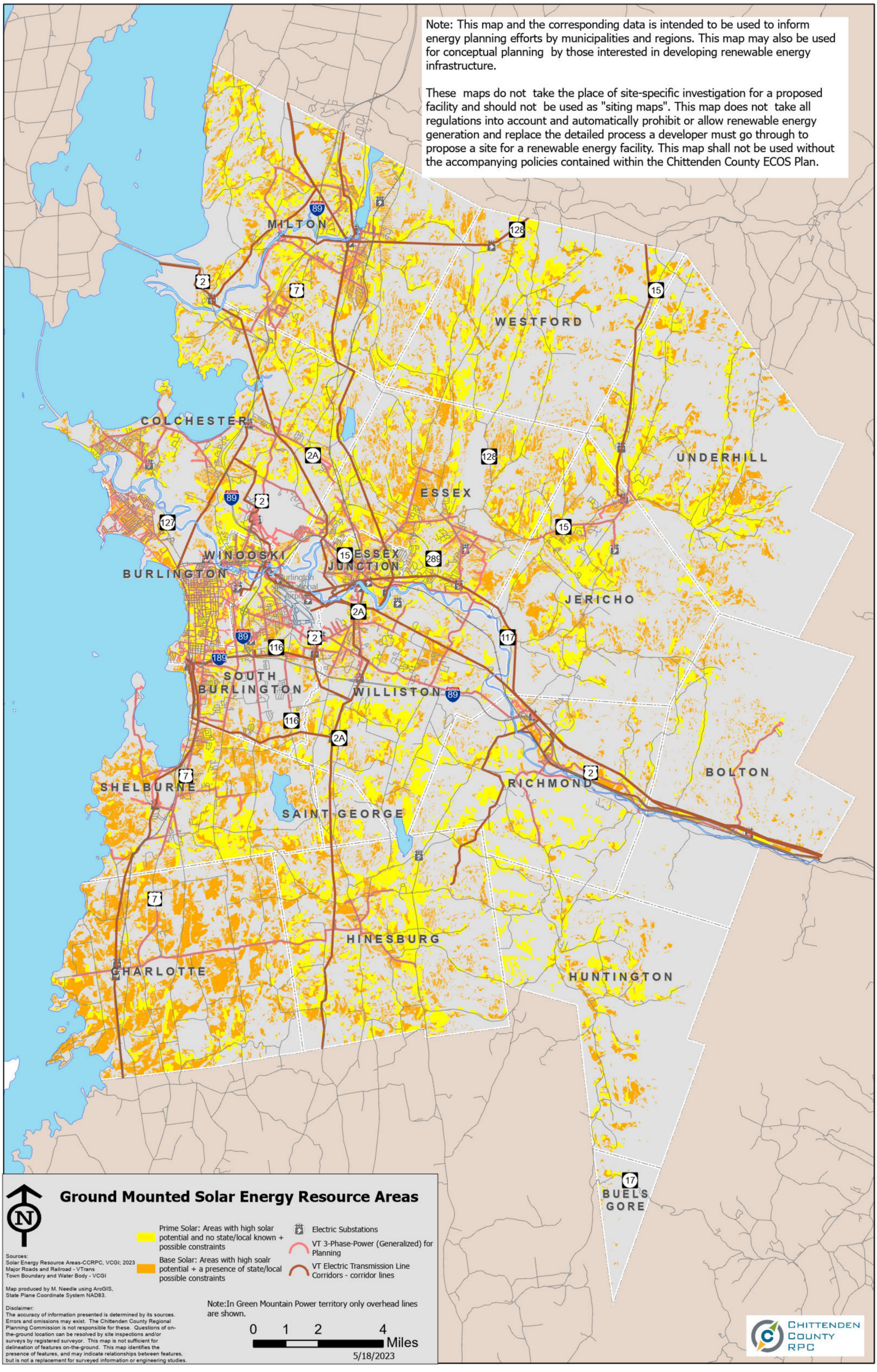
meet these guidelines does not necessarily preclude the ability to develop renewable energy generation development.

e. Locate energy generation proximate to existing distribution and transmission infrastructure with adequate capacity and near areas with high electric load (See Green Mountain Power's Solar Map and Burlington Electric Department's Distributed Generation Map)
f. Locate renewable energy generation in areas designated by a municipality in an adopted plan for such use, including specific preferred sites for net-metering, in accordance with PUC rule 5.1, rule pertaining to construction and operating of net-metering systems. State preferred sites are mapped on Map 5.
g. Locate solar generation (including but not limited to net metering) on previously impacted areas (such as, parking lots, previously developed sites, brownfields, State regulated landfills with post-closure certification, gravel pits/quarries, or on or near existing structures).
h. Locate ground-mounted solar larger than 15 kW AC (except for parking lot canopy solar installations) and wind turbines with a hub height larger than 30 meters (98 ft.) outside of state designated village centers, growth centers, downtowns, new town centers, neighborhood development areas, and historic districts on the State or National Register.
i. To mitigate load growth, integrate renewable energy generation facilities in a manner that allows infill to be the priority within areas planned for growth but outside designated areas mentioned above.
j. Locate wind generation in areas with high wind potential, such as the prime and base wind potential areas shown on Map 7.

MAP 5 – STATE PREFERRED SITES FOR SOLAR GENERATION + EXISTING RENEWABLE ENERGY GENERATION SITES

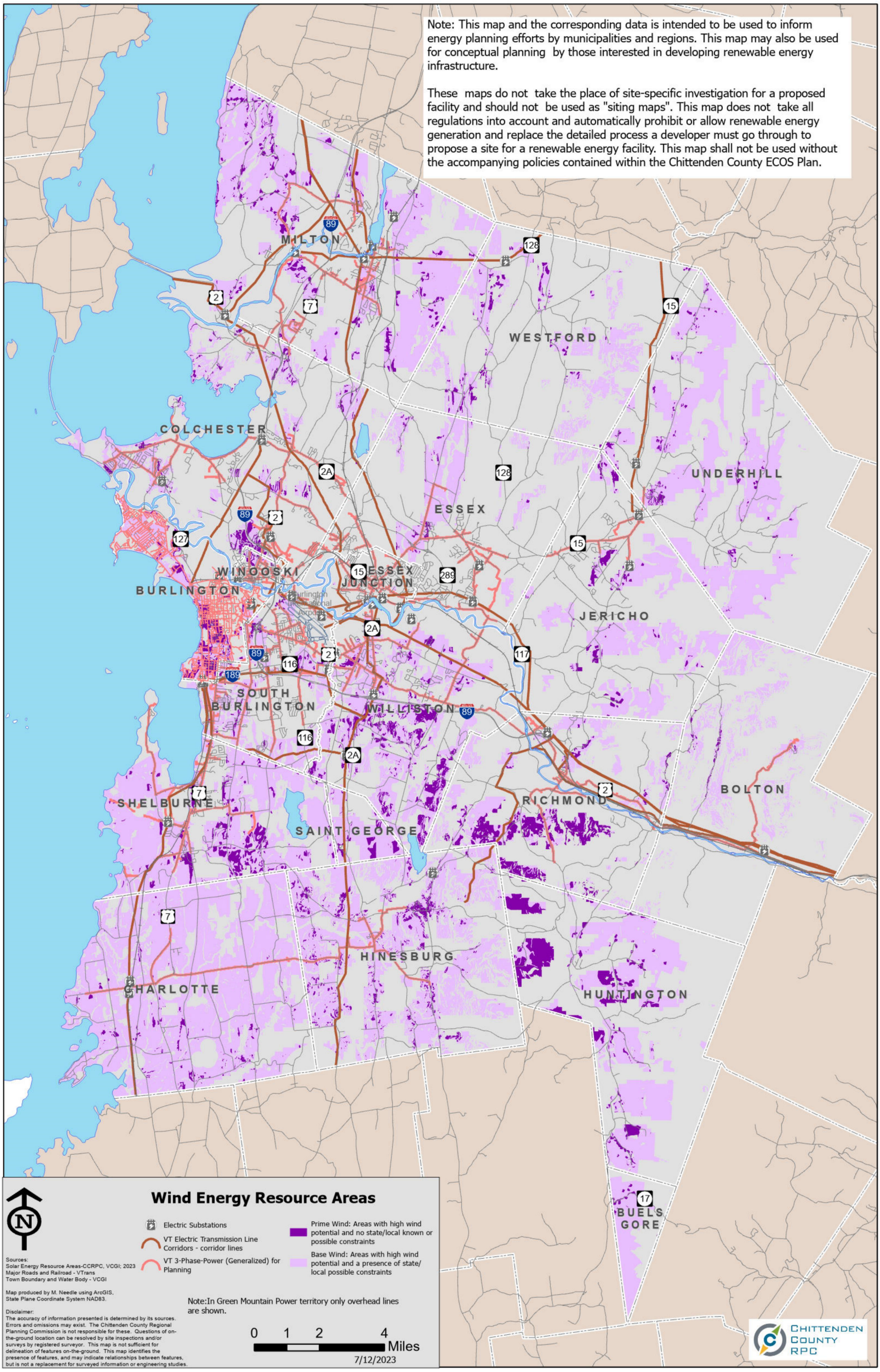


MAP 6 – SOLAR GENERATION POTENTIAL



b

MAP 7 – WIND GENERATION POTENTIAL


Note: This map and the corresponding data is intended to be used to inform energy planning efforts by municipalities and regions. This map may also be used for conceptual planning by those interested in developing renewable energy infrastructure.
These maps do not take the place of site-specific investigation for a proposed facility and should not be used as "siting maps". This map does not take all regulations into account and automatically prohibit or allow renewable energy generation and replace the detailed process a developer must go through to propose a site for a renewable energy facility. This map shall not be used without the accompanying policies contained within the Chittenden County ECOS Plan.
MILTON
COLCHESTER
ESSEX
WESTFORD
UNDERHILL
WINOOSKI
BURLINGTON
ESSEX JUNCTION
JERICHO
SOUTH BURLINGTON
WILLISTON
SHELBURNE
SAINT GEORGE
RICHMOND
BOLTON
HINESBURG
CHARLOTTE
HUNTINGTON
BUEL'S GORE
Wind Energy Resource Areas
Electric Substations
VT Electric Transmission Line Corridors - corridor lines
VT 3-Phase-Power (Generalized) for Planning
Prime Wind: Areas with high wind potential and no state/local known or possible constraints
Base Wind: Areas with high wind potential and a presence of state/ local possible constraints
Sources:
Solar Energy Resource Areas-CCRPC, VCGI; 2023
Major Roads and Railroad - VTrans
Town Boundary and Water Body - VCGI
Map produced by M. Needle using ArcGIS,
State Plane Coordinate System NAD83.
Disclaimer:
The accuracy of information presented is determined by its sources. Errors and omissions may exist. The Chittenden County Regional Planning Commission is not responsible for these. Questions of on-the-ground location can be resolved by site inspections and/or surveys by registered surveyor. This map is not sufficient for delineation of features on-the-ground. This map identifies the presence of features, and may indicate relationships between features, but is not a replacement for surveyed information or engineering studies.
Note:In Green Mountain Power territory only overhead lines are shown.
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Miles
7/12/2023
CHITTENDEN COUNTY RPC

2024 Chittenden County ECOS Plan

Supplement 6 – Energy Analysis, Targets, & Methodology
Adopted 6/19/2024

For a healthy, inclusive, and prosperous community

Chittenden County RPC
Communities Planning Together

GBIC
Good Jobs In A Clean Environment

This plan is the Regional Plan, Metropolitan Transportation Plan, and Comprehensive Economic Development Strategy in one.

This plan can be found online at: www.ecosproject.com/plan

TABLE OF CONTENTS

Energy Analysis, Targets, & Methodology

Introduction

Supplement 6 provides an overview of current energy use and a sense of the trajectories and pace of change needed to meet the State's energy and climate goals, as well as the data and analysis required for the 2024 Chittenden County ECOS Plan to meet the State of Vermont's energy planning standards.

The Department of Public Service anticipates meeting the 90X2050 goal by generating half of the State's electricity needs in-state and the remainder through imported (mostly renewable) energy. To meet the state's goals, Chittenden County is planning for a major shift away from fossil fuels in the transportation and heating sector towards renewable sources of energy, efficiency in all sectors, and an increase in-state renewable energy generators.

The analysis in this section estimates current energy use across all sectors (transportation, heating, and electricity) as well as current renewable energy generation. Targets are also provided to demonstrate milestones along the way toward meeting 90% of total energy needs with renewable energy and achieving the Global Warming Solutions Act requirements for reducing greenhouse gas emissions. The targets are intended to be a demonstration of one possible scenario to reach 90% renewable energy by 2050 and for decarbonizing energy demand. These data are not intended to prescribe a future.

Targets for future energy use are drawn from the Long-Range Energy Alternatives Planning (LEAP) analysis as part of the development of Vermont's Comprehensive Energy Plan (CEP) and Climate Action Plan (CAP), completed by the Stockholm Environmental Institute (SEI) and Northeast States for Coordinated Air Use Management (NESCAUM). The LEAP model is an accounting framework that shows one possible path for Chittenden County to meet the state energy and decarbonization goals.

The renewable energy generation targets are based on the LEAP analysis and account for existing generation currently sited or permitted within the region's boundaries. The generation targets are technology-neutral, which means the region has the flexibility to meet the targets through the development of various renewable energy technologies (e.g. biomass, solar, wind, etc.).

Please note that these data are a starting point for Chittenden County to consider its energy future. This information should provide the framework for a discussion about changes that will need to occur within Chittenden County to ensure that State energy and climate goals are met.

Part 1 of this supplement assesses the potential equity impact of the policies related to land use, transportation, energy efficiency, and renewable energy generation.

Part 2 of this supplement includes estimates of existing energy consumption for the transportation, heating, and electric sectors.

Part 3 of this supplement estimates the portion of future energy consumption and renewable energy generation the region anticipates being sited in Chittenden County to meet the state's 2050 greenhouse gas emission goals. Part 3 also explains the various methods used by CCRPC to set targets and report data. This includes the methods used by SEI and NESCAUM to complete the statewide LEAP model,

and the methods used by the Vermont Department of Public Service to break down the statewide LEAP data to each region.

Part 4 of this supplement evaluates whether forest blocks or habitat connectors should be treated as a possible constraint.

1. EQUITY ASSESSMENT

The Department of Public Service's energy planning standards requires that the potential equity impacts of the land use, energy efficiency, renewable energy generation, and transportation policies be assessed 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.

To respond to the equity assessment requirement of the energy planning standards, this section outlines CCRPC's ongoing efforts to build our organization's capacity to address systemic racism and inequities in our communities. Furthermore, this section includes a discussion explaining the approach CCRPC utilized to acknowledge the ways in which equity can be strengthened in the ECOS Plan, especially how it relates to achieving renewable energy and climate goals.

In 2021, CCPRC hired The Creative Discourse Group to conduct an organizational equity assessment. In particular, the Creative Discourse Group made a recommendation to "Establish a process for conducting a mini-equity audit ahead of all key decisions and at the beginning of projects and initiatives." This recommendation is pertinent to the ECOS Plan update process as CCRPC Staff has applied a racial equity lens to reviewing ECOS Plan goal statements, key issues, strategies, and data using the self-assessment questions found in the Guiding Principles for Just Transition. Each energy related section was assessed to determine if the ECOS Plan language could be strengthened to better identify, understand, and address the impacts of energy and climate goals on impacted communities. If a deficiency existed, CCRPC staff wrote language to clearly define impacted communities and address existing or potential inequities/burdens. Examples include acknowledging that climate impacts of energy use are driven by the wealthy and privileged while impacts generally fall on the poor and those with less power; identifying programs and policies to ensure that low-income and BIPOC residents can affordably access weatherization assistance and clean and renewable sources of energy; and adding an equity assessment to CCRPC's siting policies for renewable energy generation development. Please see the ECOS Plan sections related to energy, transportation, and land use to further understand how equity is addressed.

The ECOS Plan also contains numerous sections where equity is the central theme, including the Responsibility to Chittenden County, Civic Engagement and Social Connectedness Key Issues, and Strategy 10 (Equity). These sections serve as the backbone to the plan to ensure that all the ECOS Plan goals, strategies, and actions are implemented with an equity first approach. Additionally, CCRPC is drafting an equity action plan to ensure that equity is embedded within all projects and to facilitate the assessment of impacts to marginalized communities.

CCRPC recognizes that these small changes are only first steps intended to guide a more fundamental shift in how our organization operates over the course of the current ECOS Plan and beyond. To this end, in 2022 CCRPC established a full-time Equity and Engagement Manager position and an Equity Advisory Committee (EAC) to ensure equitable processes and outcomes in our activities. The committee includes primarily community members with diverse lived experiences, interests, and

expertise, as well as CCRPC Board members and CCRPC staff (non-voting members). Embedding the EAC within the CCRPC structure will ensure that the voices and needs of marginalized people will be elevated in all programs and projects.

2. CURRENT ENERGY DEMAND

The data below are from various data sources and represent actual current consumption and generation, rather than estimates from the Long-Range Energy Alternatives (LEAP) model found in the section on projected energy use.

Transportation Energy

Table 1 provides an overview of the passenger vehicle fleet composition by fuel source in Chittenden County and serves as a proxy for current transportation energy use. In 2022, Chittenden County was home to about 126,284 fossil fuel burning light duty vehicles. As of 2022, Chittenden County had a total of 3,183 electric vehicles registered, inclusive of both electric and plug-in hybrid vehicles. Chittenden County has seen a dramatic increase of electric vehicle ownership as more electric vehicle charging equipment has been installed, electric utilities and the State of Vermont have offered purchase incentives, and more electric vehicles models have become available for sale.

TABLE 1. CURENT CHITTENDEN COUNTY TRANSPORTATION ENERGY USE

Current Chittenden County Transportation Energy Use		
	Total	Percent
Total pleasure cars or trucks	126,284	100.00%
Total Fossil Fuel Burning	123,101	97.47%
Electric Light Duty Vehicles	3,183	2.52%
All-Electric Vehicles	*1,755*	*1.39%*
Plug in Hybrid	*1,428*	*1.13%*
Sources: Efficiency Vermont RPC Report, June 2023; VT DMV (November 2022)		

Thermal Energy

Table 2 and Table 3 below describe how homes are heated in Chittenden County. Chittenden County is served by Vermont Gas and natural gas is available in most of the ECOS Plan's areas planned for growth. As such, over half of the homes are heated with natural gas. Areas outside the Vermont Gas service area rely on delivered fuels for space heating such as fuel oil, kerosene, or propane. About 24% of homes heat their homes with one of these fuel sources.

TABLE 2. CURRENT THERMAL ENERGY USE FROM NATURAL GAS

Current Thermal Energy Use from Natural Gas, 2022		
	Total	Percent
Homes Heating with Natural Gas*	39,898 (+/- 1,970)	56% (+/- 3%)
Residential Natural Gas Consumption (MMBtu)**	3,384,366	31%
Commercial/Industrial Natural Gas Consumption (MMBtu)**	7,386,332	69%
Total Chittenden County Natural Gas Consumption (MMBtu)**	10,770,698	100%
*Sources: *American Community Survey 1-year Estimate, 2021 Table B25040, **Vermont Gas*		

TABLE 3. CURRENT THERMAL ENERGY USE

Current Thermal Energy Use from Delivered Fuels and Wood, 2021				
	Total	Margin of Error	Percent	% Margin of Error
Homes heating with Fuel oil, Kerosene, etc.	9,927	+/- 1,586	14%	+/- 2%
Homes heating with Propane	7,153	+/- 1,243	10%	+/- 2%
Total Homes Heating with Delivered Fuels	17,080	+/- 2,015	24%	+/- 3%
Total Homes Heating with Wood	2,698	+/-961	4%	
Sources: American Community Survey 2021 1-Year Estimate, Table B25040				

Weatherization and Energy Efficiency Projects

Reducing energy demand in both the thermal and electric sectors helps the region to meet the state's energy and climate goals. In particular, the state has a goal to to weatherize 120,00 homes by 2030. While there isn't a particular goal on reducing electricity demand, electric efficiency projects are one of best ways to reduce electric bills and manage load on the demand side. The best available data source for home weatherization and efficiency projects is through the State's efficiency utilities. In Chittenden County, there are two efficiency utilities. Efficiency Vermont is the efficiency utility that operates outside of the City of Burlington. Burlington Electric Department operates as its own efficiency utility for customers within Burlington. Efficiency Vermont only monitors home weatherization programs done through the Home Performance with ENERGY STAR® (HPwES) program. HPwES is a comprehensive whole-house approach to diagnosing and addressing thermal and health/safety issues in the home to ensure a more energy efficient, comfortable, safe, and healthy home. A project is a collection of one or more energy efficient measures that have been implemented at a customer's physical location. Measures may include both electric and thermal efficiency improvements. A customer can be

associated with one or more projects and in some cases, a project may be associated with multiple customers. Efficiency Vermont's data does not capture do-it-yourself projects or projects that do not go through the HPwES program. Table 5 below indicates the number of energy efficiency projects completed. It is not intended to represent the number of homes weatherized.

TABLE 5. RECENT RESIDENTIAL ENERGY EFFICIENCY PROJECTS

Recent Residential Energy Efficiency Projects	2020	2021	2022
Total Residential Projects (includes projects below)*	3,322	3,524	3,314
Home Performance with ENERGY STAR® Projects	90	102	60
Other Weatherization Projects	198	57	67
Residential New Construction Projects**	36	78	84

Source: Efficiency Vermont RPC Report, June 2023; Burlington Electric Department
*Burlington Electric Departments projects are not included because of differences in reporting.
**Comprehensive energy efficiency services to customers building new or gut-rehabbing single-family homes. This program maximizes energy efficiency, durability, and comfort through direct technical assistance, third party certification, incentives, and code compliance support. The RNC program is cosponsored with Vermont Gas Systems and Burlington Electric Department for homes in their service territories.

Electricity

An estimate of current electricity consumption by residential and commercial/industrial sector in Chittenden County is shown in Table 6.

TABLE 6. ELECTRICITY CONSUMPTION

	2022
Residential Electric Energy Use (MWh)	1,327,756
Commercial and Industrial Electric Energy Use (MWh)	469,417
Total Electric Energy Use (MWh)	1,797,173

Source: Efficiency Vermont June 2023**, Burlington Electric Department**

Current Renewable Energy Generation

As shown in Table 7, Chittenden County's current renewable generation capacity is approximately 105 MW. This capacity results in approximately 606,554 MWh of electricity generation per year. Renewable electricity generation is sourced from solar, wind, hydroelectric, and biomass facilities located inside Chittenden County, including McNeil Generating Station, half of the capacity of Georgia Mountain Community Wind, several hydroelectric dams on the Winooski River, and numerous distributed solar array and small-scale wind projects.

TABLE 7. EXISTING RENEWABLE ELECTRICITY GENERATION

Existing Renewable Electricity Generation			
	Sites	Power (MW)	Energy (MWh)
Solar	5,598	105.5	138,572
Wind	36	5.7	11,312
Hydroelectric	6	54.7	146,575
Biomass (Wood)	8	50.6	310,095
Total*	5,647	104.6	606,554

Source: Vermont Department of Public Service Distributed Generation + Survey, January 2023 (with corrections by CCRPC).
**The total existing renewable energy generation varies from the existing renewable energy generation reported in the renewable energy targets sections due to variations in the way the data is counted. These sites represent facilities that have been permitted.*

3. ENERGY TARGETS

As part of the development of Vermont's Comprehensive Energy Plan (CEP) and Climate Action Plan (CAP), Stockholm Environment Institute (SEI) and Northeast States for Coordinated Air Use Management (NESCAUM) developed a scenario model of Vermont's energy consumption and emissions and used the model to construct pathways to meet statutory greenhouse gas (GHG) reduction obligations under the state's Global Warming Solutions Act (GWSA). The model was built using SEI's Low Emissions Analysis Platform (LEAP), a software tool for energy system modeling and emissions accounting. The model contains a representation of residential, commercial, industrial and transport energy use at a state level.

In order to support enhanced energy planning at the regional and municipal levels, the Department has undertaken an effort to "regionalize" final energy demand outputs from the statewide LEAP modeling for four core sectors: residential, commercial, industrial, and transportation. This section includes a simple disaggregation of those results for the residential, transportation, and commercial sectors based on key drivers of energy demand. The targets are derived from the **Central GWSA Mitigation ("CAP Mitigation")** scenario developed to meet the state's GHG reduction requirements. These targets show the direction and magnitude of change needed meet local, regional, and state energy goals and are not intended to be used in a regulatory context.

Full details of the LEAP Model methods, data sources and assumptions may be found as **Appendix D to the 2022 Comprehensive Energy Plan**. The **Vermont Pathways Report** prepared for the Agency of Natural Resources also provides information on the analysis done using the model, including some of the revisions made after the CEP was published.

Transportation Energy Targets

The transportation energy targets for Chittenden County represent an ambitious electrification of the transportation sector to increase the amount of renewable energy used to power passenger vehicles and light, medium, and heavy-duty trucks. As indicated in Table 1, 3,183 electric light duty vehicles are registered as of 2022. To meet the 2025 target, electric vehicle registrations need to double (see Table 9). To meet the 2050 targets, electric vehicle registrations need to increase dramatically and transportation energy from all fuel sources used in all vehicle types will need to decrease 54% from 2025 levels by 2050. This will primarily be achieved by converting to more efficient electric vehicles from fossil fuel vehicles. Therefore, electricity in the transportation sector will increase by 95% from 2025 to 2050. The LEAP model shows that to achieve this reduction, a majority of passenger vehicles must be all-electric. Generally, in the LEAP model it is assumed that all-electric vehicle adoption will be more aggressive compared to adoption of plug-in hybrid vehicles. Electrifying the transportation sector will also lead to a dramatic increase in electricity use to power vehicles and a significant decrease in gasoline consumption (see Table 10).

TABLE 9. ELECTRIC VEHICLE TARGETS

EV and PHEV Stock Number of Vehicles						
	Vehicle Type	**2025**	**2030**	**2035**	**2040**	**2050**
Passenger Car	Battery Electric	3,091	13,347	31,883	50,610	75,088
	Plug In Hybrid	588	551	451	287	103
	Total	**3,679**	**13,898**	**32,334**	**50,896**	**75,191**
Light Duty Truck	Battery Electric	2,468	14,695	34,559	52,337	70,478
	Plug In Hybrid	259	358	342	227	85
	Total	**2,727**	**15,053**	**34,901**	**52,564**	**70,563**

TABLE 10. TRANSPORTATION ENERGY DEMAND

Chittenden County Total Energy Demand from Transportation Sector (Thousand MMBTUs)					
Fuel	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	178	771	1,714	2,555	3,323
Gasoline	6,639	5,018	3,154	1,677	448
Diesel	1,188	844	511	278	78
Ethanol	568	479	333	194	52
CNG/Natural Gas	21	17	11	6	2
Biodiesel	84	84	66	45	18
LPG	2,375	1,998	1,622	1,350	1,133
Total	11,053	9,210	7,410	6,105	5,054
Note: Energy demand for electric vehicle charging is captured solely under this table; it is not included in the residential or commercial electric targets.					

Thermal Energy Targets, Commercial/Industrial Sector

The LEAP Climate Action Plan mitigation scenario estimates that for Chittenden County total energy demand in the thermal commercial/industrial sector will see a 19% reduction from 2025 levels to meet future energy, carbon reduction and renewable energy source goals. This will primarily be achieved through weatherization and the use of more efficient heating technologies, like cold climate heat pumps powered by renewable electrification, in commercial buildings. By 2050, the LEAP model estimates that 64,790 new heat pumps will be installed in commercial buildings. As a result of this transformation in how commercial buildings are heated, natural gas demand is estimated to decrease by 63% from 2025 to 2050. Additionally, demand for heating oil will be eliminated and propane will be drastically reduced. Almost all the changes in energy demand and fuel switching are associated with the commercial sector. The LEAP model included considerably less detail in the industrial sector due to the lack of available information. However, it is anticipated that diesel gas demand will shift to demand for biodiesel, and from natural gas to biogas in the industrial sector.

TABLE 11. TARGETS FOR COMMERCIAL/INDUSTRIAL THERMAL ENERGY USE

Total Regional Commercial/Industrial Sector Final Energy Demand (Thousand MMBTUs)					
Fuel	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	3,910	4,086	4,246	4,390	4,426
Gasoline	389	396	404	412	430
Kerosene	8	8	7	7	7
Wood	634	672	711	747	843
Ethanol	30	32	34	36	38
Solar	147	150	154	175	163
Heat	-	113	169	282	282
Propane	855	575	307	100	90
Residual Fuel Oil	47	48	49	50	52
Wood Pellets	33	65	93	120	142
Biodiesel	412	824	1,181	1,560	1,578
Heating Oil	756	393	162	-	-
Biogas	446	737	1,025	1,131	2,087
Natural Gas	5,615	4,027	2,550	1,262	573
Total	13,281	12,124	11,092	10,272	10,711

TABLE 12. TARGETS FOR COLD CLIMATE HEAT PUMPS IN THE COMMERCIAL SECTOR

CAP Mitigation Regional Commercial New Cold Climate Heat Pumps (CCHPs)					
	2025	**2030**	**2035**	**2040**	**2050**
New CCHPs	16,752	33,309	50,661	62,265	64,790

Thermal and Electric Energy Targets, Residential Sector

Thermal energy use in Chittenden County homes is projected to decrease by 64% from 2025 to 2050.Electricity demand will increase by 140% between 2025 and 2050. Natural gas, fuel oil, and propane will be nearly eliminated. Residential buildings will use less energy for space heating due to an increase in the percentage of buildings that are weatherized and greater efficiency in heating technology. To achieve the projected energy savings, at least 82% of homes in Chittenden County need to be weatherized by 2050. Additionally, 101,654 new air-source or ground source heat pumps will need to be installed. Heat pumps are powered by electricity and are a more efficient way to heat a building compared to delivered fuels.

TABLE 13. TARGETS: RESIDENTIAL THERMAL ENERGY USE

Regional Residential Thermal Energy Demand (Thousand MMBTUs)					
Fuel	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	631	899	1,165	1,424	1,515
Heat Pump	*326*	*552*	*771*	*989*	*1,084*
Heat Pump Water Heater	*55*	*118*	*182*	*246*	*249*
Electric Resistance	*69*	*50*	*34*	*20*	*16*
Wood	1,753	1,281	957	686	435
Propane	898	652	438	241	161
Wood Pellets	164	136	119	107	99
Biodiesel	122	536	681	587	422
Heating Oil	1,980	968	335	-	-
Biogas	157	224	235	88	154
Natural Gas	2,251	1,425	694	139	61
Note: Energy demand for electric vehicle charging is not included in this table; rather, it is captured in the transportation energy targets in Table 10.					

TABLE 14. TARGETS FOR HEAT PUMPS IN THE RESIDENTIAL SECTOR

Residential New Cold Climate Heat Pumps					
Technology	**2025**	**2030**	**2035**	**2040**	**2050**
Air Source Heat Pumps	24,549	45,187	66,008	87,025	97,270
Ground Source Heat Pumps	1,107	2,036	2,970	3,908	4,384
Total	**25,657**	**47,222**	**68,978**	**90,933**	**101,654**

TABLE 15. TARGETS FOR WEATHERIZATION IN THE RESIDENTIAL SECTOR

Residential Weatherization Targets					
	2025	**2030**	**2035**	**2040**	**2050**
Homes Weatherized	18,568	31,865	40,129	48,393	64,921
Forecasted Households*	69,216	71,607	74,068	76,510	79,151
Percent Weatherized	27%	44%	54%	63%	82%
*Households are used as a proxy for housing units.					

Residential Final Energy Demand includes both thermal and electric appliance energy use which include space heating, space cooling, water heating, cooking, refrigeration, lighting, and electric appliances. Final energy demand depends on the total number of households and energy-consuming devices, as well as the annual fuel requirements per household or per device. The Vermont Pathways LEAP model simulates these end uses within the following types of buildings (different end uses / fuels are used to varying degrees based on the building type, tenure, urban/rural status. It is estimated that electricity demand will increase 54% between 2025 and 2050. Biodiesel and biogas also increase while natural gas use declines.

TABLE 16. TOTAL ENERGY DEMAND IN THE RESIDENTIAL SECTOR

Fuel Source	2025	2030	2035	2040	2050
Electricity	1,720	2,004	2,286	2,562	2,666
Wood	1,753	1,281	957	686	435
Propane	1,245	904	594	300	222
Wood Pellets	164	136	119	107	99
Biodiesel	132	601	803	769	607
Heating Oil	2,150	1,084	396	-	-
Biogas	160	227	238	88	154
Natural Gas	2,287	1,448	704	139	61
Total	**9,612**	**7,686**	**6,098**	**4,652**	**4,244**

Wood Fuel Capacity Analysis

This section analyzes the level of wood fuel consumption that can be sustainably supported by the estimated supply of in-state biomass resources. This analysis is conducted on a statewide scale since there is no regional data available for wood fuel supply. However, Map 1 below shows potential areas of woody biomass in the region. According to these data, 138,658 acres of potential biomass exists in Chittenden County.

As shown in previous sections, wood (in the form of cordwood and pellets) is a significant heating fuel source for many homes and businesses, though LEAP modeling shows an overall decrease in wood heating over time. Since current wood fuel consumption levels have not been detrimental to air quality in the state or region, it is assumed that the reduced use of wood fuel expected in the LEAP modeling would only improve air quality.

Harvesting of low-grade wood for heating through cordwood or pellets is sustainable when it does not exceed the net growth rate of low-grade wood in forests. As shown in Table 17, the state's Net Available Low-Grade (NALG) wood has increased since 2010, despite the fact that growth in demand for low-grade wood increased while net average growth rates for forests decreased. Though impacts of climate change and other disturbances may be partial causes of this decreased forest growth rates, the dominant driver is the natural forest succession process as a generation of older trees are aging and growing slower, and have yet to be replaced by younger, faster-growing trees. See the 2018 Vermont Wood Fuel Supply Study for full explanations of these trends.

TABLE 17. VERMONT WOOD FUEL SUPPLY ANALYSIS

Vermont Wood Fuel Supply Analysis		
	2010	2018
Average Forest Net Annual Growth Rate	2.10%	1.75%
Current Market Demand for Low-grade wood (Green Tons)	1,265,194	1,738,631
Total NALG Wood (Green Tons)	894,893	939,989

Source: Excerpts from 2018 Vermont Wood Fuel Supply Study, Table 2

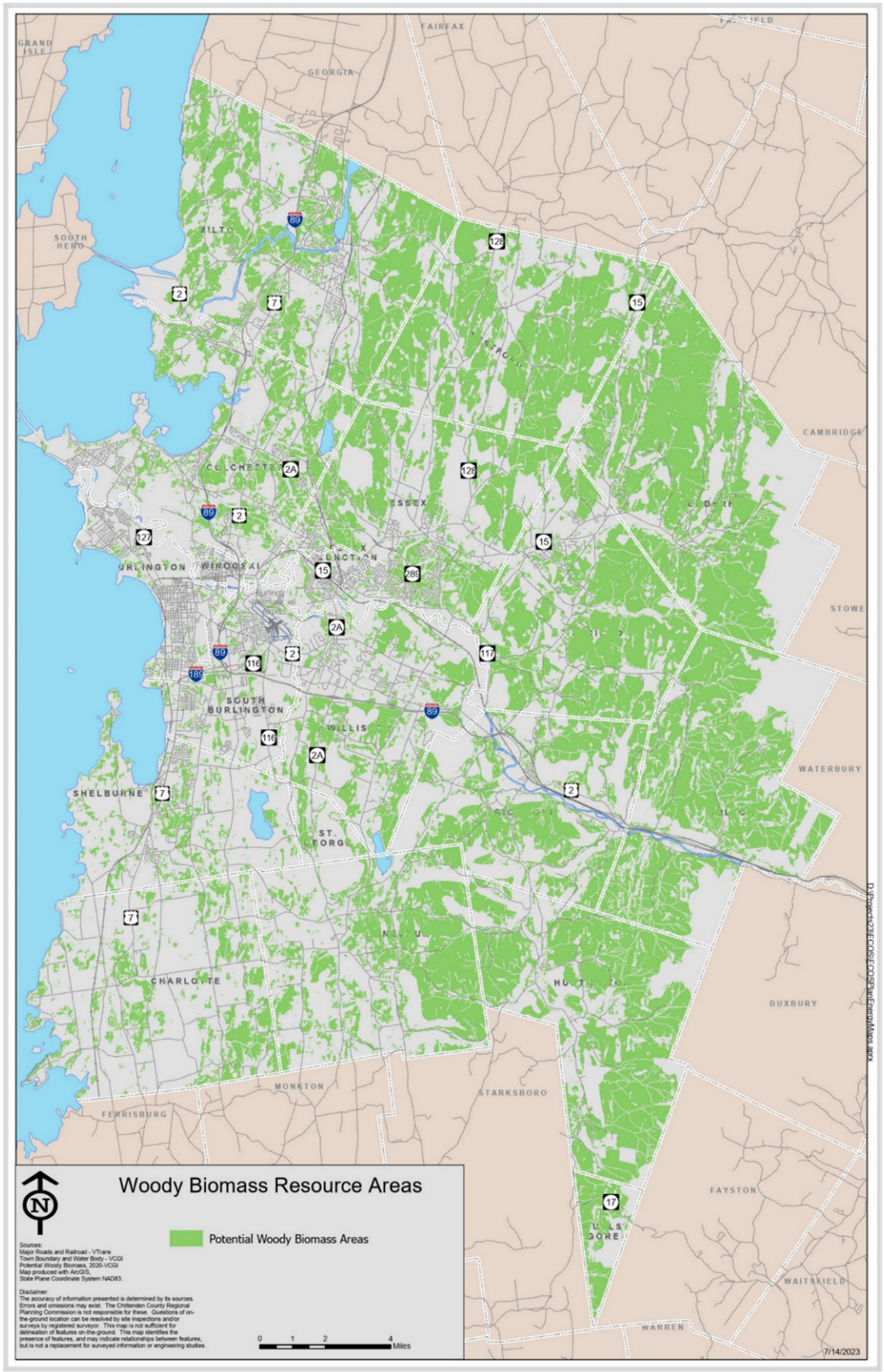
Table 17 assumes that current market demand for low-grade wood will continue at similar rates to the present. However, LEAP modeling in Section 3 of this Supplement anticipates a significant decrease in the use of cordwood and wood pellets for both residential and commercial heating. Given this, NALG will likely increase or remain steady even if forest growth rates and harvest of low-grade wood decrease as expected.

In a scenario where low-grade wood harvesting continues at current rates while forest growth decreases as expected, the demand for low-grade wood may begin to approach the amount available in forests soon after 2050. However, the forestry industry has begun implementing new practices for uneven-aged management that seek to restore the age / canopy diversity of forests, often by cutting 1-acre patches within 10-acre plots once every 10 years. This effectively regenerates the entire forest progressively over 100 years. This systems-wide approach to forest management also involves greater use of low-grade wood compared to practices from the prior century, which focused on sawlogs and pulpwood; therefore, NALG may increase compared to the present.

Maintaining a larger proportion of trees under 100 years old will also increase carbon sequestration rates, much of which will remain in the soil. This also supports the local forest economy and provides important revenue for retaining land as forest rather than converting it to agriculture or other uses. The alternative of letting forests naturally revert to mixed-age growth will still result in some carbon releases as dead wood decomposes; furthermore, it would also take far longer to reach conditions that resemble those prior to clearing in the 1800s.

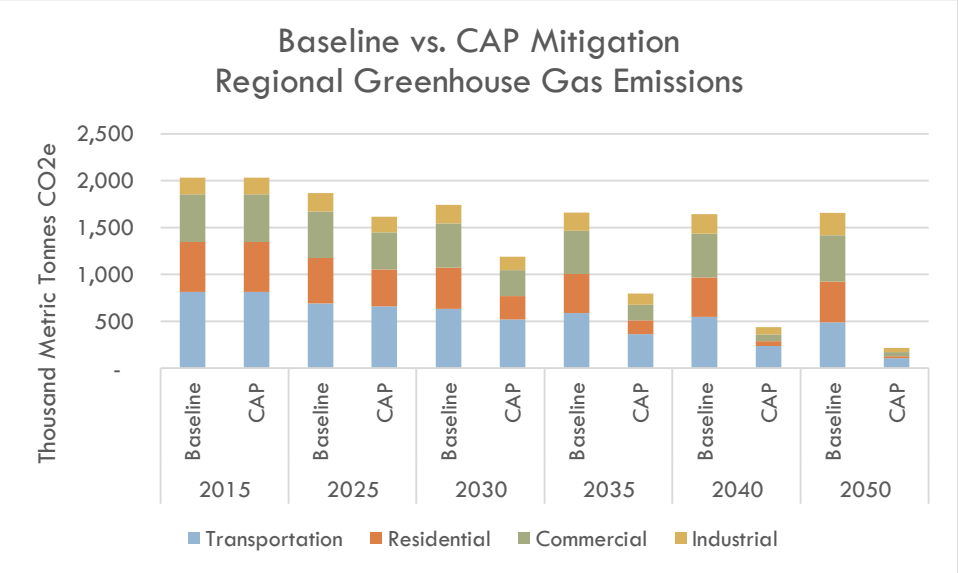
In conclusion, comparing LEAP modeling with the state's wood fuel supply analysis indicates that there will be more than sufficient supply of wood fuel to meet the state's (and the county's) energy use goals. In fact, the state's forests could support harvest at current or increased levels through at least 2050, perhaps with positive outcomes on natural systems and carbon sequestration or storage in forests. Beyond 2050, more sophisticated modeling would be needed to determine the effect of various forest management practices on low-grade wood supply, but eventually a regime of uneven-aged management would restore a consistent level of NALG from forests.

MAP 1-WOODY BIOMASS RESOURCE AREAS



Green Greenhouse Gas Emissions

Greenhouse gas emissions for each Sector (Transportation, Residential, Commercial, and Industrial) are shown below for each LEAP scenario. Please note, as currently provided by the PSD electric sector emissions are embedded within each of these sectors. This does not align with how the state's greenhouse gas inventory accounts for electricity-based emissions. The inventory currently separates electricity and considers those emissions separately. TO BE UPDATED AND REVISED WHEN REVISED DATA IS AVAILABLE



Renewable Energy Generation Targets and Potential

As seen in Table 18, total in-state electricity consumption is estimated to be nearly 12 million MWh in 2050. The Department of Public Service anticipates that fifty percent of this electricity will be generated within Vermont and the other half will be imported from out of state generators. To advance the state goals, Chittenden County needs to produce a total of 954,833 MWh by 2050, which is 16% of the state's production. The target is based on the average of Chittenden County's share of the state's land area (5.8%) and its share of the state's population (26.2%). Once the total targets for renewable energy generation were estimated, the existing renewable energy generation was subtracted from the total. The remaining amount is the new generation that must be sited within the county to meet the targets.

TABLE 18. RENEWABLE ELECTRICITY GENERATION TARGETS

Renewable Electricity Generation Targets	2032	2040	2050
State Projected Electricity Demand	8,111,649	10,731,860	11,943,816
In-State Generation Target	4,055,825	5,365,930	5,971,908
State Imported Generation	50%	50%	50%
Chittenden County Total Target	648,475	857,945	954,833
Existing Renewables Generation	606,554	606,554	606,554
New Generation Needed	41,922	251,391	348,279

Note: The Department of Public Service reports 598,409 MWh for the County. See "Calculating Existing Generation Targets" for an explanation on why CCRPC reports a different number.

Chittenden County has sufficient energy resource area to meet the above generation targets. Solar and wind potential acreage (shown in Table 19) are based on a mapping exercise completed by the Vermont Center for Geographic Information (VCGI), with modifications by CCRPC. The wind potential data is from the MA Technology Collaborative and is a model of predicted wind energy potential based on wind speed models. The solar energy potential data identifies potential areas where optimal solar radiation is available based on east, west, and south facing aspect and slopes less than 14%.

Environmental and regulatory constraints are also accounted for in the analysis of wind and solar potential. Primary or 'prime' areas are locations with high energy potential that are free from state/local known constraints. Secondary or 'base' areas are locations with high energy potential that are free from state/local known constraints but include a presence of state/local possible constraints. See the constraints and suitability methodology below for an explanation of how CCRPC defined constraints in the region and for the list of constraints that were included in the analysis.

To determine the amount of renewable energy potential from the wind and solar acreage described above, conversion factors were applied to the base and prime areas to estimate the amount of capacity available for meeting Chittenden County's targets. See the "Calculating Existing Generation and Generation Potential" section for more information.

TABLE 19. LAND AVAILABLE FOR WIND AND SOLAR GENERATION

Land Available for Wind and Solar Generation		
	Prime Potential	**Base Potential**
Solar	7,355 acres (2% of county)	63,628 acres (19% of county)
Wind	15,032 acres (3% of county)	107,090 acres (31% of county)
Sources: VCGI, CCRPC and the Department of Public Service		

Table 20 describes the various technologies available for Chittenden County to meet the renewable energy targets. These include rooftop solar, ground mounted solar, wind turbines, biomass, methane from landfills and sewage treatment plants and hydroelectric energy. The renewable energy generation targets can be met through any combination of technologies. However, given the regulatory complexities of siting new hydropower, this plan only identifies existing hydropower sites where equipment could be upgraded or expanded to provide additional generation. Similarly, current sound regulations on wind generation facilities in Vermont effectively prevent new installations. Because estimating the power generated from the use of biomass for heating or co-generation is site-specific, only the number of acres of woody biomass was included below. However, it is unclear whether the state forestry industry could support additional biomass-powered electric plants.

Given these considerations, CCRPC anticipates meeting its incremental renewable electricity generation targets primarily through solar (90%), likely split evenly between ground-mounted (45%) and rooftop installations (45%), with a small portion of generation sourced from wind power (10%) if made feasible by regulatory changes. However, as noted in the suitability policies of Strategy 4, Action 2(c), previously developed sites are preferred for renewable energy generation, and development of rooftop solar should be maximized.

TABLE 20. PROJECTED RENEWABLE ELECTRICITY GENERATION POTENTIAL

Projected Renewable Electricity Generation Potential*		
	Power (MW)	Energy (MWh)
Rooftop Solar	776	935,184
Ground-Mounted Solar** – Prime	1,051	207,082
Ground-Mounted Solar** – Base	1,212	238,878
Wind – Prime	376	166,659
Wind – Base	3,707	1,644,094
Hydroelectric	See Existing Generation Map	
Potential Biomass Area	138,658 acres	
Methane	Unknown	Unknown
Other	Unknown	Unknown

Sources: VCGI, CCRPC and the Department of Public Service

*See “Calculating Existing Generation and Generation Potential” for details on how resource areas were converted to power and energy.

**Ground-mounted solar potential reports how much land could be developed with solar based on its aspect and elevation and removes space taken up by roofs and roadways, but not other impervious surfaces like parking lots. Therefore, rooftop solar potential can be added to ground-mounted solar potential, though parking lot canopy solar installations would be included within ground-mounted solar potential.

Biomass acreage is sourced from VCGI’s VT Potential Woody Biomass Areas

4. METHODOLOGY

Calculating Existing Generation and Generation Potential

Existing Electric Energy Generation

Data on generation sites, power and energy generation are available from the Department of Public Service. The data reports sites and capacity (power) from Certificates of Public Good filed in each municipality.

Ground-Mounted Solar Energy Potential

The methodology for estimating ground-mounted solar electricity potential is to divide the number of acres available as prime and base resources by 8 acres per MW for prime solar; 60 acres per MW is used for base solar to account for the presence of possible constraints that reduce the land usable for solar panels. The annual electricity production is then estimated using the formula below.

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

Wind Energy Potential

The methodology for estimating wind electricity potential is to divide the number of acres available as prime and base resources by 25 acres per MW. There is no reduced land factor for base wind since possible constraints have a lesser impact on actual equipment siting due to the vertical nature of wind turbines. Then to estimate the amount of production using the formula below.

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

Rooftop Solar Energy Potential

Rooftop solar potential data is sourced from the Vermont Center for Geographic Information (VCGI) dataset named *Town Rooftop Solar Potential – Act 174 2022*. As explained in the release notes, these estimates use a geographic information system (GIS) model of building footprints to determine the total surface area of rooftops suitable for solar photovoltaic panels (accounting for amount of solar radiation, slope, aspect, shading of nearby objects, and minimum size of rooftop viable for solar panels). Using published data for solar radiation, the VCGI data also estimates an annual solar energy production potential for each suitable rooftop, summarized by municipality, applying a capacity factor of 13.76% as published by the U.S. Environmental Protection Agency. The total system capacity in megawatts is then estimated using the formula below.

Rooftop MW of capacity = (number of annual MWh) ÷ ((0.1376 capacity factor) * (8760 hours per year))

Calculating Renewable Energy Generation Targets

Regional Renewable Electricity Generation Target

For the 2018 ECOS Plan, CCRPC established a range (low target and high target) for renewable energy generation under the assumption that 50% of statewide annual electricity demand (in megawatt-hours or MWh) would be produced in-state. The low scenario was based on the county's share of land area available statewide for ground-mount solar and wind energy production (the only two technologies considered at the time). The high scenario was based on the county's share of the total state population. The 2018 Plan identified sufficient land for solar and wind development to meet this demand under either scenario, then allocated this regional target to each of the county's municipalities through a similar process.

The 2022 guidance from the Vermont Department of Public Service (PSD) uses a single scenario for the regional share of the state's total electricity generation target, which assumes 50% of electricity demand would be generated within the state. For Chittenden County, the regional share is 16%, which is the average of the county's portion of the state's population (26.2%) and land area (5.8%). This regional share, which represents the **total** regional electricity generation target, is applied to three milestone years (2032, 2040, and 2050) as shown in Table 20.

The **incremental** regional electricity generation target is the amount of new electricity that must be generated to meet the total target after subtracting production from existing facilities. Based on data provided by the PSD as of 1/31/2023, Chittenden County annually produces 606,554 MWh of electricity from renewable sources; the resulting incremental regional targets by milestone year are shown in Table 20.

The existing renewable energy generation for the County is the sum of each municipality's total existing renewable energy generation sited within the municipalities' borders. If a facility is located on the border between two jurisdictions, the generation is split between each jurisdiction; for example, two of the four turbines in the Georgia Mountain Community Wind project are located within the Town of Milton; therefore, half the facility's production is counted for the Town of Milton and the Chittenden County region; the other half is counted for the Town of Georgia and the Northwest region.

Note that the targets are expressed in terms of total annual electricity use in megawatt-hours (MWh). The modeling does not account for daily and seasonal fluctuations in demand as well as supply from intermittent sources like solar and wind. Therefore, in reality a higher total capacity (in megawatts or MW) among generation facilities will be required than the minimum required to produce the total regional electric generation target. However, this would be difficult to model even if there was certainty about fluctuations in demand and the types of technologies available.

Municipal Renewable Electricity Generation Targets

To better understand how the region can achieve its 2050 renewable energy generation targets, the CCRPC used a tool provided by the PSD to determine generation targets for each municipality in its region as a portion of the region's overall target. The total municipal electric generation targets were calculated by multiplying the regional target by the average of each municipality's share of the county total of three equally weighted factors: population, land area available for renewable energy production, and current electricity consumption. As with the regional targets, the incremental municipal targets are obtained by subtracting existing generation facilities located within a municipality's borders.

It should be noted that although the Town of Essex and City of Essex Junction are now separate municipalities, Efficiency Vermont still only reports electricity demand data for the Town of Essex including the City. Therefore, the PSD and CCRPC approximated usage for each municipality by dividing the total usage proportionally by population.

As seen in Table 20, a ✓ in the "Incremental Targets by Year" columns indicates that a municipality has met or exceeded the target with existing renewable energy generation within the boundaries of the jurisdiction. Production beyond these targets furthers progress towards the regional target and reduces the incremental targets for all other municipalities.

The targets are technology neutral, meaning that they can be met with any mix of technologies. It is important to note that a municipality may choose to meet its target through a variety of different renewable energy technology types (e.g., wind, hydro, or biomass). Some municipalities may be able to achieve their targets with a single technology; for example, South Burlington's 2022 Climate Action Plan states that it is possible and recommended to meet its targets exclusively through rooftop solar. However, this is not possible for every municipality, and regardless, actual renewable generation facilities developed in any municipality will likely include a variety of technologies. Regardless, at a regional level there is sufficient land area available for renewable electricity facilities to meet the regional target.

As shown in Table 21, every municipality within the region has sufficient land area available for renewable electricity facilities to meet its targets through one or more technologies. However, it is noted that the consumption figures (and thus the renewable generation targets) for Essex Town and Essex Junction include that of GlobalFoundries (a microchip manufacturer located in Essex Junction). GlobalFoundries (GF) uses approximately 400,000 MWh of electricity annually (representing about 8% of the consumption of the entire state of Vermont) and is also the state's largest for-profit employer. Due to its unique needs, GF has petitioned the Public Utilities Commission to create its own self-managed utility rather than a customer of Green Mountain Power[1]. While Essex Town and Essex Junction theoretically can still meet their renewable generation targets given their available land resources, even factoring for the consumption of GF, it is expected that this will be offset at a regional and statewide level through generation facilities in many locations, rather than solely within these municipalities.

Overall, the region is in a good position to increase renewable energy generation. CCRPC will track progress towards meeting the renewable energy targets and will revisit the targets when the ECOS Plan is updated to ensure that the targets align with current population, land available for renewable generation, and electricity consumption data.

[1] Cotton, Emma. "Public Utility Commission allows GlobalFoundries to set up its own electric utility." *VT Digger.* Retrieved 7/17/2023 from https://vtdigger.org/2022/10/24/public-utility-commission-allows-globalfoundries-to-set-up-its-own-electric-utility/

TABLE 20. MUNICIPAL RENEWABLE ENERGY TARGETS.

Municipality	Weighting Factors (33.33% each)			Total Targets by Year (MWh)			Existing Renewables (MWh)	Incremental Targets by Year (MWh)		
	2020 Population	2021 Electricity Use (MWh)	Acres Available	2032	2040	2050		2032	2040	2050
Bolton	1,301	7,911	3,205	7,792	10,309	11,474	794	6,998	9,515	10,679
Buel's Gore	29	246	1,827	3,000	3,969	4,417	10	2,990	3,959	4,408
Burlington	44,743	317,617	3,668	102,946	136,200	151,581	334,817	✓	✓	✓
Charlotte	3,783	21,586	21,113	41,405	54,779	60,965	11,257	30,148	43,522	49,708
Colchester	17,524	128,420	5,487	47,441	62,765	69,853	16,393	31,047	46,371	53,459
Essex Town*	11,504	344,140	5,038	65,585	86,770	96,569	11,994	53,591	74,776	84,575
Essex Junction*	10,590	316,798	343	53,469	70,741	78,729	25,853	27,616	44,887	52,876
Hinesburg	4,698	38,387	13,331	32,184	42,579	47,388	6,154	26,030	36,426	41,234
Huntington	1,934	7,486	9,074	17,962	23,764	26,447	1,741	16,221	22,023	24,706
Jericho	5,104	23,333	6,304	19,616	25,953	28,884	8,308	11,308	17,645	20,575
Milton	10,723	77,239	14,119	46,090	60,977	67,864	83,646	✓	✓	✓
Richmond	4,167	19,706	5,308	16,333	21,609	24,050	5,973	10,360	15,636	18,076
Shelburne	7,717	56,692	11,260	35,084	46,417	51,659	8,618	26,466	37,799	43,041
South Burlington	20,292	200,330	4,444	58,360	77,211	85,931	32,465	25,895	44,746	53,465
St. George	794	3,209	1,727	4,189	5,542	6,168	801	3,388	4,741	5,367
Underhill	3,129	11,999	11,851	24,515	32,434	36,097	2,709	21,806	29,725	33,387
Westford	2,062	8,677	5,747	12,954	17,138	19,074	1,406	11,548	15,732	17,667
Williston	10,103	120,456	9,468	43,349	57,352	63,829	35,001	8,349	22,351	28,828
Winooski	7,997	42,856	357	16,201	21,435	23,855	18,613	✓	2,822	5,243
Chittenden County	**168,194**	**1,747,086**	**133,671**	**648,475**	**857,945**	**954,833**	**606,554**	**41,922**	**251,391**	**348,279**

Sources: VT Department of Public Service, VCGI, and CCRPC.
**Note:*

TABLE 21: TOTAL ENERGY POTENTIAL BY TECHNOLOGY AS A PERCENT OF INCREMENTAL GENERATION TARGETS

Target Year: 2050	Incremental Target (MWh)	Total Energy Potential (MWh)	All Resources	Prime Solar	Base Solar	Rooftop Solar	Prime Wind	Base Wind
Bolton	10,679	44,806	420%	32%	37%	46%	8%	296%
Buel's Gore	4,408	20,637	468%	5%	8%	1%	13%	442%
Burlington	✓	181,104	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Charlotte	49,708	289,030	581%	11%	82%	55%	7%	426%
Colchester	53,459	180,664	338%	30%	30%	191%	13%	73%
Essex Town	84,575	157,721	186%	20%	30%	92%	1%	43%
Essex Junction	52,876	67,848	128%	6%	6%	116%	0%	0%
Hinesburg	41,234	194,208	471%	49%	48%	55%	26%	294%
Huntington	24,706	119,136	482%	37%	29%	36%	79%	301%
Jericho	20,575	118,014	574%	72%	66%	153%	22%	261%
Milton	✓	246,536	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Richmond	18,076	87,171	482%	65%	38%	96%	98%	185%
Shelburne	43,041	191,446	445%	24%	41%	117%	25%	237%
South Burlington	53,465	211,916	396%	7%	14%	297%	7%	72%
St. George	5,367	24,071	448%	28%	29%	58%	41%	292%
Underhill	33,387	167,207	501%	56%	51%	44%	11%	339%
Westford	17,667	95,538	541%	104%	83%	68%	27%	258%
Williston	28,828	243,163	843%	64%	39%	425%	56%	259%
Winooski	5,243	29,507	563%	58%	15%	451%	13%	26%
Chittenden County	**348,279**	**44,806**	**767%**	**59%**	**69%**	**269%**	**37%**	**333%**

Sources: VT Department of Public Service, VCGI, and CCRPC.

This table shows the potential energy that could be generated using the full land / rooftop extent of each renewable technology (and all technologies combined) relative to the incremental municipal targets in Table 20. Green cells indicate that there is sufficient area to meet targets with a given technology, while red cells indicate there is not enough. Using the county as an example, 767% for All Resources means that the county 7.76 times more resource area than it needs to meet the 2050 target. However, it could only meet 59% of its target through prime solar alone. N/A indicates that a municipality has met its target but can still contribute to meeting the overall county target.

Constraints and Suitability Methodology

Natural Resource Constraints

The Department of Public Service's energy planning standards establish known and possible constraints to identify potential areas for the development and siting of renewable energy, storage, transmission, and distribution resources and areas that are unsuitable for siting those resources. Constraints are grouped into the following categories: state known constraints, local known constraints, state possible constraints, and local possible constraints. Development should be located to avoid state and local known constraints, and to minimize impacts to state and local possible constraints.

The state/local known and possible constraints and their associated policies constitute the land conservation measures that might be given substantial deference by the Public Utilities Commission in the Section 248 process for permitting renewable energy generation. The accompanying policies for local and state constraints are discussed in Strategies 4, 6, and 7 of the ECOS Plan

Areas that represent known state/local known constraints are removed from wind and solar energy resource areas to estimate the amount of primary or 'prime' energy resource available for siting renewable energy generation and associated infrastructure. Prime energy resource areas are areas that a free from local/state known constraints.

Areas that represent possible state/local constraints are NOT removed from wind and solar energy resource areas. Instead, they are included with wind and solar energy resources areas to constitute secondary or 'base' energy resource areas. Base energy resource areas are areas with high solar and wind potential and a presence of state/local possible constraints. See Table 22 below for the list of state known and possible constraints.

While the first Chittenden County enhanced regional plan was being developed in 2017-2018, CCRPC went through a process with municipalities and the Long Range Planning Energy Subcommittee to identify local natural resource constraints that might be given substantial deference in the context of particular project review under section 248. While there was some overlap between the constraints identified by each municipality, no constraints emerged as being universal restrictions to development across the county. Therefore, no regional natural resource constraints were added.

These local constraints are included in the ECOS Plan due to their importance at the local level. For a local constraint to be identified, supporting text in an adopted municipal plan or municipal land use regulation such as zoning regulations or subdivision regulations must align with the classification of known or possible constraint below. To be consistent with the energy planning standards, constraints must be equally restrictive of all development, not just renewable energy development.

The local constraints identified in this plan are not an exhaustive list of every development constraint. Therefore, CCRPC will continue to work with municipalities to complete or update energy plans. CCRPC will also continue to review municipal plans through CCRPC's *Guidelines and Standards for Confirmation of Municipal Planning Processes and Approval of Municipal Plans*. CCRPC will check to ensure that any local policies don't preclude municipalities from meeting their energy generation targets and complying with the state energy goals.

Known Constraints: Zoning districts or resource areas where development is prohibited with no exceptions. Typically, phrases such as "development *shall not* take place" are used to denote these areas.

Possible Constraints: Zoning districts or resource areas such as those in which:

- Development is not completely prohibited, but impacts of development should be "minimized", "avoided," "limited," "avoided *where possible,*" mitigated or similar.
- Development is allowed only following conditional use review.
- The goals of the zoning district are such that large-scale energy development may not be appropriate, such as scenic overlay districts.

TABLE 22. LOCAL/STATE KNOWN AND POSSIBLE CONSTRAINTS*

Bolton	Burlington	Charlotte	Colchester
Known Constraints: • Surface Water Setbacks • Wetland Buffers • Slopes 25% or more **Possible Constraints:** • Conservation District • Slopes 15% to 25% • Forest District • Town Owned Land	**Known Constraints:** none identified **Possible Constraints:** • View Corridors • Burlington Country Club property • City-owned parks and Centennial Woods	**Known Constraints:** none identified **Possible Constraints:** • Shoreland Setback and Buffer Area • Surface Waters, Wetlands, and Buffer areas • Special Natural Areas • Wildlife Habitat • Historic Districts, Site, and Structures • Slopes greater than 15% • Land in Active Agriculture • Water Supply Protection	**Known Constraints:** • Slopes 20% or greater • Wetlands and Surface Water Buffers **Possible Constraints:** • Shoreland Overlay District

Essex	Hinesburg	Jericho	Milton
Known Constraints: • Slopes Higher than 20% **Possible Constraints:** • Scenic Resource Protection Overlay District • Resource Protection District • Slopes 15%-20% • Core Habitat • Habitat Blocks	**Known Constraints:** • Slopes Higher than 25% **Possible Constraints:** • Slopes (15-25%) • Core Habitat	**Known Constraints:** • Well Protection Area Overlay District • Natural Resource Overlay District • Primary Conservation Areas **Possible Constraints:** • Secondary Conservation Areas	**Known Constraints:** None identified **Possible Constraints**: • Town Forest and Municipal Natural and Rec Areas w/Management Plans • Habitat Blocks 8-10 • Encumbered Open Space

Richmond	Shelburne	South Burlington	Underhill
Known Constraints: • Slopes equal to or greater than 35% **Possible Constraints:** • Wetlands and associated buffers • Water Supply Protection Areas • Surface Water Buffers	**Known Constraints:** None identified **Possible Constraints:** • Significant View Areas • Lakeshore Buffer • Archeologically Sensitive Areas (not mapped)	**Known Constraints:** • Wetlands and buffer • River Corridor • B2 • Very Steep Slopes greater than 25% **Possible Constraints:** • Habitat Block and Corridor Overlay District • Slopes 15% to 25% • SEQ Natural Resource Protection Area • B1 500-year Floodplain	**Known Constraints:** • Above 1,500 ft. Elevation **Possible Constraints:** • Slopes 15% or greater • Mt. Mansfield Scenic Preservation District • Wetlands and associated buffers, • Surface Waters and buffers

Westford	Williston	State	State

Known Constraints:
• Slopes 25% or greater
• Deer Wintering Areas
• Ledge Outcropping
• Flood Hazard Overlay
• Water Resources Overlay
 	
Possible Constraints:
None identified
	Known Constraints:
	• Water Protection Buffers
	• Primary Viewshed Areas
	• Slopes 30% or greater
	
	Possible Constraints:
	• Slopes 15% - 30%
	• Conservation Areas/Natural Communities
		Known Constraints
		• FEMA Floodways
		• DEC River Corridors
		• National Wilderness Areas
		• State-significant Natural Communities and Rare, Threatened, and Endangered Species
		• Confirmed Vernal Pools Class 1 and 2 wetlands (VSWI and advisory layers)
			Possible Constraints
			• Potential Vernal Pools
			• Agricultural Soils + Hydric Soils
			• Act 250 Ag. Soil Mitigation Areas
			• FEMA Special Flood Hazard Areas
			• VT Conservation Design Highest Priority
			  ○ Interior Forest Blocks
			  ○ Connectivity Blocks
			  ○ Physical Landscape Blocks
			  ○ Surface Water and Riparian Area
			• Protected Lands (State fee lands and private conservation lands)
			• Deer Wintering Areas

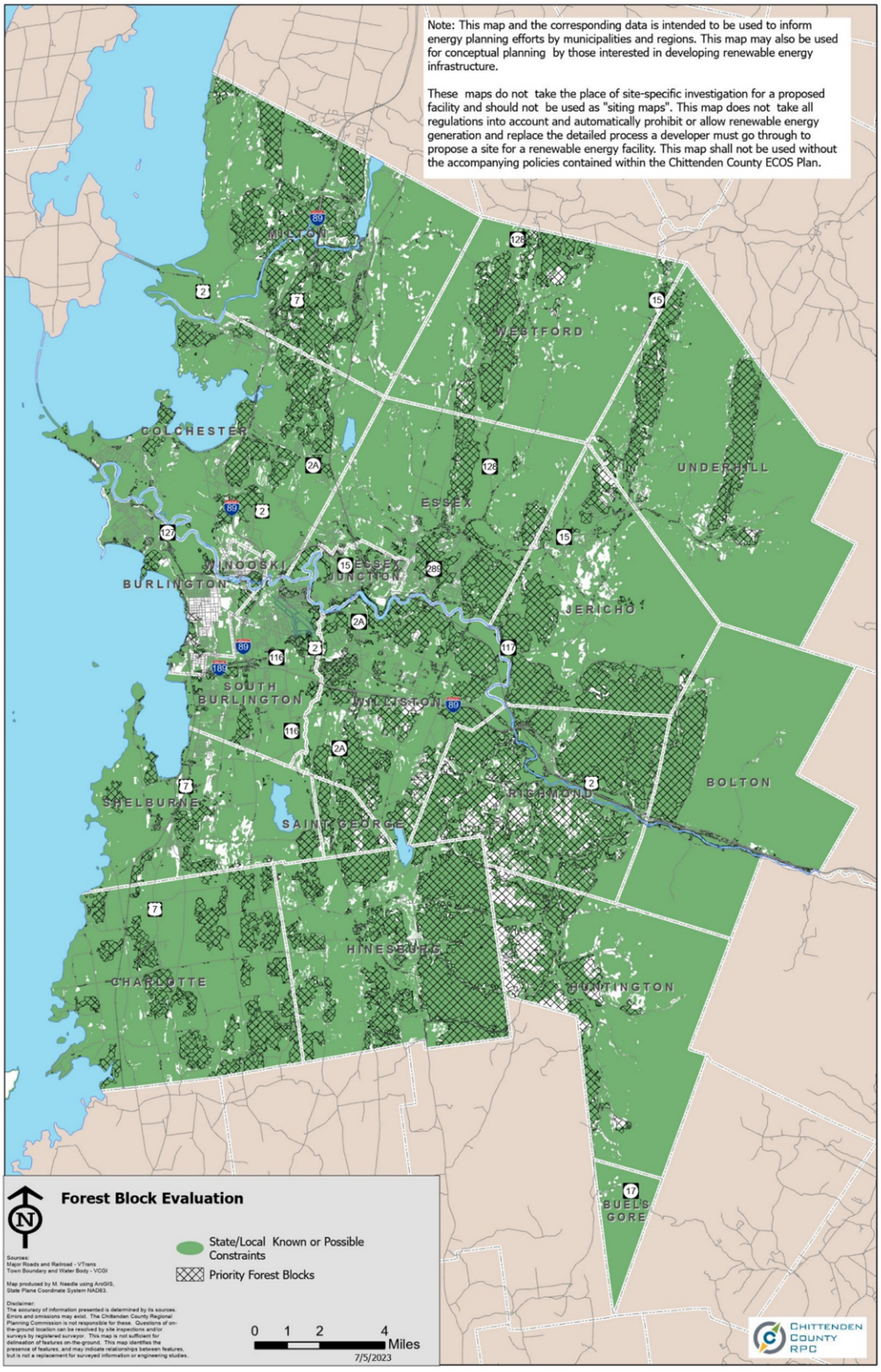
* Not every constraint to development in Chittenden County is reflected in the regional energy planning process. Some municipalities did not request any local constraints. CCRPC did not receive requests from Buel's Gore, Huntington, St. George, or Winooski. In the case of Winooski, it was determined that local constraints were not needed as the local constraints were sufficiently addressed by the state's constraints.

Suitability Methodology

Constraints represent areas in which development, including energy generation, is restricted. However, areas in which development is generally appropriate still have different levels of *suitability* for different types and scales of renewable energy generation. This may be due to conflicts between energy generation and other types of planned development, or infrastructure capacity issues. Therefore, we have incorporated considerations of scale into our siting suitability policy statements in strategy 4.

Forest Block Evaluation

The energy planning standards require an evaluation of whether forest blocks or habitat connectors should be treated as a possible constraint. CCRPC conducted an overlay analysis of all state/local known and possible constraints included in this plan with priority forest block areas from the Agency of Natural Resources' Vermont Conservation Design. CCRPC determined that most of the priority forest block areas are treated as possible constraints already in the ECOS Plan due to the inclusion of local constraints with some exceptions in Westford, Jericho, Richmond, and Huntington (see white hatched areas on the following map below). Although the state/local constraints are combined into one color, each individual natural resource constraint is associated with an accompanying policy either directing renewable energy generation away from the natural resource or calling for mitigation. Huntington did not request local constraints in the ECOS Plan which explains why the map is showing a gap. However, the ECOS Plan contains a strategy or policy statement encouraging the decrease in subdividing significant habitats and identifies regionally important forest blocks as Vermont Conservation Design's highest priority and priority forest blocks.


Note: This map and the corresponding data is intended to be used to inform energy planning efforts by municipalities and regions. This map may also be used for conceptual planning by those interested in developing renewable energy infrastructure.
These maps do not take the place of site-specific investigation for a proposed facility and should not be used as "siting maps". This map does not take all regulations into account and automatically prohibit or allow renewable energy generation and replace the detailed process a developer must go through to propose a site for a renewable energy facility. This map shall not be used without the accompanying policies contained within the Chittenden County ECOS Plan.
MILTON
WESTFORD
COLCHESTER
UNDERHILL
ESSEX
WINOOSKI
BURLINGTON
ESSEX JUNCTION
JERICHO
SOUTH BURLINGTON
WILLISTON
BOLTON
SHELBURNE
SAINT GEORGE
RICHMOND
HINESBURG
CHARLOTTE
HUNTINGTON
BUELS GORE
Forest Block Evaluation
State/Local Known or Possible Constraints
Priority Forest Blocks
0 1 2 4 Miles
7/5/2023
CHITTENDEN COUNTY RPC

X. ENERGY AND GREENHOUSE GAS EMISSIONS REDUCTION

Energy Goal: ~~Move~~In pursuit of an equitable transition for all communities, move Chittenden County's energy system toward cleaner, more efficient, and renewable sources in a manner that ~~is accessible to all and does not unfairly burden any groups, communities, locations, or economic sectors, and~~ benefits public health, the natural environment, economic development, and the local/global climate in alignment with the State's Comprehensive Energy Plan goals and the Global Warming Solutions Act.

Key Issues/Trends/Insights

[Data for this section drawn from: Energy Analysis, Targets & Methodology in Supplement 6 of this Plan, Energy Analysis Report, the State of Vermont Comprehensive Energy Plan, and associated appendices and Climate Change Trends and Impacts Report].

Energy Overview

- As noted in the Climate section, fossil fuel combustion is a major cause for increases in the atmospheric concentration of carbon dioxide and other greenhouse gases, which are the causes of global climate change. Because fossil fuels drive our present-day economy, countries with higher gross domestic products and people with wealth have higher carbon footprints than poorer countries or individuals. Climate change will have profound impacts on the environment, public health, infrastructure, and economy of Chittenden County. However, just as the contribution to climate change is not distributed evenly, nor are the impacts of climate change.
- According to the State of Vermont's Climate Council's Guiding Principles for a Just Transition, "studies continue to show that low-income communities, indigenous people, and Black and communities of color are among those who are particularly vulnerable to the impacts of climate change~~."~~. Impacted populations also include older and chronically ill Vermonters, as well as people with disabilities. Additionally, the initial up-front cost of transitioning to electrification in the renewable energy generation, heating, and transportation sectors may be burdensome to these impacted communities. Therefore, investments, policies, administration, and oversight should tackle the needs of impacted people first by including targeted strategies for different groups that ~~take into account~~consider their specific histories, sociocultural, and economic realities.
- A transition to renewable energy will drive down carbon emissions ~~and~~to avoid more severe impacts of climate change. To meet the goals in the State of Vermont Comprehensive Energy Plan (CEP), the region is planning for a major shift away from fossil fuels in the transportation and heating sectors to renewable sources of energy, efficiency in all sectors, and an increase in renewable energy generation within the state and from outside the state.
- Vermont citizens, businesses, and industries spend about $1.9 billion a year to pay for imported fossil fuels (2022 Energy Action Network (EAN) Annual Report). About 75% of this money leaves the County and state immediately. This outflow of energy dollars acts as a drain on the local economy. The inverse is true for electricity: about 70% of spending on electricity recirculates within the state economy (regardless of how renewable energy credits are traded). Developing local renewable energy generation systems will provide more jobs and economic stimulation within the state in addition to advancing other energy-related goals.
- The 2022 Vermont Energy Action Network's Annual Progress Report documents the power mix physically delivered to the state (based on contractual, or ownership entitlements) as shown in the pie chart below. The power mix looks different after renewable energy credits are traded, but

Commented [RM126]: From Anne Margolis conversation on 6/23 - really thinks the map layer changes in the requirements is the most important; and the policy changes with equity/forest protection stuff. Doing this work is more important than the LEAP data. And then maybe you do the LEAP modeling afterward because the standards don't really say that you have to use the most recent LEAP model. There is also the renewable generation targets, and their tool will consider the grid/transmission constraints. In accordance with the guidance we can keep our current generation targets (but the constraints will change that).

Commented [MN127]: Maybe we end the goal after sectors because the second of half of the goal is implied in the first part by "not burdening any groups.."

Commented [AS128R127]: We could combine it into "Move Chittenden County's energy system toward cleaner, more efficient, and renewable sources in a manner than is accessible to all, does not unfairly burden any communities, and benefits public health, the natural environment, economic development, and the local and global climate." ?

Commented [DS129R127]: I used Anne Nelson's language with some modifications. Thanks!

Commented [RM130]: We should include the state Comprehensive Energy Plan here.

Commented [AS131]: Maybe we open this section up with this bullet, followed by the bullet that is currently the first one. In my opinion, it's also important to name who/what is contributing the most to CO2 emissions/using the most energy. It's not our low income communities. Globally, at least, the top 1% contributes over double the emission of the poorest half of society. We need to hold the right people accountable.

I also wonder if its worth mentioning the tension between the need to grow the economy while also decreasing energy use/CO2 emissions.

Commented [DS132R131]: Moved as suggested, will try to add language that addresses source of impacts and growth vs. GHG reductions.

Commented [MN133R131]: Thanks! I took a stab at it too. Feel free to revise.

Commented [AS134R131]: Great!

Commented [AS135]: This is great!

Commented [AS136]: Could this be combined with the bullet point above?

Commented [DS137R136]: Combined these bullets

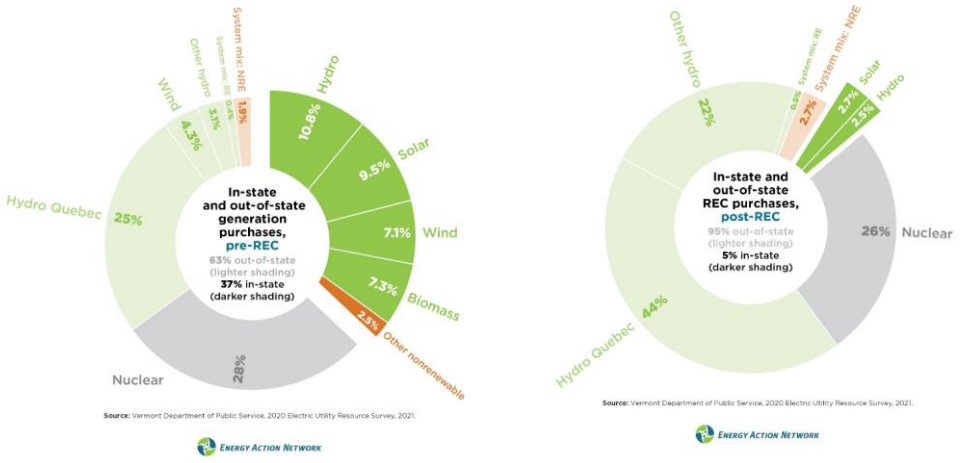
Commented [MN138]: 75%, EAN graphic, hydro quebec imports, staying in the US?

Commented [RM139R138]: Could we include a pie chart of where our energy comes from?

Commented [DS140R138]: I'm resolving this because we now reference the 2022 EAN report and include the energy mix graphics below.

Commented [DS141]: Change to reference EAN annual report since it breaks out system mixes. Remove PSD pie charts and report references.

either approach shows that Vermont's electricity consumption is 96-97% carbon-free and less than 5% fossil fuel based. See the annual report for further information.



- The price of energy is forecasted to continue increasing in the future, which will result in an additional burden on the County's residents and businesses, especially for low- or fixed--income households. Reducing energy consumption and generating on-site renewable energy are ways to mitigate the increasing costs of energy.
- Vermont, and the County, ~~relies~~rely heavily on gasoline and diesel for transportation. However, gasoline usage for transportation has decreased due to improved fuel economy standards and the ~~inclusion~~adoption of electric vehicles in the light duty sector. According to the Energy Information Administration, between 2012 and 2021, motor gasoline consumption decreased by almost 11% or from 7,409 to 6,606[43] thousand barrels[44].
- Chittenden County is home to an international airport and a National Guard base. Transportation fuel consumption in the County not only includes gasoline, diesel, and compressed natural gas, but also aviation gasoline and jet fuel.

Weatherization and Energy Efficiency

- Weatherizing homes has an immediate impact on people's lives and promotes energy efficiency and a cleaner environment. Once a home is weatherized, there is an average annual energy savings of 31~~%,~~%[45], which puts much-needed money back into the pockets of people who need it the most. Weatherization is a critical anti-poverty program for low-income households that also promotes environmental justice and health equity. For example, weatherization programs reduce carbon emissions and assist in the removal of environmental hazards such as lead, asbestos, and vermiculite. These environmental hazards are typically found in older buildings located within Chittenden County's disadvantaged neighborhoods, as defined by the Federal Justice40 Initiative.
- The 2022 CEP and the State Climate Action Plan calls for an ambitious target to weatherize 120,000 homes by 2030 statewide to meet carbon reduction goals and to protect the health and financial security of Vermont's most impacted communities. According to the LEAP analysis,

Commented [DS142]: I think this figure from page 31 of the 2022 EAN Progress Report does a better job explaining the mix of electricity, including in-state vs. out-of-state. Not sure if we want to get a cleaner version or try to reproduce it.

Commented [DS143R142]: Crop better or download graphics from EAN website

Commented [AS144]: I wonder how much aviation gasoline and jet fuel? Who is using it/who is it for? No need to include this, just curious.

Commented [AS145]: These additions are great, Melanie!

Chittenden County would need to weatherize ~~XX~~44% of homes by ~~2025~~2030 and ~~XX~~82% of homes by 2050 to advance this weatherization goal. According to the 2022 Vermont Energy Action Report, 31,338 homes have been weatherized statewide as of 2020. To meet the state's weatherization goal, the Energy Action Network estimates that Vermont's qualified weatherization workforce needs to grow from 770 people working in weatherization as field workers, office staff, and energy auditors to 6,200 people by 2030[46]. To meet the weatherization goal, the State needs to address all the challenges affecting the weatherization workforce. These challenges include shortages of skilled workers willing to work in uncomfortable conditions, wage competition with less-strenuous working conditions, fluctuations in funding/incentives for weatherization projects, and affordable housing. As noted in the Comprehensive Economic Development Strategy (CEDS), a current workforce shortage in the weatherization industry represents a challenge to meeting these goals, but there is also an opportunity to address this by supporting reskilling and ~~transition~~transitioning from the fossil fuel industry.

- Chittenden County has a long history of electrical and natural gas energy efficiency programs, dating back to 1990, these programs have provided significant energy savings and economic benefits to the state and County. These programs along with improvements in federal standards have led to a reduction in per household and per employee energy consumption of electricity and natural gas. Reduction in energy consumption directly results in a reduction in energy bills. The Home Performance with ENERGY STAR® guidelines and building/renovating to the State's Building Energy Code are two programs which assist Vermonters with reducing energy consumption from heating and electricity in homes and businesses~~.~~.
- The Affordable Heat Act of 2023 will create a market mechanism to be implemented in 2026 that will incentivize the delivery of cleaner energy options so these options can become increasingly available and affordable for Vermonters. This is intended to accelerate weatherization and switching to clean fuels in the thermal sector.

Fuel Switching and Electrification

- **Electric Grid Evolution.** Vermont's energy future includes a transition to beneficial electrification in the heating and transportation sector. Beneficial electrification is a term for replacing fossil fuel powered appliances and vehicles with ~~-~~heat pumps, electric vehicles, energy storage and smart appliances to reduce emissions and energy costs. However, increased electricity ~~end use~~demand coupled with renewable energy generation and storage may create challenges for the electric grid and for homes. Homes and businesses may need costly upgrades to electric service to ensure adequate amperage for increased electrical appliances like EV charging and cold climate heat pumps. Therefore, innovative programs and education are needed to ensure that low income and BIPOC communities are not particularly burdened by the transition to electrification, ~~-~~Smart Grid technology coupled with education, behavior change, price signaling (e.g., time of use rates), and load control technologies can help reduce peak demand and defer substation upgrades, which can result in substantial cost saving.
- **Transportation.** To prepare for electric / zero-emission vehicles accounting for 100% of light-duty vehicle sales by 2035, electric vehicle charging station equipment (EVSE) should be installed as part of new development or redevelopment to ensure charging is available ~~at homes, businesses, and workplaces as these are the locations where people are most likely to be charging their vehicles given current technology.~~. Most EV owners do their charging at home. However, public charging at key locations and workplace charging may offer benefits for businesses, employees, and customers.
    - Retrofitting existing residential multi-unit dwellings (MUDs) with EVSE and the necessary electric service amperage is imperative to ensure that electric vehicle adoption is equitable, and all drivers have adequate access to charging infrastructure. MUD residents in apartments and condominiums often have more challenges in gaining

Commented [RM146]: Clarify what this means.

Commented [AS147]: Yes! It's a funny thing: the wealthy communities contribute more to the problem and then are also the ones that can afford the "solutions"

access to home EV charging due to parking issues and cost. Renters in MUDs have additional barriers to long-term investments in charging infrastructure for shorter-term housing. In addition, policies, and pricing structures to encourage off peak charging need to be considered to mitigate grid constraints associated with electric vehicle charging. Refer to the EV Charging Equipment Location Prioritization Technical Report for specific priority locations for EVSE.

- The 2023 Metropolitan Transportation Plan (MTP) anticipates ~~a~~increases in transit ridership, significant mode shift from driving to biking or walking, including the use of electric bikes (e-bikes~~). Improving the region's active transportation infrastructure will be necessary to support this transition.~~) to reduce energy and emissions from transportation. See the MTP for additional information.

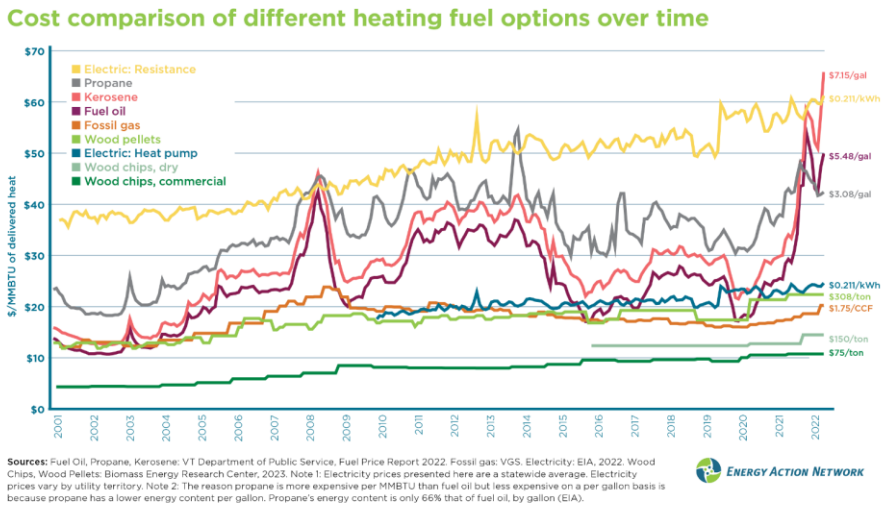


Figure sourced from 2022 Vermont Energy Action Network Annual Progress Report, page 27.

- **Heating.** ~~It is necessary to shift~~ With the passage of the Affordable Heat Act, the heating sector will shift away from fossil fuel use. Promoting air source and ~~geothermal~~ ground source heat pumps (powered by a renewable electric grid), in addition to using sustainably harvested wood/biomass systems, biogas and networked geothermal ~~heating systems, is~~, are key steps to meeting the Global Warning Solutions Act requirements and the 2022 CEP goals. However, low income, BIPOC, and renter households are likely to experience barriers and be burdened by the cost of transitioning to heat pump technology or any technology because of the cost of upfront investments to retrofit buildings. ~~Additionally~~Incentive programs specifically designed for impacted or burdened populations are necessary to ensure the transition to heat pumps is equitable and accessible. However as noted in the 2022 Vermont Energy Action Network Annual Report, natural gas costs less than electricity[1] so customers are not likely to save money on their energy bills by replacing existing natural gas heating systems with heat pumps~~.~~. Buildings switching from fuel oil or propane to a heat pump system will save customers money

[1] The 2022 Vermont Annual Energy Report notes that as of November 2022, the residential effective cost of natural gas was $15.67 per Metric Million British thermal units (MMBTU) compared with $22.44 / MMBTU for air source heat pumps.

Commented [MN148]: needs to be linked

Commented [MN149]: need data on rates

and protect customers from price volatility as the cost of electricity is less than fuel oil or propane and is less susceptible to price fluctuations. Net-zero buildings and heat pumps as the primary fuel source in new buildings will help the region meet its goal of shifting the heating sector away from fossil fuels. Additionally, key partners in the energy transition are making progress towards becoming more renewable in the thermal sector. These are described in the bullets below.

- The City of Burlington is pursuing a district heating system from McNeil Generation Station's waste heat to be a source of renewable thermal energy for University of Vermont and University of Vermont Medical Center. When constructed, this heat source will replace natural gas demand and help the region meet its thermal energy targets. Additionally, the city has adopted a Net Zero Energy Roadmap to reduce and eliminate fossil fuel use from heating.
- VGS's comprehensive strategy for NetZero by 2050, with an immediate goal of reducing GHG emissions for customers by 30% by 2030, is critical to achieving the State's energy and climate goals. Expanding renewable natural gas to make up 20% of the supply mix by 2030 ~~is also part of VGS's strategy,~~ and is also part of VGS's strategy. Moreover, VGS is exploring networked geothermal for its customers with a priority focus on affordable housing and low to middle income communities which will ensure that lower income households have access to an equitable way to transition off fossil fuels for heating and the burden is not placed on them to bear the responsibility of making the transition.
- **Biomass for Heating.** Wood chips and pellets remain one of the most affordable sources of heating in Vermont, but as noted in other sections of this plan, their use must be balanced with the need to maintain ecological values and carbon sequestration and storage. In simple terms, harvesting of low-grade wood for electricity or heating is sustainable when it does not exceed the net growth rate of low-grade wood in forests. The state's Net Available Low-Grade (NALG) wood has increased since 2010; though NALG may decrease in the short-term due to fluctuations in the rates of forest growth and demand for low-grade wood, the long-term outlook allows for use of low-grade wood for both heating and electricity generation at current or slightly higher levels (see Supplement 6 for further analysis). Carefully planned harvesting of mature trees (particularly those useful for low-grade wood) through the practice of uneven-aged management will in fact increase overall tree growth and carbon sequestration rates while restoring the health and diversity of Vermont's forests. It will also provide an important source of local, renewable, and carbon-neutral fuel that provides economic value to retaining forests as they are rather than converting them to non-forest uses. Given this, CCRPC continues to support use of low-grade wood for both heating and electricity provided that is sourced through forest management practices that prioritize maintaining long-term ecological health, carbon sequestration and storage rates, and regenerative economic value from forests.

Renewable ~~Energy~~Electricity Generation

- As of 2022, Chittenden County generates 606,554 MWh (an 19% from 511,242 in 2017) of renewable energy from a range of non-fossil fuel based, renewable energy production sites owned by utilities, private parties, and municipalities. Reliable, cost effective, and environmentally sustainable energy availability is critical to support the economy and natural resources of Chittenden County.
- **Equitable Access to Renewables.** ~~However, the~~The environmental and cost saving benefits of renewable energy generation are not always equally accessible. Impacted communities may be left out or burdened by renewable energy generation programs because of not owning homes or living in multi-unit buildings~~.~~ that are not well suited for installing their own systems. Community

Commented [MN150]: Adding discussion about Ebikes, infrastructure and safety

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solar is one way to increase ownership access to renewable energy generation because zero upfront financial investment is needed ~~and participating in~~to install a community solar ~~programs does not require~~array. Community solar ~~panel installations.~~participation also provides savings on electricity expenses which is especially helpful for lower income households.

- ~~**Grid** **Peak Loads and** **Resilience.** As we transition to more renewables, grid~~Grid resilience is valued by both residents and business~~, especially because~~. Vermont's weather and landscape patterns make ~~us~~the state vulnerable to ~~grid~~power outages. ~~When storage is coupled with~~ Therefore, coupling distributed energy generation ~~it can provide a source of backup power and also offer the potential~~with battery storage systems will help to improve grid resilience. Moreover, as the region electrifies the heating and transportation sectors with solar and wind generation sources, energy storage systems will be necessary to ~~minimize loads at~~manage peak ~~times, thereby reducing energy costs compared to the use of centralized power plants.~~loads and turn intermittent sources into relatively consistent sources of energy.
- **Renewable Electricity Standard.** ~~A Vermont law passed in 2015,~~ Act 56~~,~~ established a renewable energy standard (RES) which requires Vermont's electric utilities to source 55% of their retail electricity from renewable sources by 2017, 75% by 2032, and 90% by 2050.
  - Among the three electric utilities that operate within Chittenden County, Green Mountain Power's supply is now 100% carbon free post and 68% renewable now and will be 100% renewable by 2030. Burlington Electric Department's portfolio is also 100% renewable. Both utilities claim these achievements post renewable energy credit sales. Vermont Electric Co-op plans to meet or exceed its RES obligations by 2030.
  - While the region's baseline electricity consumption overwhelmingly comes from carbon-free and even renewable sources, during peak demand times that exceed renewables' capacity the demand must be met with imports from the New England (NE) System Mix. To meet the demand, peak electricity is mostly provided by natural gas generation, which is a source of greenhouse gas emissions.
- ~~As part of Act 56,~~The RES requires electric utilities ~~also need~~ to work with customers to reduce fossil fuel use and decrease carbon emissions from transportation and thermal heating by offering new innovative programs and services to their customers. ~~The~~For example, electric utilities ~~subject to Act 56~~serving the region are offering ~~innovative products for electrification and~~ incentives for electric vehicles, charging equipment and heat pumps to meet the statute and deliver innovation.
- Vermont's rural nature offers challenges for the transmission and distribution of energy. It is important to maintain and develop an energy production, transmission, and distribution infrastructure in Chittenden County that is efficient, reliable, cost-effective, and environmentally responsible. ~~Current energy distribution projects include: Extension of 3-phase power in south Hinesburg along VT116 by Green Mountain Power; and the City of Burlington and partners are planning to advance a district heating system using McNeil's waste heat for distribution to the University of Vermont Medical Center. See the CEDS Project list in Supplement 4 for cost estimates, funding sources and proposed timelines for these projects.~~The Vermont Electricity Power Company (VELCO) is Vermont's electricity transmission utility. VELCO's 2021 Long-range Transmission Plan notes that the regional transmission system serving West Central Vermont adequately serves current needs, yet may require substantial upgrades in future years, particularly as more local electricity generation occurs. Several of the principal electricity distribution utilities serving the region, including Burlington Electric, Green Mountain Power, Washington Electric Coop, and Vermont Electric Coop, all have areas with significant system constraints where future system upgrades may be needed.
- The cost of electricity is impacted by the distance it travels. When electricity is transmitted over long distances a significant amount of electricity is lost. Locating ~~distributed~~ generation near electric loads reduces transmission losses and ~~could~~may result in more cost-effective retail electricity rates.

Commented [MN155]: link to franchise areas

Commented [DS156R155]: Linked to here: https://publicservice.vermont.gov/electric-utility-service-territory-map

Commented [MN157]: Recgnize difference btwn total demand vs peak demand

Commented [DS158R157]: Added text below.

Commented [DS159]: Check if there's data on renewable / non-renewable sources during peak times.

Commented [DS160]: Consider consolidating with Heating above

- ~~Every three years, Vermont Electric Power Company (VELCO), the State's transmission utility, completes a Long-range Transmission Plan. This plan identifies transmission-constrained areas and reliability concerns. The plan also identifies potential infrastructure projects that may be needed to address identified concerns. The 2021 Long-range Transmission Plan identifies several projects within Chittenden County, and in areas immediately adjacent to the County, that will likely need to be installed over the next decade due to anticipated growth in electric demand due to mass electrification and due to the State's increasing reliance on distributed generation (see pages 38-39). Adequate transmission and distribution grids that are able to accommodate the planned increase in electricity use, and reduces energy loss, are necessary to meet the goals of this section.~~

Energy and Land-Use Planning

- **Compact Development Patterns.** ~~One of the~~The most impactful ~~ways~~way to reduce greenhouse gas emissions is to enable more compact walkable neighborhoods in the region's areas planned for growth. Chittenden County, perhaps more so than other regions of the State, can achieve great energy efficiency and GHG benefits because of development density and infill development goals.
  - **Energy Efficiency**. Compact walkable neighborhoods encourage smaller building footprints with lower heating and cooling needs, ~~promotes~~promote efficient travel that is less dependent on cars and ~~provides~~provide more opportunity for walking, biking, and transit.
  - **Conservation for Carbon.** Compact development also decreases development pressure on Vermont's working and natural landscapes~~, preserving~~. This preserves land for ~~existing and future~~ carbon sequestration and storage. ~~Maximizing use of rooftops and other previously developed sites for renewable energy generation also achieves this goal.~~
  - **Electric Load Efficiency.** Dense population centers make distributed generation easier because energy can be produced near significant numbers of customers and load. Additionally, ~~portions of~~ the county's dense land use pattern may ~~allow for~~enable innovative energy solutions, such as district heating and microgrids.
- **Enhanced Energy Planning.** In 2016, the Vermont Legislature ~~Enacted~~enacted Act 174 to improve energy planning and to give town and regional plans greater weight or "substantial deference" in Public Utility Commission (PUC) proceedings. As of 2022, Bolton, Burlington, Charlotte, Colchester, Essex Junction, Hinesburg, Huntington, Jericho, Richmond, Shelburne, Underhill, Williston, Winooski~~, Hinesburg, Underhill~~, and Westford have adopted enhanced energy plans.
  - **Development Constraints.** ~~One element of~~The Act 174 enhanced energy planning ~~involves~~standards involve identifying and mapping ~~restrictions on~~constraints to development~~, which under Act 174~~. These constraints must be applied equally to renewable electricity generation projects as well as other forms of development. While this is generally good policy, there may be circumstances where ~~ground-mounted solar panels or wind turbines~~renewable energy generation projects could be developed without creating negative impacts~~.~~ to some specific state-required constraints (e.g., wetlands). Further study and consideration of these policies is warranted to find workable solutions for responsibly siting renewables amidst these constraints. This will

Commented [MN161]: Darren:Should this section be moved to the start to greater emphasize its importance?

Commented [DS162R161]: Fine for now since this will become web based

Commented [DS163]: Also talk about why EEPs are important to accessing CPRG implementation funds

Commented [DS164R163]: Also tie to an action of supporting development of renewable resources (public and private) through technical assistance, funneling grant $

Commented [MN165]: Wetlands to become a possible constraint add to actions. ANR wetland rules

Commented [DS166R165]: Took a stab at this but I'm not sure it captures the nuance sufficiently.

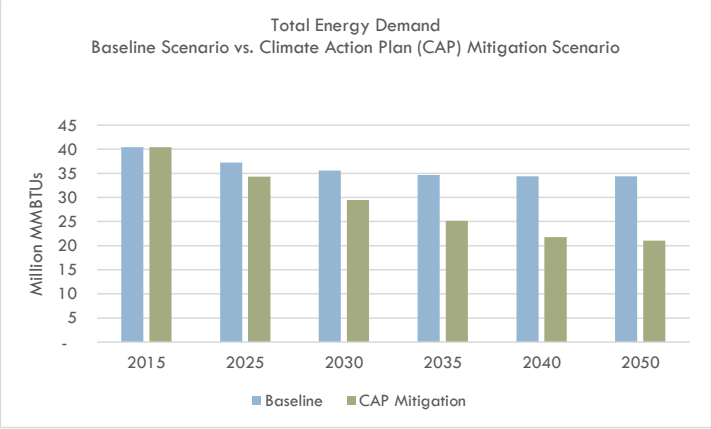
Commented [DS167R165]: Work with PSD and ANR to clarify process for listing constraints

Commented [DS168]: Distill to one sentence about balancing climate goals with negative impacts of renewables development

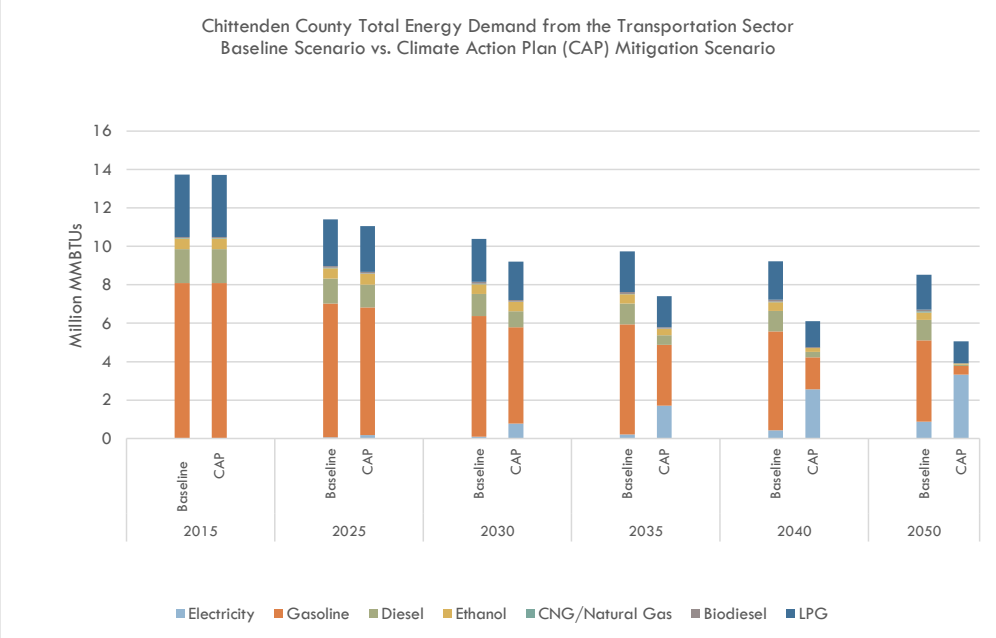
reduce competition between renewables and other forms of development which typically have greater impacts on protected resources.

Energy Analysis and Targets~~Furthermore, the current~~

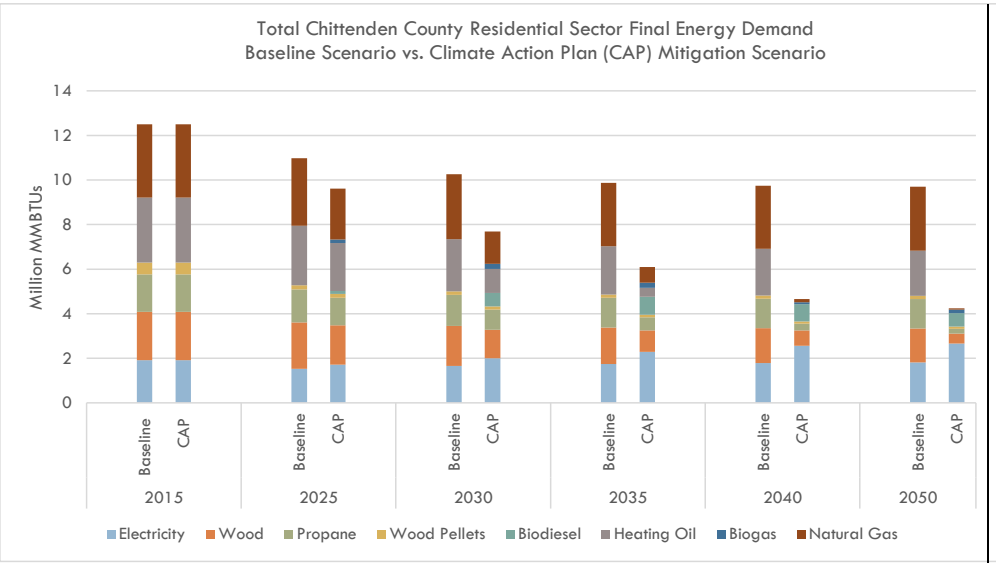
- The Department of Public Service developed a scenario model of Vermont's energy consumption to construct pathways to align with Vermont's Comprehensive Energy Plan (CEP) and Climate Action Plan (CAP) and to meet statutory greenhouse gas (GHG) reduction obligations under the state's Global Warming Solutions Act (GWSA). This scenario is referred to as the Central GWSA Mitigation or CAP Mitigation scenario. A second, baseline, scenario was also developed to estimate Vermont's energy demand given business as usual conditions. The model was built with the Low Emissions Analysis Platform (LEAP), a software tool for energy system modeling and emissions accounting. The following charts below represent the magnitude of change needed in the commercial, industrial and transportation sectors to meet state energy and climate goals in Chittenden County. The targets needed to meet the energy planning standards are derived from the CAP scenario and are contained in the ECOS Plan's supplement 6.
- As the region strives to meet renewable energy and decarbonization goals, the region will see a decrease in total energy demand (inclusive of the transportation sector) as buildings and vehicles become more efficient through weatherization and fuel switching. In addition, energy use will move away from fossil fuel consumption towards electricity from renewable sources (see chart below). Based on the comparison of total energy demand in the baseline scenario and the CAP mitigation scenario, Chittenden County's total energy demand will be 48% less in the year 2050 than it was in the year 2015 with the implementation of the policies that were modeled in the CAP mitigation scenario.



- The CEP includes a goal of having zero-emission vehicles account for 100% of light duty vehicle sales in Vermont by 2035 and calls for the transportation sector to meet 10% of energy needs from renewable energy by 2025, and 45% by 2040. As the county transforms the transportation sector to meet these goals, electricity as a fuel source in the transportation sector will increase (see chart below). As a result, it is estimated that Chittenden County will need to have 28,950 electric vehicles by 2030 and 145,754 electric vehicles by 2050 in the passenger and light duty sectors. In comparison, Chittenden County has 3,183 EVs registered as of 2022.



- Thermal energy use in Chittenden County homes is projected to decrease by 64% from 2025 to 2050. Electricity demand will need to increase by 140% between 2025 and 2050. Natural gas, fuel oil, and propane will virtually be eliminated, per the CAP scenario. Residential buildings will use less energy for space heating due to an increase in the percentage of buildings that are weatherized and the greater efficiency in heating technology.



- Chittenden County's energy demand in the thermal commercial/industrial sector will need to be reduced by 19% from 2025 levels to meet future energy, carbon reduction and renewable energy source goals. This will primarily be achieved through weatherization of commercial buildings and the use of more efficient heating technologies (e.g. cold climate heat pumps powered by renewable electrification). By 2050, the LEAP model targets the region to have 64,790 new heat pumps installed in commercial buildings. Natural gas demand is estimated to decrease by 63% from 2025 to 2050 and the demand for heating oil and propane will be eliminated.

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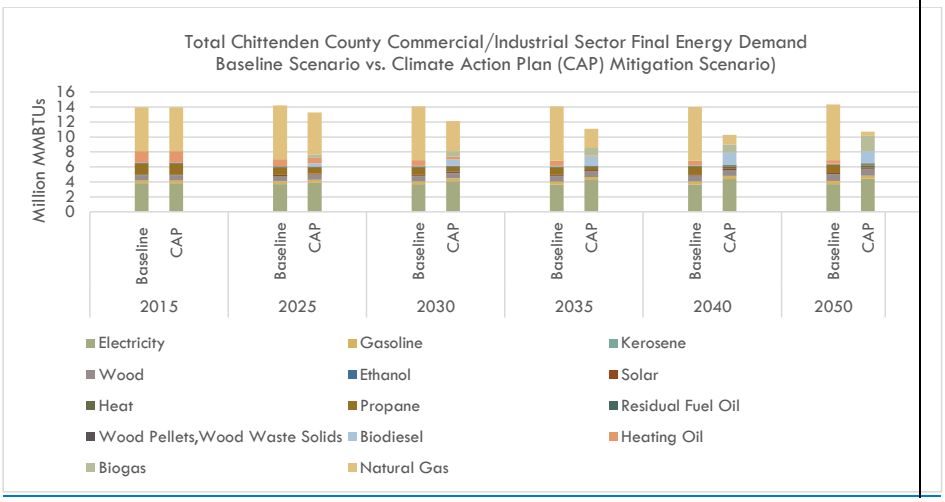
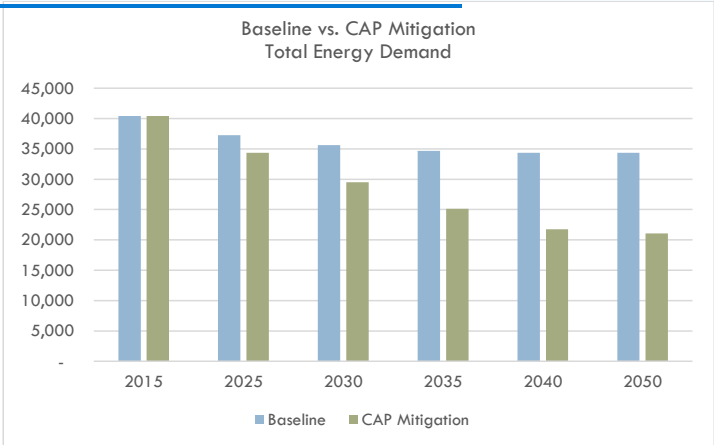


- **Electricity Generation Targets.** CCRPC supports the generation of new renewable energy in the County to meet Vermont's Global Warming Solutions Act and Comprehensive Energy Plan's goal of using 90% renewable energy by 2050, in a manner that is equitable, cost effective and respects the natural environment.
  - Specifically, Chittenden County needs to generate a total of 954,833 MWh (Megawatt hours) of energy annually (a 57% increase over 2022) to meet state energy and climate goals. Table XX sets progressive milestones to reach this goal, including the amount of additional generation that must be brought into production after accounting for existing renewables. These targets are based on the average of the county's share of statewide population and land area. While the county has sufficient land to build new renewable electricity generation projects to reach the 2050 generation targets, the electric transmission and distribution system will likely need upgrades to be able to move electricity from generation to demand.
    The targets are technology neutral, meaning that they can be met with any mix of solar, wind, hydroelectric, biomass, or other sources of renewable electricity. CCRPC has completed an analysis of areas suitable for solar and wind energy generation to determine our ability to meet the 90% renewable by 2050 and decarbonization goals and has determined that the region has sufficient land to meet its targets by relying on wind and solar energy generation.
  - However, the current PUC's sound rule for wind generation makes developing new wind generation unfeasible because the PUC Rule 5.700 imposes standards and requirements on wind energy that have the effect of prohibiting its development. CCRPC supports regulatory changes to make wind power more viable for several reasons. First, it is complementary to solar in terms of its generation profile. Second, it can provide local low-cost electricity for Vermont rate payers. Host communities' benefit from increased property taxes and jobs. Wind generation in Vermont can also reduce Vermont's strong dependence on external electricity providers, such as Hydro Quebec, to supply our electric needs in an increasingly electrified world.

Energy Analysis and Targets

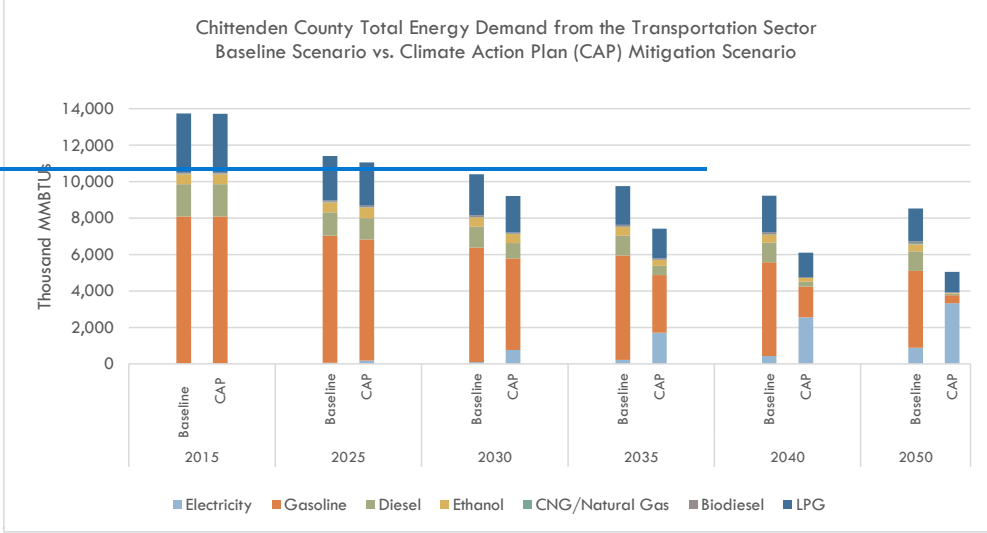
- As part of the development of Vermont's Comprehensive Energy Plan (CEP) and Climate Action Plan (CAP), the Stockholm Environment Institute (SEI) and Northeast States for Coordinated Air Use Management (NESCAUM) developed a scenario model of Vermont's energy consumption to construct pathways to meet statutory greenhouse gas (GHG) reduction obligations under the state's Global Warming Solutions Act (GWSA). This scenario is referred to as the Central GWSA Mitigation or CAP Mitigation scenario. A second, baseline, scenario was also developed to estimate Vermont's energy demand given business as usual conditions. The model was built using SEI's Low Emissions Analysis Platform (LEAP), a software tool for energy system modeling and emissions accounting. The model contains a representation of residential, commercial, industrial and transport energy use at the state level. The Department of Public Service then regionalized energy demand outputs to support regional energy planning.
- As the region strives to meet renewable energy and decarbonization goals, the region will see a decrease in total energy demand (inclusive of the transportation sector) as buildings and vehicles become more efficient through weatherization and fuel switching. In addition, energy use will move away from fossil fuel consumption towards electricity from renewable sources (see chart below). Based on the comparison of total energy demand in the baseline scenario and the CAP mitigation scenario, Chittenden County's energy demand will be 48% less in the year 2050 than it was in the year 2015 with the implementation of the policies that were modeled in the CAP mitigation scenario.



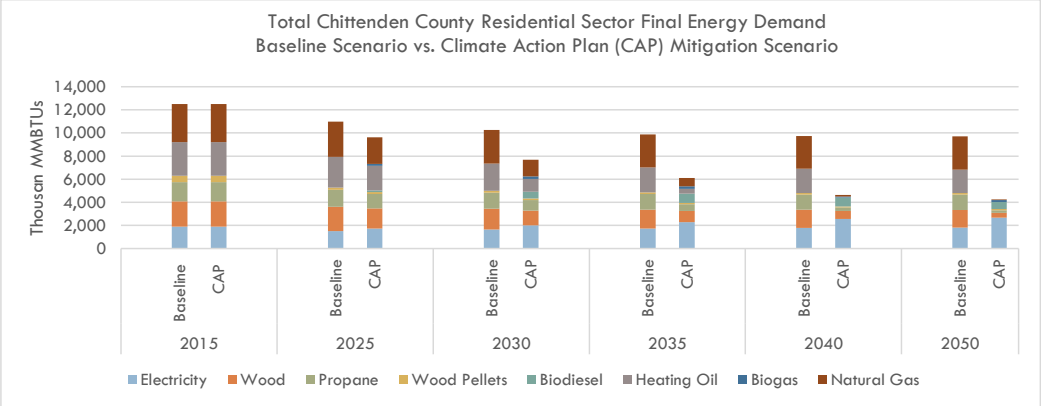
- The CEP includes a goal of having zero-emission vehicles account for 100% of light-duty vehicle sales in Vermont by 2035 and calls for the transportation sector to meet 10% of energy needs from renewable energy by 2025, and 45% by 2040. As the county transforms the transportation sector to meet these goals, electricity as a fuel source in the transportation sector will increase (see chart below). As a result, by 2030 it is estimated that Chittenden County will need to have 28,950 electric vehicles and by 2050, 145,754 electric vehicles in the passenger and light duty sectors.

Commented [DS170]: Should this move to follow the "Energy Overview" so that other key issues flow from this? Would definitely flow better for the renewable electricity generation targets discussion.

Commented [DS171R170]: Melanie and I agreed that it's better to keep the key issues focused up-front on context rather than analysis and targets.



- ~~Based on the LEAP Climate Action Plan Mitigation Scenario,thermal energy use in Chittenden County homes is projected to decrease by 64% from 2025 to 2050.Electricity demand will increase by 140% between 2025 and 2050. Natural gas, fuel oil, and propane will virtually be eliminated. Residential buildings will use less energy for space heating due to an increase in the percentage of buildings that are weatherized and greater efficiency in heating technology.~~



- ~~The LEAP Climate Action Plan mitigation scenario estimates that for Chittenden County total energy demand in the thermal commercial/industrial sector needs a 19% reduction from 2025 levels to meet future energy, carbon reduction and renewable energy source goals. This will primarily be achieved through weatherization of commercial buildings and the use of more efficient heating technologies, like cold climate heat pumps powered by renewable electrification. By 2050, the LEAP model estimates that 64,790 new heat pumps will be installed in commercial buildings. As a result of this transformation in how commercial buildings~~

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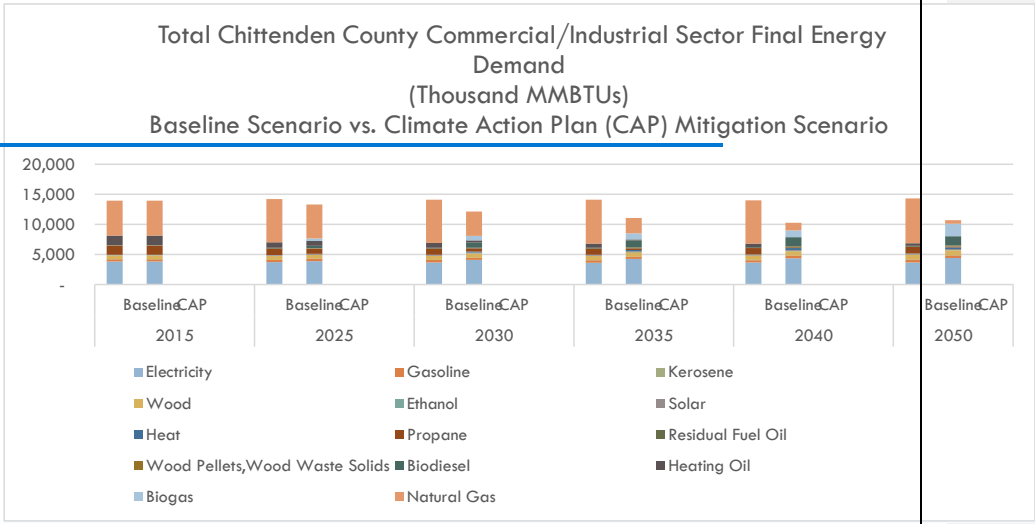
~~are heated, natural gas demand is estimated to decrease by 63% from 2025 to 2050. Additionally, demand for heating oil and propane will be eliminated.~~



- ~~**Electricity Generation Targets.** CCRPC supports the generation of new renewable energy in the County to meet Vermont's Global Warming Solutions Act and Comprehensive Energy Plan's goal of using 90% renewable energy by 2050, in a manner that is equitable, cost effective and respects the natural environment.~~
  - ~~Specifically, Chittenden County needs to generate a total of 954,833 MWh (Megawatt hours) of energy annually (a 57% increase over 2022). Table XX sets progressive milestones to reach this goal, including the amount of additional generation that must be brought into production after accounting for existing renewables. These targets are based on the average of the county's share of statewide population and land area.~~
  - ~~The targets are technology-neutral, meaning that they can be met with any mix of solar, wind, hydroelectric, biomass, or other sources of renewable electricity. CCRPC has completed an analysis of areas suitable for solar and wind energy generation to determine our ability to meet the 90% renewable by 2050 goal. See Supplement 6 for an analysis of existing generation and future generation possibilities and documentation that the region has sufficient land available to meet its targets using solar or wind.~~
  - CCRPC's renewable energy generation facility siting policies are detailed in Strategy 4, Action 2 and will inform CCRPC's preferred sites policy.

TABLE XX: CHITTENDEN COUNTY RENEWABLE ELECTRICITY GENERATION & TARGETS (MWH / YEAR)

~~Target~~ Year	2018*	2022	2032	2040	2050
Total Renewables Target	N/A	N/A	648,475	857,945	954,833
Existing Renewables ~~(2022)~~	501,196	606,554	606,554	606,554	606,554
New Renewables Target	N/A	N/A	41,922	251,391	348,279
*As reported in 2018 ECOS Plan based on data from Vermont Community Energy Dashboard					

Commented [DS173]: Check this reference in the final document

Commented [MN174]: will be updated once PSD guidance and LEAP data is available. July/August timeframe

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Key Indicators

Additional indicators can be found on the ECOS Scorecard.

Indicators	Location
Annual Natural Gas Consumption	Scorecard
Annual Electricity Consumption	Scorecard
Percent of Electricity Saved	Scorecard
Renewable Energy Capacity Sited in Chittenden County	Scorecard

See Supplement 6 for the complete Act 174 Energy Planning Analysis and Targets

2. LAND USE: STRIVE FOR 90% OF NEW DEVELOPMENT IN AREAS PLANNED FOR GROWTH, WHICH AMOUNTS TO 15% OF OUR LAND AREA.

The areas planned for growth are defined as the Center, Metro, Suburban, Village, and Enterprise Planning Areas (all but Rural) as displayed on the Future Land Use Map. This strategy mimics the development patterns we've seen in the recent past. A Transit Oriented Development (TOD) overlay planning area has been added to depict and encourage a higher concentration of growth within walking distance to bus routes to reduce transportation energy consumption, carbon emissions, and preserve our natural and working landscapes. This overlay is within the areas planned for growth.

Commented [DS308]: Keith Epstein (Energy Subcommittee): can this section mention the % of land area included in the TOD overlay so we can track it over time like the areas planned for growth?

Increasing investment in denser, mixed use growth areas will improve economic opportunities, housing options, transportation options and improve community health. Focusing growth in the appropriate planning areas is also a cost-effective approach to increasing the supply of affordable housing and using existing infrastructure efficiently. Also, this pattern of growth reduces energy consumption for transportation. Homes are in closer proximity to jobs and other services, making trips shorter and making travel by walking, biking, transit and carsharing more feasible.

Actions

1. **Invest in Areas Planned for Growth** -

    a. Invest in wastewater, water and stormwater infrastructure, energy systems (e.g. distribution, storage, and generation) and transportation infrastructure (prioritizing bicycles, pedestrians and public transit) in areas currently developed and/or planned for growth.
    b. Target reuse, rehabilitation, redevelopment, infill, and brownfield investments to -areas planned for growth.
    c. Retrofit existing buildings to reduce energy use and greenhouse gas emissions.
    d. Improve the walkability and streetscapes of high density areas, and allow flexibility for creative solutions to improve vibrancy and livability.

2. **Municipal Planning and Zoning** - Strengthen and direct development toward areas planned for growth through infill development and adaptive reuse of existing buildings through municipal plan and bylaw revisions and state designation programs.

    a. Municipal Development Review Regulations should be revised to improve the mix of uses, shared parking, support for transit, access to a variety of services (for example restaurants, grocery stores, parks, entertainment) via active transportation, energy efficiency, renewable energy and the affordability of housing. A particular emphasis is needed on providing for affordable rental housing.
    b. Integrate capital planning and budgeting in planning efforts to provide the right mix of infrastructure over time. Official maps can also be a useful tool to drive infrastructure improvements in the areas planned for growth.
    c. Health Impact Assessments (HIA) provide a tool to use at the regional, municipal, agency, and organizational level to assure that planning decisions maintain or improve the public health. Access can be improved by co-locating public facilities, in particular, medical and mental health facilities in areas with easy access via active transportation and public transit. Town health officers should be encouraged to participate in community planning efforts.

d. Empower local officials through trainings and education on strategies to achieve the above plan and bylaw amendments, and implementation of them during development review. This could include how to effectively analyze development costs and benefits, and select appropriate multi-modal congestion mitigation measures.

3. **Broadband** – Coordinate with the VT Community Broadband Board, municipalities and service providers to ensure all residents and businesses are served by fiber broadband service.

4. **State/Local Permitting Coordination & Improvement**

a. Support changes to the local and state permitting process to make the two more coordinated and effective. Participate in the Commission on Act 250 to improve the State's development review process, particularly to encourage development in appropriately planned places and discourage development outside of those areas. This could include expedited permitting processes for projects in areas that are: a) designated for growth; and b) where a community has a robust plan, regulations and staff capacity. In conjunction with a reduction of permit review redundancies in areas planned for growth it may be appropriate to develop more stringent standards and thresholds for development review in rural areas.

b. Collaborate with stakeholders to ensure local and state regulations, bylaws and plans encourage transparency, predictability and timely review of sustainable and environmentally sound development applications. Support the establishment of an ambassador position to help those wishing to start businesses in Vermont understand and navigate the state permitting process.

c. Develop a transportation assessment process that supports existing and planned land use densities and patterns in Center, Metro, Suburban, Village, and Enterprise Planning Areas to allow for more congestion and greater mode choice than allowed by current standards. The CCRPC will collaborate with the Vermont Agency of Transportation (VTrans), the Natural Resources Board, and other state and local stakeholders to develop a process that evaluates the transportation impact from a multi-modal perspective rather than just a traffic flow standpoint.

d. Policies and planning studies that are adopted as part of this ECOS Plan and subsequent amendments will guide CCRPC's position in permit proceedings.

Commented [AJ309]: @Taylor Newton We will not be ensuring fiber broadband to all. This would mean overbuilding where there is cable internet, which is deemed to be sufficient and currently not eligible for public funding. We WILL be working on providing high speed internet to all un and underserved locations. (Mostly through CCCUD - so like Colchester, which decided not to join - is on their own.)

Commented [RM310]: Look at Strategy 4: Beef up or make connections on forest connectivity strategies (like Williston). And other strategies for protecting forest areas (Current Use, Carbon Sequestration programs, and others).

Commented [RM311R310]: From Bob H: Here's the carbon credit program: https://familyforestcarbon.org/

Commented [RM312]: Include language to identify off ramps for municipalities or specific geographic areas.

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Commented [RM314]: Congestion policy with MTP language and Vtrans work.

5. **Housing Proximity** – The proportion of Chittenden County employees who live outside the county has increased since 2002; this increases greenhouse gas emissions as workers travel greater distances to work. While some may be living outside of the County by choice, others have no choice because they can't afford a home in the County. Reversing this trend to achieve 75% of Chittenden County workers living in the region will require two things: enough housing to accommodate more Chittenden County workers, and housing stock that is affordable and accessible to a wide variety of residents.

4. CLIMATE/ENERGY: TRANSFORM THE REGION'S ENERGY SYSTEM TO MEET VERMONT'S ENERGY AND GREENHOUSE GAS REDUCTION GOALS WHILE AVOIDING UNFAIR IMPACTS ON MARGINALIZED GROUPS AND MAINTAINING ECOLOGICAL HEALTH, ECONOMIC VITALITY, AND EQUITABLE ACCESS TO AFFORDABLE ENERGY.

1. Energy and Climate Goals~~.~~

a. Reduce energy consumption, increase renewable energy generation and decrease greenhouse gas emissions~~,~~ to support the State's energy goals in the 2022 Vermont Comprehensive Energy Plan and the Global Warming Solutions Act as incorporated by reference here~~:~~.

~~a. Meet the Global Warming Solutions Act greenhouse~~Greenhouse gas ~~emissions (GHG)~~ reduction requirements~~:~~

~~o —~~ (26% ~~reduction~~ from 2005 levels ~~by 2025~~

~~o —~~, 40~~% reduction~~ from 1990 levels by 2030

~~o~~b. , 80% ~~reduction~~ from 1990 levels by 2050

~~b.~~c. Weatherize 120,000 Vermont homes by 2030 (relative to the 2008 baseline)

~~c.~~ Meet ~~90% of Vermont's energy from renewable sources by 2050~~

~~o~~d. ~~Intermediate goals of~~ 25% of energy needs from renewable sources by 2025~~ and~~, 45% by 2035~~.—~~, and 90% by 2050.

~~o~~e. In the transportation sector, 10% of energy needs ~~will be~~from carbon-free resources by 2032, with at least 75% from renewable energy~~ by 2025, and 45% by 2040.~~. Zero-emission vehicles account for 100% of light-duty ~~vehicle~~ sales in Vermont by 2035.

~~o~~f. In the thermal sector, 30% of energy needs will be from renewable energy by 2025, and 70% by 2042. ~~Weatherizing 120,000 households by 2030. Achieve net-zero ready construction for newly constructed buildings by 2030.~~

~~o~~g. In the electric sector, be 100% decarbonized and at least 75% renewable by 2032.

h. Achieve net-zero ready construction for newly constructed buildings by 2030.

2. Municipal Assistance

~~i.~~a. Provide assistance to municipalities when requested to enhance town plans to be consistent with Act 174 standards for the purpose of enabling municipalities the ability to gain substantial deference in the Certificate of Public Good Section 248 process. This assistance will include working with municipalities to identify natural, cultural, historic, or scenic resources to be protected from all development types, identify preferred locations for renewable energy generation facilities.

~~ii.~~b. Provide assistance to municipalities to implement their energy plans and encourage municipalities to lead by example with respect to energy efficiency for buildings and transportation and the deployment of renewable energy.

Commented [AS329]: I wonder if this could read: "Transform the region's energy system to meet Vermont's energy and greenhouse gas reduction goals, while balancing and managing ecological health, access, economic vitality, and unfair burden on communities."

Commented [DS330R329]: I rephrased with your suggestions Anne Nelson - wasn't sure if "balancing and managing unfair burden on communities" was clear enough. But feel free to keep wordsmithing!

Wondering if we could name "marginalized groups" instead of "communities," which might be read as simply "municipalities."

Commented [DS331]: Keith Epstein: consolidate this with item xi

~~iii.~~c. Review municipal plans, ordinances, bylaws, and policies to identify best practices for meeting energy goals, including enabling more compact walkable neighborhoods in areas planned for growth, and share these with other municipalities and partners.

~~c.~~3. Transportation

~~i.~~a. Reduce fossil fuel consumption in the transportation sector through transit-oriented development, particularly in bus and rail served locations, transportation demand management (TDM) and electric vehicle promotion strategies outlined in Part 6 of this section and in the Metropolitan Transportation Plan (MTP) included in this plan.

~~ii.~~b. **Renewable Transportation Fuels.** Work with municipalities and relevant stakeholders to plan for local renewable transportation refueling networks and infrastructure, such as Level 2 and Level 3 electric vehicle recharging and hydrogen refueling. Ensure that these support both commuting and regional destinations (e.g., downtowns, villages, resorts, tourist sites, transportation hubs, major employers and multi-unit housing) and that they are planned along major regional transportation ~~routes~~routes per the National Electric Vehicle Infrastructure (NEVI) Plan.

~~d.~~4. Thermal Sector Partnerships

~~i.~~a. Continue partnerships with VGS, Burlington Electric Department, Efficiency Vermont and the Champlain Valley Office of Economic Opportunity Weatherization Assistance Program to promote weatherization and energy efficiency programs and incentives for homes and businesses.

~~ii.~~b. Decrease fossil fuel consumption in the thermal sector by working with partners such as Green Mountain Power, VGS, Efficiency Vermont, Burlington Electric Department, and other energy service providers to educate developers, businesses, and homeowners about cold climate heat pumps, heat pump hot water heaters, wood heating, biofuels, and geothermal systems.

~~iii.~~c. Advocate for the State, utilities, and workforce/business development organizations to address weatherization workforce challenges identified in the 2021 Weatherization Workforce Report. Promote the expansion of current workforce training programs that are effective, such as ReSOURCE's weatherization and HVAC 101 training programs.

~~iv.~~d. Encourage the State of Vermont to implement a single building energy code standard at least as high as the current stretch code for all new development and retrofits that accelerates net zero building practices and electric vehicle charging infrastructure. The code should be enforced at the state level ~~and should~~. The state must ensure that energy efficient construction is accessible to and does not unfairly burden communities of color and ~~those with lower incomes, installations. This will ensure progress is made on the State energy goals and Global Warning Solutions Act.~~ lower income households.

e. Support VGS's and other organizations in bringing networked geothermal to the region.

~~e.~~5. Renewable and Resilient Electricity

~~i.~~a. Support a wide variety of renewable energy generation types, including storage, sustainable uses of biomass for heating, passive solar building design, bio-digesters for electricity generation, photovoltaic solar, wind turbines, and optimizing the energy potential for existing hydro-electric dams.

~~ii.~~b. Coordinate with transmission and distribution utilities to resolve electric grid constraints to enable the region to achieve Chittenden County's renewable energy generation target needed for the electrification of the heating and transportation sector.

Commented [AJ332]: @Melanie Needle Would it make sense to reference our Climate Change and Land Use document in this section?

Commented [DS333]: Jeff Forward specifically asked to include a policy about transitioning off-road equipment to electric, is this an appropriate place to include or is that too detailed for the ECOS Plan?

Encourage fuel switching for off-road equipment such as lawnmowers to clean and non-fossil fuels.

Commented [AJ334]: @Melanie Needle I don't want to complicate things, but VTrans and ACCD are really focusing on installing EVSE along the federally designated NEVI corridors - they don't really need our help with that. Ideally we would say something like "work with municipalities, VTrans, utilities, and ACCD to plan for community level charging in workplaces, near public attractions, and homes including multi-unit housing." Feel free to tell me to shut up if it is too late to make changes. :)

Commented [DS335]: Moved and modified from CEDS

Commented [DS336]: Based on a comment from Keith Epstein, Energy Subcommittee that we encourage all towns to adopt stretch code.

Commented [DS337R336]: Jeff Forward noted that it is difficult to get municipalities to adopt and enforce stretch codes. Also, PSD should be consulted on this policy since their approach has relied on having 2 levels of code to test new technologies / techniques.

Commented [DS338R336]: Taylor determined this is a non-issue

Commented [AS339]: It reads a little bit too much like it was an afterthought. Maybe we could say, "...in a manner that ensures the considerations of low income and communities of color are taking into account, while progress is made on the State energy goals and Global Warming Solutions Act requirements."

Commented [DS340R339]: I rephrased to bring the equity considerations forward and make them a little more specific. But I'm not really sure what this would look like, and how CCRPC will truly make an impact on this outside of improving existing weatherization assistance and affordable housing programs.

~~iii.~~c. Support in-place upgrades of existing facilities, including existing renewable energy generation, storage, transmission lines, distribution lines, substations, and energy storage as needed to reliably serve municipalities and the region with a resilient and low-carbon electric grid that supports a growing renewable electricity economy and low electricity costs. The existing law (30 V.S.A. 218c and PUC Docket 7081) does not sufficiently enable VELCO with the authority needed to effectively plan for grid modernization that meets the state's energy and climate goals. To plan for the transmission constraints that our State and our region are facing, the state should enable VELCO to design and fund a transmission system to address grid constraints in an equitable and proactive manner.

d.

6. Statewide Renewable Energy Generation Regulation~~.~~

~~f.~~ Support changes in federal, state, and local policies to achieve the state of Vermont Comprehensive Energy Plan, Climate Action Plan goals, and to ensure burdens are shifted away from impacted communities~~.~~

~~i.~~a. Support changes to the Renewable Energy Standard to prioritize in-state generation over electricity imports to avoid externalizing both environmental and societal costs and benefits.

~~ii. Factor in societal costs~~ Increase the maximum size of net-metered projects and ~~benefits in calculating the cost of the net-metering program to utilities, which may help broaden participation in the net-metering program among lower-income households.~~

~~iii.~~b. ~~Establish~~establish a tiered system for net-metering rates in which utilities pay a lower ~~premium~~ rate to facilities over a certain size (such as 500kW) ~~to encourage larger projects to use this program~~ to increase net-metering participation and reduce the energy burden for public and non-profit entities.

~~iv.~~c. Increase the maximum size of net-metered projects (currently 500kW) for public, and non-profit, and community ownership entities to encourage them to maximize development of renewable energy sources.

~~v.~~d. Advocate for the Public Utility Commission to open the rule making process on Rule 5.700, Sound Levels ~~From~~from Wind Generation Facilities, to reassess existing sound standards with the intent of allowing all sizes and scales of wind energy generation possible in Chittenden County.

7. **Renewable Energy Generation Siting and Suitability Policies~~.~~**

~~g.~~a. CCRPC supports the generation of new renewable energy in the County to meet Vermont's ~~-~~Global Warming Solutions Act requirements and~~-~~ Comprehensive Energy Plan's goal of using 90% renewable energy by 2050, in a manner that is cost effective, respects the natural environment, and does not unfairly burden low-income communities with the impacts of development. Specifically, Chittenden County needs to generate a total of 954,833 MWh (Megawatt hours) of energy annually (a ~~63%%-~~57%increase). As 2022,Chittenden County generates ~~598,409~~606,554 MWh of renewable energy. The targets are technology neutral, meaning that they can be met with any mix of technologies. ~~The following statements are CCRPC's renewable energy generation facility siting policies and will inform CCRPC's preferred sites policy.~~

Commented [MN341]: @Taylor Newton I added this policy per your suggestion from the marked up hard copy of energy edits. Thoughts?

Commented [342R341]: It mostly borrows from our letter, correct? If yes, then I think it's sufficient for now for the Energy Sub-committee to review.

Commented [DS343]: Keith Epstein: this is very broad, but other actions could be organized under this.

Commented [DS344]: D. Parkins asked to add language that expanding access to small renewables is an energy equity issue.

Commented [DS345R344]: Specific sub-actions added based on Energy Subcommittee meeting 5/25/23, but not sure all of these should stay.

Commented [DS346]: Keith Epstein: this is very broad, but other actions could be organized under this.

Commented [DS347R346]: Specific sub-actions added based on Energy Subcommittee meeting 5/25/23, but not sure all of these should stay.

Commented [DS348]: Consolidated with xii above

Commented [MN349]: will be updated once PSD guidance and LEAP data is available. July/August timeframe

~~Constraint Policies:~~The following statements are CCRPC's renewable energy generation facility siting policies that will inform CCRPC's preferred sites for net-metering policy. Ground mounted renewable energy generation is constrained in certain areas due to state and local restrictions on development.

~~iv.~~b. Site renewable energy generation to avoid state and local known constraints and to minimize impacts to state and local possible constraints, as defined in Strategy 3, Action 1.f, and Strategy 4, Action 1.f, and Action 2.e. Renewable energy generation sited on existing structures or parking lots complies with this policy.

~~i.~~ Site ground-mounted solar development in accordance with setback standards as defined in 30 V.S.A. §248(s) and municipal screening requirements adopted in accordance with 30 V.S.A. §248(b)(B).

c. ~~Suitability Policies:~~ After considering the constraints referenced above and found in Supplement 3, different levels of suitability exist for different scales and types of renewable energy generation depending on location within the County.

d. To determine an appropriate location for a facility, first review the constraints above and then look at the polices below to determine how and where CCRPC encourages renewable energy generation facilities. CCRPC recommends the location of renewable energy generation facilities in accordance with the relevant guidelines below. Inability to meet these guidelines does not necessarily preclude the ability to develop renewable energy generation development.

~~vi.~~e. Locate energy generation proximate to existing distribution and transmission infrastructure with adequate capacity and near areas with high electric load (See Green Mountain Power's Solar Map and Burlington Electric Department's Distributed Generation Map)

~~vii.~~f. Locate renewable energy generation in areas designated by a municipality in an adopted plan for such use, including specific preferred sites for ~~solar (state~~net-metering, in accordance with PUC rule 5.1, rule pertaining to construction and operating of net-metering systems. State preferred sites are mapped on Map 5~~).~~.

~~viii.~~g. Locate solar generation (including but not limited to net metering) on previously impacted areas (such as, parking lots, previously developed sites, brownfields, State regulated landfills with post-closure certification, gravel pits/quarries, or on or near existing structures).

~~ix.~~h. Locate ground-mounted solar larger than 15 kW AC (except for parking lot canopy solar installations) and wind turbines with a hub height larger than 30 meters (98 ft.) outside of state designated village centers, growth centers, downtowns, new town centers, neighborhood development areas, and historic districts on the State or National Register.

~~x.~~i. To mitigate load growth, integrate renewable energy generation facilities in a manner that allows infill to be the priority within areas planned for growth but outside designated areas mentioned above.

~~xi.~~j. Locate wind generation in areas with high wind potential, such as the prime and base wind potential areas shown on Map 7.

Commented [DS350]: Daniel Parkins asks if the areas outside of constraints can be more clearly identified on the maps (right now it's negative space).

Commented [MN351]: wind rules?

Commented [AS352]: Maybe somewhere, we could add language about being mindful about where we site energy generation projects. Land is the most affordable near low-income communities, which means they bear more of the impact.

Commented [DS353R352]: This is absolutely important!

Since this is in our suitability policies, it will affect how we review Section 248 energy development projects. How would we evaluate the equity impacts of a project given our limited access to race and income data?

Commented [DS354R352]: I did add a sentence to #2 above that tries to address this.

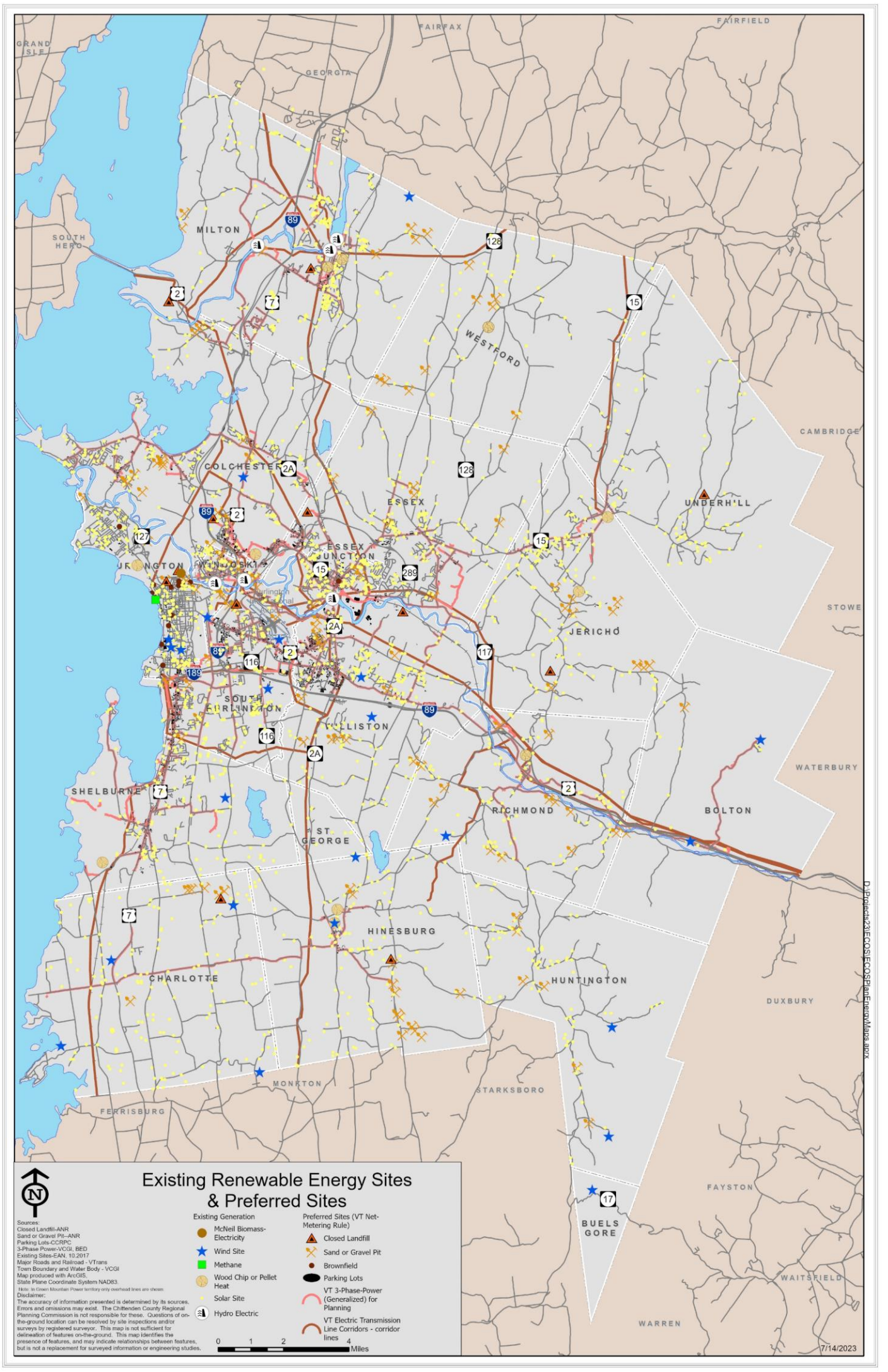
Commented [DS355]: Jeff Forward asked whether this can be modified to apply only to buildings listed on the state or national register, rather than historic districts to allow more flexibility for renewables.

I suspect this would be an uphill battle against national historic preservation standards / state policies.

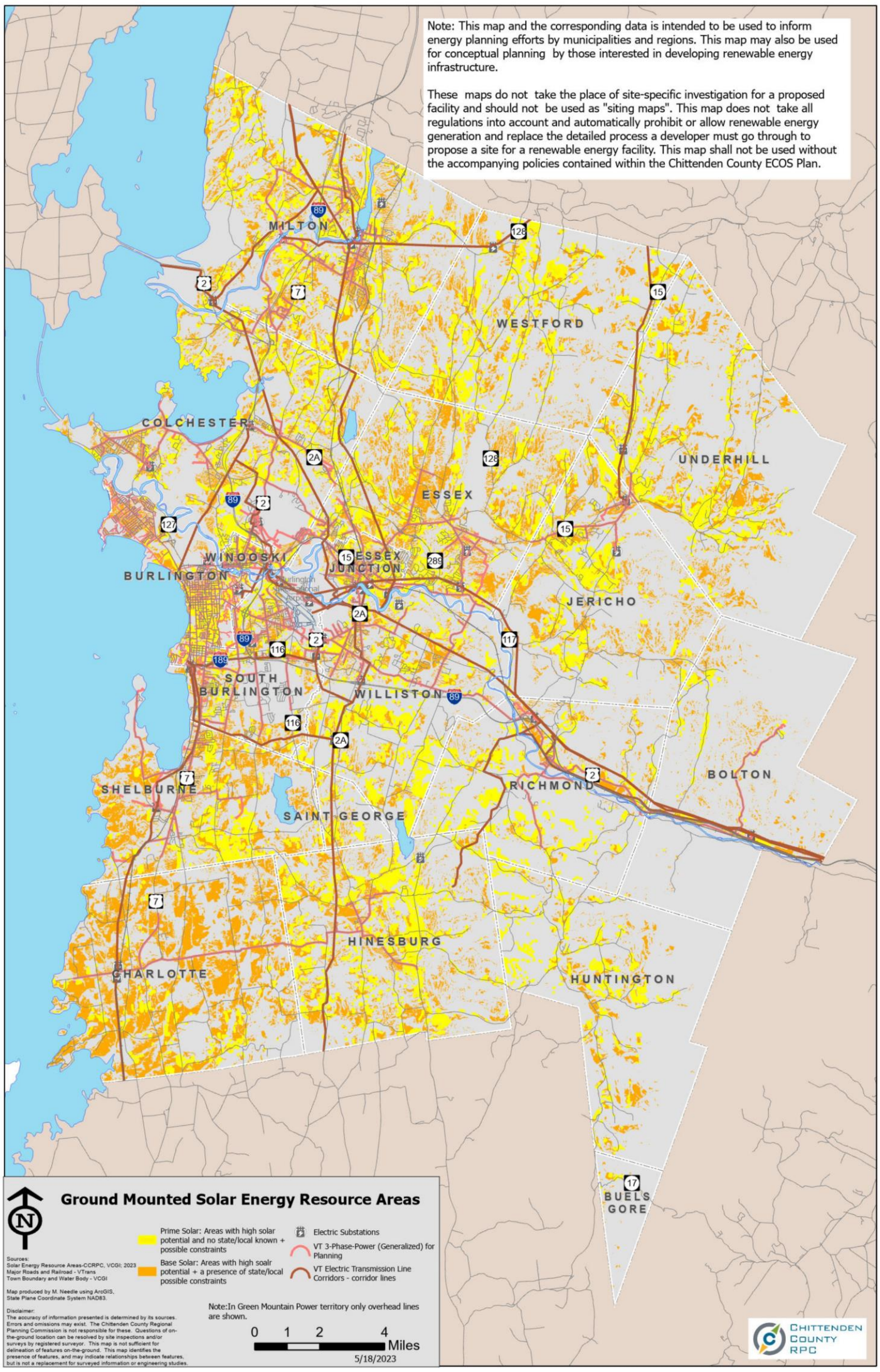
Commented [DS356]: Jeff Forward suggests re-evaluating restrictions re: solar on historic districts and buildings, especially if it would not detract from the historically important elements.

Commented [MN357]: clarify that these generation faciliteis are to be integrated to keep load and generation. clarify that areas planned for growth is minus designated areas

Commented [MN358R357]: This modification also addresses the removal of Burlington's Mixed Use Institutional Core Campus and Enterprise Zoning from list of possible constraints. The PAC had a conversation about these districts not fitting as a possible constraint because possible constraints need to be equally restrictive across all types of development.

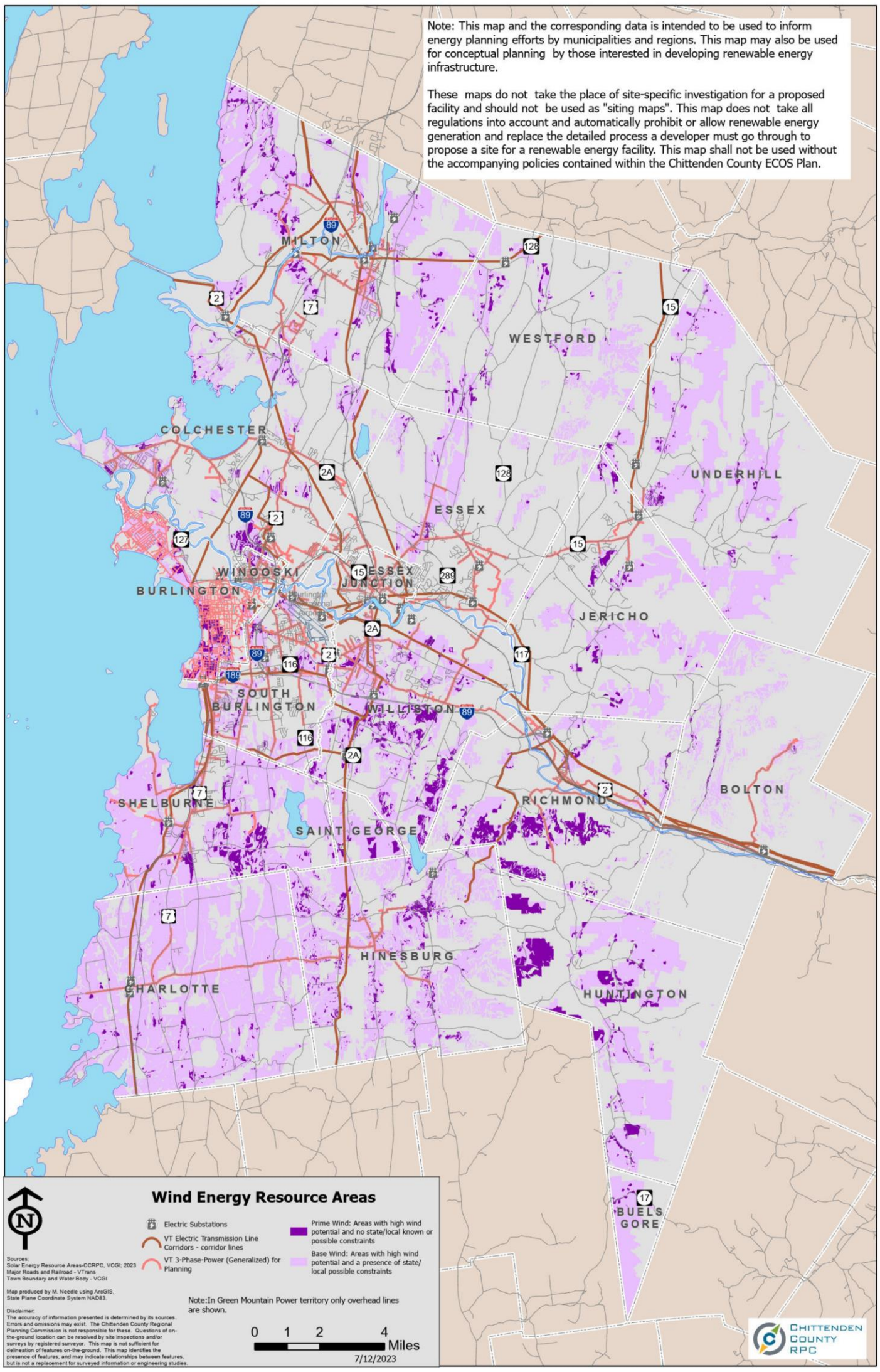

GRAND ISLE
SOUTH HERO
FAIRFAX
FAIRFIELD
GEORGIA
MILTON
COLCHESTER
ESSEX
ESSEX JUNCTION
WINOOSKI
JERICHO
UNDERHILL
CAMBRIDGE
STOWE
WESTFORD
SOUTH BURLINGTON
WILLISTON
SHELBURNE
ST GEORGE
RICHMOND
BOLTON
WATERBURY
HINESBURG
CHARLOTTE
HUNTINGTON
DUXBURY
MONKTON
FERRISBURG
STARKSBORO
FAYSTON
BUELS GORE
WAITSFIELD
WARREN
Existing Renewable Energy Sites & Preferred Sites
Existing Generation
McNeil Biomass-Electricity
Wind Site
Methane
Wood Chip or Pellet Heat
Solar Site
Hydro Electric
Preferred Sites (VT Net-Metering Rule)
Closed Landfill
Sand or Gravel Pit
Brownfield
Parking Lots
VT 3-Phase-Power (Generalized) for Planning
VT Electric Transmission Line Corridors - corridor lines
0 1 2 4 Miles
Sources:
Closed Landfill-ANR
Sand or Gravel Pit--ANR
Parking Lots-CCRPC
3-Phase Power-VCGI, BED
Existing Sites-EAN, 10.2017
Major Roads and Railroad - VTrans
Town Boundary and Water Body - VCGI
Map produced with ArcGIS.
State Plane Coordinate System NAD83.
Note: In Green Mountain Power territory only overhead lines are shown.
Disclaimer:
The accuracy of information presented is determined by its sources. Errors and omissions may exist. The Chittenden County Regional Planning Commission is not responsible for these. Questions of on-the-ground location can be resolved by site inspections and/or surveys by registered surveyor. This map is not sufficient for delineation of features on-the-ground. This map identifies the presence of features, and may indicate relationships between features, but is not a replacement for surveyed information or engineering studies.
7/14/2023
D:\Projects\23\ECOS\ECOSPlan\EnergyMaps.aprx

MAP 6 – SOLAR GENERATION POTENTIAL



b

MAP 7 – WIND GENERATION POTENTIAL


Note: This map and the corresponding data is intended to be used to inform energy planning efforts by municipalities and regions. This map may also be used for conceptual planning by those interested in developing renewable energy infrastructure.
These maps do not take the place of site-specific investigation for a proposed facility and should not be used as "siting maps". This map does not take all regulations into account and automatically prohibit or allow renewable energy generation and replace the detailed process a developer must go through to propose a site for a renewable energy facility. This map shall not be used without the accompanying policies contained within the Chittenden County ECOS Plan.
MILTON
WESTFORD
COLCHESTER
ESSEX
UNDERHILL
WINOOSKI
BURLINGTON
ESSEX JUNCTION
JERICHO
SOUTH BURLINGTON
WILLISTON
BOLTON
SHELBURNE
RICHMOND
SAINT GEORGE
HINESBURG
CHARLOTTE
HUNTINGTON
BUELS GORE
Wind Energy Resource Areas
Electric Substations
VT Electric Transmission Line Corridors - corridor lines
VT 3-Phase-Power (Generalized) for Planning
Prime Wind: Areas with high wind potential and no state/local known or possible constraints
Base Wind: Areas with high wind potential and a presence of state/ local possible constraints
Sources:
Solar Energy Resource Areas-CCRPC, VCGI; 2023
Major Roads and Railroad - VTrans
Town Boundary and Water Body - VCGI
Map produced by M. Needle using ArcGIS,
State Plane Coordinate System NAD83.
Disclaimer:
The accuracy of information presented is determined by its sources. Errors and omissions may exist. The Chittenden County Regional Planning Commission is not responsible for these. Questions of on-the-ground location can be resolved by site inspections and/or surveys by registered surveyor. This map is not sufficient for delineation of features on-the-ground. This map identifies the presence of features, and may indicate relationships between features, but is not a replacement for surveyed information or engineering studies.
Note:In Green Mountain Power territory only overhead lines are shown.
0 1 2 4
Miles
7/12/2023
CHITTENDEN COUNTY RPC

2024 Chittenden County ECOS Plan

Supplement 6 – Energy Analysis, Targets, & Methodology
Adopted 6/19/2024

For a healthy, inclusive, and prosperous community

This plan is the Regional Plan, Metropolitan Transportation Plan, and Comprehensive Economic Development Strategy in one.

This plan can be found online at: www.ecosproject.com/plan

~~Transportation Energy~~

TABLE OF CONTENTS

Energy Analysis, Targets, & Methodology

Introduction

Commented [DS1]: Revised to reflect the new organization of the document and to reduce redundancy.

Supplement 6 provides an overview of current energy use and a sense of the trajectories and pace of change needed to meet the State's energy and climate goals, as well as the data and analysis required for the 2024 Chittenden County ECOS Plan to meet the State of Vermont's energy planning standards.

The Department of Public Service anticipates meeting the 90X2050 goal by generating half of the State's electricity needs in-state and the remainder through imported (mostly renewable) energy. To meet the state's goals, Chittenden County is planning for a major shift away from fossil fuels in the transportation and heating sector towards renewable sources of energy, efficiency in all sectors, and an increase in-state renewable energy generators.

The analysis in this section estimates current energy use across all sectors (transportation, heating, and electricity) as well as current renewable energy generation. Targets are also provided to demonstrate milestones along the way toward meeting 90% of total energy needs with renewable energy and achieving the Global Warming Solutions Act requirements for reducing greenhouse gas emissions. The targets are intended to be a demonstration of one possible scenario to reach 90% renewable energy by 2050 and for decarbonizing energy demand. These data are not intended to prescribe a future.

Targets for future energy use are drawn from the Long-Range Energy Alternatives Planning (LEAP) analysis as part of the development of Vermont's Comprehensive Energy Plan (CEP) and Climate Action Plan (CAP), completed by the Stockholm Environmental Institute (SEI) and Northeast States for Coordinated Air Use Management (NESCAUM). The LEAP model is an accounting framework that shows one possible path for Chittenden County to meet the state energy and decarbonization goals.

The renewable energy generation targets are based on the LEAP analysis and account for existing generation currently sited or permitted within the region's boundaries. The generation targets are technology-neutral, which means the region has the flexibility to meet the targets through the development of various renewable energy technologies (e.g. biomass, solar, wind, etc.).

Please note that these data are a starting point for Chittenden County to consider its energy future. This information should provide the framework for a discussion about changes that will need to occur within Chittenden County to ensure that State energy and climate goals are met.

Part 1 of this supplement assesses the potential equity impact of the policies related to land use, transportation, energy efficiency, and renewable energy generation.

Part 2 of this supplement includes estimates of existing energy consumption for the transportation, heating, and electric sectors.

Part 3 of this supplement estimates the portion of future energy consumption and renewable energy generation the region anticipates being sited in Chittenden County to meet the state's 2050 greenhouse gas emission goals. Part 3 also explains the various methods used by CCRPC to set targets and report data. This includes the methods used by SEI and NESCAUM to complete the statewide LEAP model,

and the methods used by the Vermont Department of Public Service to break down the statewide LEAP data to each region.

Part 4 of this supplement evaluates whether forest blocks or habitat connectors should be treated as a possible constraint.

1. EQUITY ASSESSMENT

The Department of Public Service's energy planning standards requires that the potential equity impacts of the land use, energy efficiency, renewable energy generation, and transportation policies be assessed 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.

~~CCRPC staff are working on a variety of work products that are in development. These include strengthening the equity narrative in the entirety of the ECOS Plan, equity action plan, and updating the mission and vision of the organization.~~

~~CCRPC also conducted an Equity Impact Assessment and the Organizational Equity Assessment. These resources should be used for all projects to begin to assess impacts on communities.~~

~~Once the equity work for the ECOS Plan is completed this section will be finished.~~

To respond to the equity assessment requirement of the energy planning standards, this section outlines CCRPC's ongoing efforts to build our organization's capacity to address systemic racism and inequities in our communities. Furthermore, this section includes a discussion explaining the approach CCRPC utilized to acknowledge the ways in which equity can be strengthened in the ECOS Plan, especially how it relates to achieving renewable energy and climate goals.

In 2021, CCPRC hired The Creative Discourse Group to conduct an organizational equity assessment. In particular, the Creative Discourse Group made a recommendation to "Establish a process for conducting a mini-equity audit ahead of all key decisions and at the beginning of projects and initiatives." This recommendation is pertinent to the ECOS Plan update process as CCRPC Staff has applied a racial equity lens to reviewing ECOS Plan goal statements, key issues, strategies, and data using the self-assessment questions found in the Guiding Principles for Just Transition. Each energy related section was assessed to determine if the ECOS Plan language could be strengthened to better identify, understand, and address the impacts of energy and climate goals on impacted communities. If a deficiency existed, CCRPC staff wrote language to clearly define impacted communities and address existing or potential inequities/burdens. Examples include acknowledging that climate impacts of energy use are driven by the wealthy and privileged while impacts generally fall on the poor and those with less power; identifying programs and policies to ensure that low-income and BIPOC residents can affordably access weatherization assistance and clean and renewable sources of energy; and adding an equity assessment to CCRPC's siting policies for renewable energy generation development. Please see the ECOS Plan sections related to energy, transportation, and land use to further understand how equity is addressed.

The ECOS Plan also contains numerous sections where equity is the central theme, including the Responsibility to Chittenden County, Civic Engagement and Social Connectedness Key Issues, and

Commented [DS2]: Melanie's comment:

@Taylor Newton @Darren Schibler @Anne Nelson Stoner I ran out of time to flesh out the equity assessment discussion for the Energy Subcommittee so I sent the document with placeholder text. I had some time today after I sent the packet to flesh out the assessment discussion. The Energy Subcommittee will review this content at their 7/24 meeting. In the meantime, I would love your thoughts on this section. Does it sufficiently address the equity standard that says "Does your plan's energy element assess the potential equity impacts of the policies and objectives included to meet standards on land use, transportation, renewable energy, and energy efficiency?

Commented [AS3R2]: @Melanie Needle I think it looks great! Thanks for working on this.

Commented [DS4]: We should name the sections where equity is central - I added those I think this includes but feel free to add others.

Strategy 10 (Equity). These sections serve as the backbone to the plan to ensure that all the ECOS Plan goals, strategies, and actions are implemented with an equity first approach. Additionally, CCRPC is drafting an equity action plan to ensure that equity is embedded within all projects and to facilitate the assessment of impacts to marginalized communities.

Commented [AS5]: Change to marginalized

CCRPC recognizes that these small changes are only first steps intended to guide a more fundamental shift in how our organization operates over the course of the current ECOS Plan and beyond. To this end, in 2022 CCRPC established a full-time Equity and Engagement Manager position and an Equity Advisory Committee (EAC) to ensure equitable processes and outcomes in our activities. The committee includes primarily community members with diverse lived experiences, interests, and expertise, as well as CCRPC Board members and CCRPC staff (non-voting members). Embedding the EAC within the CCRPC structure will ensure that the voices and needs of marginalized people will be elevated in all programs and projects.

2. CURRENT ENERGY DEMAND

The data below are from various data sources and represent actual current consumption and generation, rather than estimates from the Long-Range Energy Alternatives (LEAP) model found in the section on projected energy use.

Transportation Energy

Table 1 provides an overview of the passenger vehicle fleet composition by fuel source in Chittenden County and serves as a proxy for current transportation energy use. In 2022, Chittenden County was home to about 126,284 fossil fuel burning light duty vehicles. As of 2022, Chittenden County had a total of 3,183 electric vehicles registered, inclusive of both electric and plug-in hybrid vehicles. Chittenden County has seen a dramatic increase of electric vehicle ownership as more electric vehicle charging equipment has been installed, electric utilities and the State of Vermont have offered purchase incentives, and more electric vehicles models have become available for sale.

TABLE 1. CURENT CHITTENDEN COUNTY TRANSPORTATION ENERGY USE

Current Chittenden County Transportation Energy Use		
	Total	Percent
Total pleasure cars or trucks	126,284	100.00%
Total Fossil Fuel Burning	123,101	97.47%
Electric Light Duty Vehicles	3,183	2.52%
All-Electric Vehicles	*1,755*	*1.39%*
Plug in Hybrid	*1,428*	*1.13%*
Sources: Efficiency Vermont RPC Report, June 2023; VT DMV (November 2022)		

Thermal Energy

Table 2 and Table 3 below describe how homes are heated in Chittenden County. Chittenden County is served by Vermont Gas and natural gas is available in most of the ECOS Plan's areas planned for growth. As such, over half of the homes are heated with natural gas. Areas outside the Vermont Gas service area rely on delivered fuels for space heating such as fuel oil, kerosene, or propane. About 24% of homes heat their homes with one of these fuel sources.

TABLE 2. CURRENT THERMAL ENERGY USE FROM NATURAL GAS

Current Thermal Energy Use from Natural Gas, 2022		
	Total	Percent
Homes Heating with Natural Gas*	39,898 (+/- 1,970)	56% (+/- 3%)
Residential Natural Gas Consumption (MMBtu)**	3,384,366	31%
Commercial/Industrial Natural Gas Consumption (MMBtu)**	7,386,332	69%
Total Chittenden County Natural Gas Consumption (MMBtu)**	10,770,698	100%

*Sources: *American Community Survey 1-year Estimate, 2021 Table B25040, **Vermont Gas*

TABLE 3. CURRENT THERMAL ENERGY USE

Current Thermal Energy Use from Delivered Fuels and Wood, 2021				
	Total	Margin of Error	Percent	% Margin of Error
Homes heating with Fuel oil, Kerosene, etc.	9,927	+/- 1,586	14%	+/- 2%
Homes heating with Propane	7,153	+/- 1,243	10%	+/- 2%
Total Homes Heating with Delivered Fuels	17,080	+/- 2,015	24%	+/- 3%
Total Homes Heating with Wood	2,698	+/-961	4%	

Sources: American Community Survey 2021 1-Year Estimate, Table B25040

Weatherization and Energy Efficiency Projects

~~The State of Vermont's~~Reducing energy demand in both the thermal and electric sectors helps the region to meet the state's energy and climate goals ~~include~~. In particular, the state has a goal to to weatherize 120,00 homes by 2030. While there isn't a particular goal on reducing electricity demand, electric efficiency projects are one of best ways to reduce electric bills and manage load on the demand side. The best available data source for home weatherization ~~is~~and efficiency projects is through the State's efficiency utilities. In Chittenden County, there are two efficiency utilities. Efficiency Vermont is the efficiency utility that operates outside of the City of Burlington. Burlington Electric Department operates as its own efficiency utility for customers within Burlington. Efficiency Vermont only monitors home weatherization programs done through the Home Performance with ENERGY STAR® (HPwES) program. HPwES is a comprehensive whole-house approach to diagnosing and addressing thermal and health/safety issues in the home to ensure a more energy efficient, comfortable, safe, and healthy home. A project is a collection of one or more energy efficient measures that have been implemented at a customer's physical location. Measures may include both electric and thermal efficiency improvements. A customer can be associated with one or more projects and in some cases, a project may be associated with multiple customers. Efficiency Vermont's data does not capture do-it-yourself projects or projects that do not go through the HPwES program. Table 45 below indicates the number of energy efficiency projects completed. It is not intended to represent the number of homes weatherized.

TABLE 45. RECENT RESIDENTIAL ENERGY EFFICIENCY PROJECTS ~~(NEEDS TO BE UPDATED ONCE WE GET BED DATA TO BE INCLUDED WITH RPC ENERGY REPORT~~

Recent Residential Energy Efficiency Projects	2020	2021	2022
Total Residential Projects (includes projects below)*	3,322	3,524	3,314
Home Performance with ENERGY STAR® ~~Leads~~Projects	90	102	60
~~Home Performance with ENERGY STAR®~~Other Weatherization Projects	198	57	67
~~Total~~ Residential New Construction Projects ~~(includes Home Performance with ENERGY STAR® projects)~~**	36	78	84

Source: Efficiency Vermont RPC Report, June 2023; ~~*BED*~~Burlington Electric Department
*Burlington Electric Departments projects are not included because of differences in reporting.
**Comprehensive energy efficiency services to customers building new or gut-rehabbing single-family homes. This program maximizes energy efficiency, durability, and comfort through direct technical assistance, third party certification, incentives, and code compliance support. The RNC program is cosponsored with Vermont Gas Systems and Burlington Electric Department for homes in their service territories.

Electricity

An estimate of current electricity consumption by residential and commercial/industrial sector in Chittenden County is shown in Table ~~5~~6.

TABLE ~~5~~6. ELECTRICITY CONSUMPTION ~~(NEEDS TO BE UPDATED ONCE WE GET BED DATA TO BE INCLUDED WITH RPC ENERGY REPORT~~

	2022
Residential Electric Energy Use (MWh)	~~425,335~~1,327,756
Commercial and Industrial Electric Energy Use (MWh)	~~1,483,006~~469,417
Total Electric Energy Use (MWh)	1,~~908,341~~797,173

Source: Efficiency Vermont June 2023**, Burlington Electric Department**

Current Renewable Energy Generation

As shown in Table 7, Chittenden County's current renewable generation capacity is approximately 105 MW. This capacity results in approximately 606,554 MWh of electricity generation per year. Renewable electricity generation is sourced from solar, wind, hydroelectric, and biomass facilities located inside Chittenden County, including McNeil Generating Station, half of the capacity of Georgia Mountain Community Wind, several hydroelectric dams on the Winooski River, and numerous distributed solar array and small-scale wind projects.

TABLE 7. EXISTING RENEWABLE ELECTRICITY GENERATION

Existing Renewable Electricity Generation			
	Sites	Power (MW)	Energy (MWh)
Solar	5,598	105.5	138,572
Wind	36	5.7	11,312
Hydroelectric	6	54.7	146,575
Biomass (Wood)	8	50.6	310,095
Total*	5,647	104.6	606,554

Source: Vermont Department of Public Service Distributed Generation + Survey, January 2023 (with corrections by CCRPC).
**The total existing renewable energy generation varies from the existing renewable energy generation reported in the renewable energy targets sections due to variations in the way the data is counted. These sites represent facilities that have been permitted.*

3. ENERGY TARGETS

As part of the development of Vermont's Comprehensive Energy Plan (CEP) and Climate Action Plan (CAP), Stockholm Environment Institute (SEI) and Northeast States for Coordinated Air Use Management (NESCAUM) developed a scenario model of Vermont's energy consumption and emissions and used the model to construct pathways to meet statutory greenhouse gas (GHG) reduction obligations under the state's Global Warming Solutions Act (GWSA). The model was built using SEI's Low Emissions Analysis Platform (LEAP), a software tool for energy system modeling and emissions accounting. The model contains a representation of residential, commercial, industrial and transport energy use at a state level.

In order to support enhanced energy planning at the regional and municipal levels, the Department has undertaken an effort to "regionalize" final energy demand outputs from the statewide LEAP modeling for four core sectors: residential, commercial, industrial, and transportation. This section includes a simple disaggregation of those results for the residential, transportation, and commercial sectors based on key drivers of energy demand. The targets are derived from the **Central GWSA Mitigation ("CAP Mitigation")** scenario developed to meet the state's GHG reduction requirements. These targets show the direction and magnitude of change needed meet local, regional, and state energy goals and are not intended to be used in a regulatory context.

Full details of the LEAP Model methods, data sources and assumptions may be found as **Appendix D to the 2022 Comprehensive Energy Plan**. The **Vermont Pathways Report** prepared for the Agency of Natural Resources also provides information on the analysis done using the model, including some of the revisions made after the CEP was published.

Commented [DS6]: Can we consolidate this with wherever we talk about calculating our electricity generation targets?

Commented [MN7R6]: I don't understand the question.

Commented [DS8R6]: After we discussed this we decided to slightly reorganize but mostly keep the same order.

Commented [AJ9]: @Melanie Needle The Standards Form Question 9A asks if the plan evaluates existing renewable energy generation and breaks it out by municipality. I don't see the breakouts. What should I put as the location of this information? In 2017, you put in the note: Municipal breakdown was provided to municipalities on 4/30/17, but not reported in the plan itself. Please advise.

Commented [MN10R9]: @Ann Janda The municipal break out is in table 27. Thank!

Commented [DS11]: How this was calculated: PSD tool includes a total of 10.7 MW existing wind generation across the county. 10MW of this is Georgia Community Wind in Milton, but half of that should be allocated to NRPC, so total is 0.7+(10/2) = 5.7

Commented [MN12R11]: @Darren Schibler how does the following data compare to what is in the PSD tool for existing generation?

energy-atlas-site-export_20170919.xlsx

Commented [DS13R11]: There's a lot of inconsistency between the two - seems like PSD generally captures more than EA, but there are some in the EA but not in PSD. Unfortunately there's no way to easily merge or cross-check them because the PSD data has such limited detail.

I do like that the EA breaks down solar projects by roof vs. ground vs. tracker, and wind by commercial vs. small-scale.

It looks like EA is at least more reliable for hydro, but those are easy to check.

Commented [DS14]: How this was calculated: PSD tool includes a total of 21,167 MWh of existing wind generation

Commented [MN15R14]: @Darren Schibler We used the energy dashboard to create this chart.The data may not all

Commented [DS16R14]: Understood. Like my comment above, I figured it made sense to update existing gen with t

Commented [DS17]: The PSD Tool data says there are only 4 sites. This doesn't include GMP Gorge 18 in Colche

Commented [MN18R17]: @Darren Schibler I think 6 sites is the correct number from looking at the community energ

Commented [DS19R17]: Yep, just confirming that this is a departure from the PSD data that we are 100% sure about.

Commented [DS20]: PSD tool includes total of 50.6 MW existing, but doesn't include GMP Gorge #19, which produ

Commented [MN21R20]: @Darren Schibler see above

Commented [DS22]: PSD tool includes total of 128,575 of existing hydro, but doesn't include GMP Gorge #19 dam in

Commented [MN23R22]: @Darren Schibler See above

Commented [DS24]: How this was calculated: PSD tool totals 105.46 MW capacity across the county, all technolog

Commented [MN25R24]: @Darren Schibler Chittenden County Community Statistics 2017-07-18.xlsx

Transportation Energy Targets

The transportation energy targets for Chittenden County represent an ambitious electrification of the transportation sector to increase the amount of renewable energy used to power passenger vehicles and light, medium, and heavy-duty trucks. As indicated in Table 1, 3,183 electric light duty vehicles are registered as of 2022. To meet the ~~energy goals,~~2025 target, electric vehicle registrations need to double (see Table 9). To meet the 2050 targets, electric vehicle registrations need to increase dramatically and transportation energy from all fuel sources used in all vehicle types will need to decrease 54% from 2025 levels by 2050. This will primarily be achieved by converting to more efficient electric vehicles from fossil fuel vehicles. Therefore, electricity in the transportation sector will increase by 95% from 2025 to 2050. The LEAP model shows that to achieve this reduction, a majority of passenger vehicles must be all-electric. Generally, in the LEAP model it is assumed that all-electric vehicle adoption will be more aggressive compared to adoption of plug-in hybrid vehicles. Electrifying the transportation sector will also lead to a dramatic increase in electricity use to power vehicles and a significant decrease in gasoline consumption (see ~~table 9)~~Table 10).

TABLE ~~8~~9. ELECTRIC VEHICLE TARGETS

EV and PHEV Stock Number of Vehicles						
	Vehicle Type	**2025**	**2030**	**2035**	**2040**	**2050**
Passenger Car	Battery Electric	3,091	13,347	31,883	50,610	75,088
	Plug In Hybrid	588	551	451	287	103
	Total	**3,679**	**13,898**	**32,334**	**50,896**	**75,191**
Light Duty Truck	Battery Electric	2,468	14,695	34,559	52,337	70,478
	Plug In Hybrid	259	358	342	227	85
	Total	**2,727**	**15,053**	**34,901**	**52,564**	**70,563**

TABLE ~~9~~10. TRANSPORTATION ENERGY DEMAND

Chittenden County Total Energy Demand from Transportation Sector (Thousand MMBTUs)					
Fuel	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	178	771	1,714	2,555	3,323
Gasoline	6,639	5,018	3,154	1,677	448
Diesel	1,188	844	511	278	78
Ethanol	568	479	333	194	52
CNG/Natural Gas	21	17	11	6	2
Biodiesel	84	84	66	45	18
LPG	2,375	1,998	1,622	1,350	1,133
Total	11,053	9,210	7,410	6,105	5,054
Note: Energy demand for electric vehicle charging is captured solely under this table; it is not included in the residential or commercial electric targets.					

Thermal Energy Targets, Commercial/Industrial Sector

The LEAP Climate Action Plan mitigation scenario estimates that for Chittenden County total energy demand in the thermal commercial/industrial sector will see a 19% reduction from 2025 levels to meet future energy, carbon reduction and renewable energy source goals. This will primarily be achieved through weatherization and the use of more efficient heating technologies, like cold climate heat pumps powered by renewable electrification, in commercial buildings. By 2050, the LEAP model estimates that 64,790 new heat pumps will be installed in commercial buildings. As a result of this transformation in how commercial buildings are heated, natural gas demand is estimated to decrease by 63% from 2025 to 2050. Additionally, demand for heating oil will be eliminated and propane will be ~~eliminated~~drastically reduced. Almost all the changes in energy demand and fuel switching are associated with the commercial sector. The LEAP model included considerably less detail in the industrial sector due to the lack of available information. However, it is anticipated that diesel gas demand will shift to demand for biodiesel, and from natural gas to biogas in the industrial sector.

Commented [MN26]: Waiting on weatherization targets from PSD

TABLE ~~10. PROJECTED~~11. TARGETS FOR COMMERCIAL/INDUSTRIAL THERMAL ENERGY USE

Total Regional Commercial/Industrial Sector Final Energy Demand (Thousand MMBTUs)					
Fuel	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	3,910	4,086	4,246	4,390	4,426
Gasoline	389	396	404	412	430
Kerosene	8	8	7	7	7
Wood	634	672	711	747	843
Ethanol	30	32	34	36	38
Solar	147	150	154	175	163
Heat	-	113	169	282	282
Propane	855	575	307	100	90
Residual Fuel Oil	47	48	49	50	52
Wood Pellets	33	65	93	120	142
Biodiesel	412	824	1,181	1,560	1,578
Heating Oil	756	393	162	-	-
Biogas	446	737	1,025	1,131	2,087
Natural Gas	5,615	4,027	2,550	1,262	573
Total	13,281	12,124	11,092	10,272	10,711

TABLE ~~11.~~12. TARGETS FOR COLD CLIMATE HEAT PUMPS IN THE COMMERCIAL SECTOR

CAP Mitigation Regional Commercial New Cold Climate Heat Pumps (CCHPs)					
	2025	**2030**	**2035**	**2040**	**2050**
New CCHPs	16,752	33,309	50,661	62,265	64,790

Thermal and Electric Energy Targets, Residential Sector

Thermal energy use in Chittenden County homes is projected to decrease by 64% from 2025 to 2050.Electricity demand will increase by 140% between 2025 and 2050. Natural gas, fuel oil, and propane will ~~virtually~~ be nearly eliminated. Residential buildings will use less energy for space heating due to an increase in the percentage of buildings that are weatherized and greater efficiency in heating technology. To achieve the projected energy savings, at least ~~75~~82% of homes in Chittenden County need to be weatherized by 2050. Additionally, ~~111~~101,654 new air-source or ~~geothermal~~ground source heat pumps will need to be installed. Heat pumps are powered by electricity and are a more efficient way to heat a building compared to delivered fuels.

TABLE ~~12. PROJECTED~~13. TARGETS: RESIDENTIAL THERMAL ENERGY USE

Regional Residential Thermal Energy Demand (Thousand MMBTUs)					
Fuel	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	631	899	1,165	1,424	1,515
Heat Pump	*326*	*552*	*771*	*989*	*1,084*
Heat Pump Water Heater	*55*	*118*	*182*	*246*	*249*
Electric Resistance	*69*	*50*	*34*	*20*	*16*
Wood	1,753	1,281	957	686	435
Propane	898	652	438	241	161
Wood Pellets	164	136	119	107	99
Biodiesel	122	536	681	587	422
Heating Oil	1,980	968	335	-	-
Biogas	157	224	235	88	154
Natural Gas	2,251	1,425	694	139	61

~~**Table 13.**~~*~~Note: Energy demand for electric vehicle charging is not included in this table; rather, it is captured in the transportation energy targets in Table 10.~~*

TABLE 14. TARGETS FOR HEAT PUMPS IN THE RESIDENTIAL SECTOR

Residential New Cold Climate Heat Pumps					
Technology	**2025**	**2030**	**2035**	**2040**	**2050**
Air Source Heat Pumps	24,549	45,187	66,008	87,025	97,270
Ground Source Heat Pumps	1,107	2,036	2,970	3,908	4,384
Total	**25,657**	**47,222**	**68,978**	**90,933**	**101,654**

TABLE 15. TARGETS FOR WEATHERIZATION IN THE RESIDENTIAL SECTOR

Residential Weatherization Targets					
	2025	**2030**	**2035**	**2040**	**2050**
Homes Weatherized	18,568	31,865	40,129	48,393	64,921
Forecasted Households*	69,216	71,607	74,068	76,510	79,151
Percent Weatherized	27%	44%	54%	63%	82%
*Households are used as a proxy for housing units.					

Commented [MN27]: We do not have weatherization targets at this time. Waiting for PSD to update their tool for estimating weatherization targets.

Commented [AJ28]: Target number doesn't match table below.

Commented [MN29R28]: Fixed.

Residential Final Energy Demand includes both thermal and electric appliance energy use which include space heating, space cooling, water heating, cooking, refrigeration, lighting, and electric appliances. Final energy demand depends on the total number of households and energy-consuming devices, as well as the annual fuel requirements per household or per device. The Vermont Pathways LEAP model simulates these end uses within the following types of buildings (different end uses / fuels are used to varying degrees based on the building type, tenure, urban/rural status. It is estimated that electricity demand will increase 54% between 2025 and 2050. Biodiesel and biogas also increase while natural gas use declines.

TABLE ~~14~~16. TOTAL ENERGY DEMAND IN THE RESIDENTIAL SECTOR

Fuel Source	2025	2030	2035	2040	2050
Electricity	1,720	2,004	2,286	2,562	2,666
Wood	1,753	1,281	957	686	435
Propane	1,245	904	594	300	222
Wood Pellets	164	136	119	107	99
Biodiesel	132	601	803	769	607
Heating Oil	2,150	1,084	396	-	-
Biogas	160	227	238	88	154
Natural Gas	2,287	1,448	704	139	61
Total	**9,612**	**7,686**	**6,098**	**4,652**	**4,244**

Wood Fuel Capacity Analysis

This section analyzes the level of wood fuel consumption that can be sustainably supported by the estimated supply of in-state biomass resources. This analysis is conducted on a statewide scale since there is no regional data available for wood fuel supply. However, Map 1 below shows potential areas of woody biomass in the region. According to these data, 138,658 acres of potential biomass exists in Chittenden County.

As shown in previous sections, wood (in the form of cordwood and pellets) is a significant heating fuel source for many homes and businesses, though LEAP modeling shows an overall decrease in wood heating over time. Since current wood fuel consumption levels have not been detrimental to air quality in the state or region, it is assumed that the reduced use of wood fuel expected in the LEAP modeling would only improve air quality.

Harvesting of low-grade wood for heating through cordwood or pellets is sustainable when it does not exceed the net growth rate of low-grade wood in forests. As shown in Table 17, the state's Net Available Low-Grade (NALG) wood has increased since 2010, despite the fact that growth in demand for low-grade wood increased while net average growth rates for forests decreased. Though impacts of climate change and other disturbances may be partial causes of this decreased forest growth rates, the dominant driver is the natural forest succession process as a generation of older trees are aging and growing slower, and have yet to be replaced by younger, faster-growing trees. See the 2018 Vermont Wood Fuel Supply Study for full explanations of these trends.

Commented [DS30]: Inserted this here to satisfy the biomass criterion of the standards, but it might need to be relocated / split up to fit the current vs. targets format.

Commented [MN31R30]: @Darren Schibler I think the whole section on wood could be better summarized to shorten it and moved to the target section. Are you able to do this?

TABLE 17. VERMONT WOOD FUEL SUPPLY ANALYSIS

Vermont Wood Fuel Supply Analysis		
	2010	2018
Average Forest Net Annual Growth Rate	2.10%	1.75%
Current Market Demand for Low-grade wood (Green Tons)	1,265,194	1,738,631
Total NALG Wood (Green Tons)	894,893	939,989
Source: Excerpts from 2018 Vermont Wood Fuel Supply Study, Table 2		

Table 17 assumes that current market demand for low-grade wood will continue at similar rates to the present. However, LEAP modeling in Section 3 of this Supplement anticipates a significant decrease in the use of cordwood and wood pellets for both residential and commercial heating. Given this, NALG will likely increase or remain steady even if forest growth rates and harvest of low-grade wood decrease as expected.

In a scenario where low-grade wood harvesting continues at current rates while forest growth decreases as expected, the demand for low-grade wood may begin to approach the amount available in forests soon after 2050. However, the forestry industry has begun implementing new practices for uneven-aged management that seek to restore the age / canopy diversity of forests, often by cutting 1-acre patches within 10-acre plots once every 10 years. This effectively regenerates the entire forest progressively over 100 years. This systems-wide approach to forest management also involves greater use of low-grade wood compared to practices from the prior century, which focused on sawlogs and pulpwood; therefore, NALG may increase compared to the present.

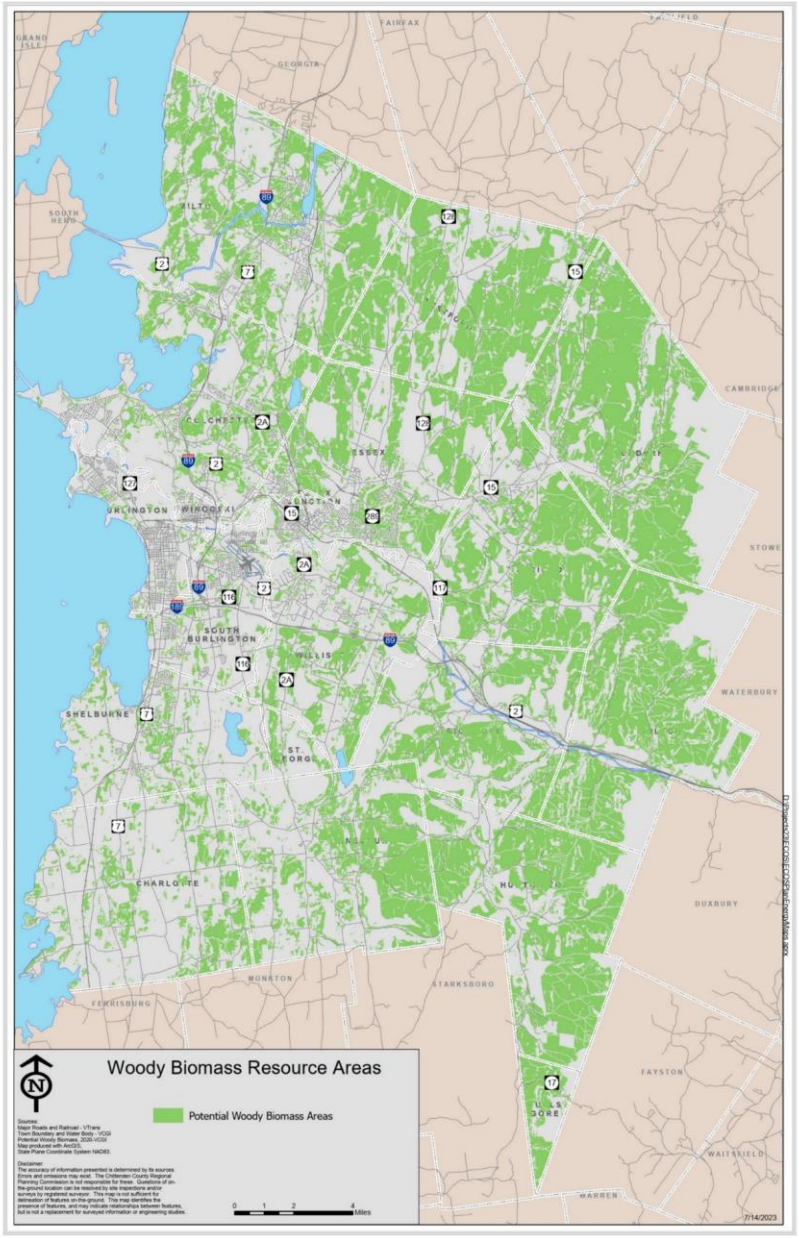
Maintaining a larger proportion of trees under 100 years old will also increase carbon sequestration rates, much of which will remain in the soil. This also supports the local forest economy and provides important revenue for retaining land as forest rather than converting it to agriculture or other uses. The alternative of letting forests naturally revert to mixed-age growth will still result in some carbon releases as dead wood decomposes; furthermore, it would also take far longer to reach conditions that resemble those prior to clearing in the 1800s.

In conclusion, comparing LEAP modeling with the state's wood fuel supply analysis indicates that there will be more than sufficient supply of wood fuel to meet the state's (and the county's) energy use goals. In fact, the state's forests could support harvest at current or increased levels through at least 2050, perhaps with positive outcomes on natural systems and carbon sequestration or storage in forests. Beyond 2050, more sophisticated modeling would be needed to determine the effect of various forest management practices on low-grade wood supply, but eventually a regime of uneven-aged management would restore a consistent level of NALG from forests.

Commented [DS32]: Re-number subsequent tables and associated text.

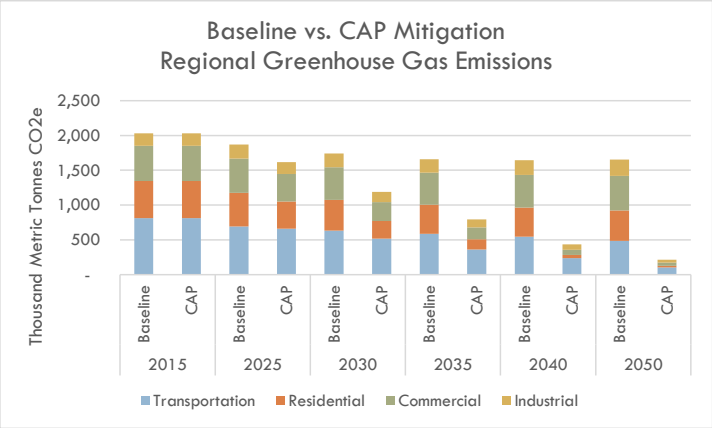
Commented [DS33]: Technically carbon impacts of wood harvesting are not required to meet this standard, so we can strike this to be more succinct, but I think it's relevant to the climate change parts of ECOS.

MAP 1-WOODY BIOMASS RESOURCE AREAS



Green Greenhouse Gas Emissions

Greenhouse gas emissions for each Sector (Transportation, Residential, Commercial, and Industrial) are shown below for each LEAP scenario. Please note, as currently provided by the PSD electric sector emissions are embedded within each of these sectors. This does not align with how the state's greenhouse gas inventory accounts for electricity-based emissions. The inventory currently separates electricity and considers those emissions separately. TO BE UPDATED AND REVISED WHEN REVISED DATA IS AVAILABLE



Renewable Energy Generation Targets and Potential

As seen in Table ~~14~~18, total in-state electricity consumption is estimated to be nearly 12 million MWh in 2050. The Department of Public Service anticipates that fifty percent of this electricity will be generated within Vermont and the other half will be imported from out of state generators. To advance the state goals, Chittenden County needs to produce a total of 954,833 MWh by 2050, which is 16% of the state's production. The target is based on the average of Chittenden County's share of the state's land area (5.8%) and its share of the state's population (26.2%). Once the total targets for renewable energy generation were estimated, the existing renewable energy generation was subtracted from the total. The remaining amount is the new generation that must be sited within the county to meet the targets.

TABLE ~~14~~18. RENEWABLE ELECTRICITY GENERATION TARGETS

Renewable Electricity Generation Targets	2032	2040	2050
State Projected Electricity Demand	8,111,649	10,731,860	11,943,816
In-State Generation Target	4,055,825	5,365,930	5,971,908
State Imported Generation	50%	50%	50%
Chittenden County Total Target	648,475	857,945	954,833
Existing Renewables Generation	606,554	606,554	606,554
New Generation Needed	41,922	251,391	348,279

Note: The Department of Public Service reports 598,409 MWh for the County. See "Calculating Existing Generation Targets" for an explanation on why CCRPC reports a different number.

Chittenden County has sufficient energy resource area to meet the above generation targets. Solar and wind potential acreage (shown in Table ~~15~~19) are based on a mapping exercise completed by the Vermont Center for Geographic Information (VCGI), with modifications by CCRPC. The wind potential data is from the MA Technology Collaborative and is a model of predicted wind energy potential based on wind speed models. The solar energy potential data identifies potential areas where optimal solar radiation is available based on east, west, and south facing aspect and slopes less than 14%.

Environmental and regulatory constraints are also accounted for in the analysis of wind and solar potential. Primary or 'prime' areas are locations with high energy potential that are free from state/local known constraints. Secondary or 'base' areas are locations with high energy potential that are free from state/local known constraints but include a presence of state/local possible constraints. See the constraints and suitability methodology below for an explanation of how CCRPC defined constraints in the region and for the list of constraints that were included in the analysis.

To determine the amount of renewable energy potential from the wind and solar acreage described above, conversion factors were applied to the base and prime areas to estimate the amount of capacity available for meeting Chittenden County's targets. See the "Calculating Existing Generation and Generation Potential" section for more information.

TABLE ~~15~~19. LAND AVAILABLE FOR WIND AND SOLAR GENERATION

Land Available for Wind and Solar Generation		
	Prime Potential	**Base Potential**
Solar	7,355 acres (2% of county)	63,628 acres (19% of county)
Wind	15,032 acres (3% of county)	107,090 acres (31% of county)

Sources: VCGI, CCRPC and the Department of Public Service

Table ~~16~~20 describes the various technologies available for Chittenden County to meet the renewable energy targets. These include rooftop solar, ground mounted solar, wind turbines, biomass, methane from landfills and sewage treatment plants and hydroelectric energy. The renewable energy generation targets can be met through any combination of technologies. However, given the regulatory complexities of siting new hydropower, this plan only identifies existing hydropower sites where equipment could be upgraded or expanded to provide additional generation. Similarly, current sound regulations on wind generation facilities in Vermont effectively prevent new installations. Because estimating the power generated from the use of biomass for heating or co-generation is site-specific, only the number of acres of woody biomass was included below. However, it is unclear whether the state forestry industry could support additional biomass-powered electric plants.

Commented [MN34]: The biomass acreage is old and I am not sure the source for updating it. Checking with PSD on whether the energy standards require us to discuss energy potential from biomass.

Given these considerations, CCRPC anticipates meeting its incremental renewable electricity generation targets primarily through solar (90%), likely split evenly between ground-mounted (45%) and rooftop installations (45%), with a small portion of generation sourced from wind power (10%) if made feasible by regulatory changes. However, as noted in the suitability policies of Strategy 4, Action 2(c), previously developed sites are preferred for renewable energy generation, and development of rooftop solar should be maximized.

TABLE ~~16~~20. PROJECTED RENEWABLE ELECTRICITY GENERATION POTENTIAL

Projected Renewable Electricity Generation Potential*		
	Power (MW)	Energy (MWh)
Rooftop Solar	~~1,071~~776	~~197,344~~935,184
Ground-Mounted Solar** – Prime	1,051	207,082
Ground-Mounted Solar** – Base	1,212	238,878
Wind – Prime	376	166,659
Wind – Base	3,707	1,644,094
Hydroelectric	See ~~Hydro~~Existing Generation Map	
Potential Biomass Area	~~129,073~~138,658 acres	
Methane	Unknown	Unknown
Other	Unknown	Unknown

Sources: VCGI, CCRPC and the Department of Public Service

*See "Calculating Existing Generation and Generation Potential" for details on how resource areas were converted to power and energy.

**Ground-mounted solar potential reports how much land could be developed with solar based on its aspect and elevation and removes space taken up by roofs and roadways, but not other impervious surfaces like parking lots. Therefore, rooftop solar potential can be added to ground-mounted solar potential, though parking lot canopy solar installations would be included within ground-mounted solar potential.

Biomass acreage is sourced from VCGI's VT Potential Woody Biomass Areas

Commented [DS35]: Waiting for response from PSD (Lou Cecere) about accuracy of this figure vs. VCGI rooftop solar data, which says this should be 935,184 MWh

Commented [DS36]: Is this changing based on new constraints mapping?

Commented [DS37]: @Melanie Needle this is correct based on the new solar mapping process, right?

Commented [MN38R37]: @Darren Schibler I removed rooftops and road impervious surface

4. METHODOLOGY

Calculating Existing Generation and Generation Potential

Existing Electric Energy Generation

Data on generation sites, power and energy generation are available from the Department of Public Service. The data reports sites and capacity (power) from Certificates of Public Good filed in each municipality.

Ground-Mounted Solar Energy Potential

The methodology for estimating ground-mounted solar electricity potential is to divide the number of acres available as prime and base resources by 8 acres per MW for prime solar; 60 acres per MW is used for base solar to account for the presence of possible constraints that reduce the land usable for solar panels. The annual electricity production is then estimated using the formula below.

Commented [DS39]: Added this to clarify why there are two factors used.

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

Wind Energy Potential

The methodology for estimating wind electricity potential is to divide the number of acres available as prime and base resources by 25 acres per MW. There is no reduced land factor for base wind since possible constraints have a lesser impact on actual equipment siting due to the vertical nature of wind turbines. Then to estimate the amount of production using the formula below.

Commented [DS40]: Added this to try and explain why we use only one conversion from acres to MW for wind, but please correct if needed.

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

Rooftop Solar Energy Potential

Commented [DS41]: @Melanie Needle this probably needs to change to reflect the VCGI rooftop solar data workflow, right? I can summarize that here unless you did something slightly different.

Commented [DS42R41]: Updated

Rooftop solar potential data is sourced from the Vermont Center for Geographic Information (VCGI) dataset named *Town Rooftop Solar Potential – Act 174 2022*. As explained in the release notes, these estimates use a ~~solar radiation~~ geographic information system (GIS) model ~~based on a LiDAR-based digital surface model~~of building footprints to determine the total surface area of rooftops suitable for solar photovoltaic panels (accounting for amount of solar radiation, slope, aspect, shading of nearby objects, and minimum size of rooftop~~). To obtain~~ viable for solar panels). Using published data for solar radiation, the VCGI data also estimates an annual solar energy production potential for each suitable rooftop, summarized by municipality, applying a capacity factor of 13.76% as published by the U.S. Environmental Protection Agency. The total system capacity in ~~Megawatts, the resulting roof area~~megawatts is ~~multiplied by 1.5 acres per MW under the assumption that the average rooftop system can produce 3 kW per 200 square feet of panels. Finally, total energy production is~~then estimated using the formula below.

Commented [MN43]: Rooftop solar is sourced from VCGI, less potential is indicated in the PSD tool need to reconcile which is the one to be using and what percentage is applied to reduce potential due to rooftop limitations

Commented [DS44R43]: I think I resolved this somewhat. PSD uses two conversion factors that are different from VCGI (though I can't fully explain why PSD is different):

Capacity factor (system efficiency) is 0.145 for PSD, which cites the VCGI Rooftop Solar data as a source but it's unclear where this number comes from since the actual capacity factor used in the ESRI workflow is 0.1376. See the VCGI metadata for both the statewide and town-level rooftop solar potential.

Additionally, PSD uses a land factor of 1.5 Acres / MW (assuming 3 kW / 200 SF), but at least for Chittenden County towns, the VCGI land factor comes to about 2 Acres / MW.

Rooftop ~~MWh~~MW of ~~energy~~capacity = (number of ~~MW) * (~~annual MWh) ÷ ((0.~~145~~1376 capacity factor) * (8760 hours per year~~)))~~

Calculating Renewable Energy Generation Targets

Regional Renewable Electricity Generation Target

For the 2018 ECOS Plan, CCRPC established a range (low target and high target) for renewable energy generation under the assumption that 50% of statewide annual electricity demand (in megawatt-hours or MWh) would be produced in-state. The low scenario was based on the county's share of land area available statewide for ground-mount solar and wind energy production (the only two technologies considered at the time). The high scenario was based on the county's share of the total state population. The 2018 Plan identified sufficient land for solar and wind development to meet this demand under either scenario, then allocated this regional target to each of the county's municipalities through a similar process.

Commented [DS45]: Not sure if this background is necessary.

The 2022 guidance from the Vermont Department of Public Service (PSD) uses a single scenario for the regional share of the state's total electricity generation target, which assumes 50% of electricity demand would be generated within the state. For Chittenden County, the regional share is 16%, which is the average of the county's portion of the state's population (26.2%) and land area (5.8%). This regional share, which represents the **total** regional electricity generation target, is applied to three milestone years (2032, 2040, and 2050) as shown in Table ~~28~~20.

The **incremental** regional electricity generation target is the amount of new electricity that must be generated to meet the total target after subtracting production from existing facilities. Based on data provided by the PSD as of 1/31/2023, Chittenden County annually produces 606,554 MWh of electricity from renewable sources; the resulting incremental regional targets by milestone year are shown in Table ~~28~~20.

The existing renewable energy generation for the County is the sum of each municipality's total existing renewable energy generation sited within the municipalities' borders. If a facility is located on the border between two jurisdictions, the generation is split between each jurisdiction; for example, two of the four turbines in the Georgia Mountain Community Wind project are located within the Town of Milton; therefore, half the facility's production is counted for the Town of Milton and the Chittenden County region; the other half is counted for the Town of Georgia and the Northwest region.

Note that the targets are expressed in terms of total annual electricity use in megawatt-hours (MWh). The modeling does not account for daily and seasonal fluctuations in demand as well as supply from intermittent sources like solar and wind. Therefore, in reality a higher total capacity (in megawatts or MW) among generation facilities will be required than the minimum required to produce the total regional electric generation target. However, this would be difficult to model even if there was certainty about fluctuations in demand and the types of technologies available.

Commented [DS46]: Kevin Thorley asked to add a seasonal / monthly capacity factor to highlight temporal issues. Use PV Watts.

Municipal Renewable Electricity Generation Targets

To better understand how the region can achieve its 2050 renewable energy generation targets, the CCRPC used a tool provided by the PSD to determine generation targets for each municipality in its region as a portion of the region's overall target. The total municipal electric generation targets were calculated by multiplying the regional target by the average of each municipality's share of the county total of three equally weighted factors: population, land area available for renewable energy production, and current electricity consumption. As with the regional targets, the incremental municipal targets are obtained by subtracting existing generation facilities located within a municipality's borders.

Commented [DS47]: Would it be helpful to also express this in a formula?

Commented [MN48R47]: Sure! A visual is always helpful.

It should be noted that although the Town of Essex and City of Essex Junction are now separate municipalities, Efficiency Vermont still only reports electricity demand data for the Town of Essex including the City. Therefore, the PSD and CCRPC approximated usage for each municipality by dividing the total usage proportionally by population.

As seen in Table ~~27~~20, a ~~negative number~~✓ in the "Incremental Targets by Year" columns indicates that a municipality has met or exceeded the target with existing renewable energy generation within the boundaries of the jurisdiction. Production beyond these targets furthers progress towards the regional target and reduces the incremental targets for all other municipalities.

The targets are technology neutral, meaning that they can be met with any mix of technologies. It is important to note that a municipality may choose to meet its target through a variety of different renewable energy technology types (e.g., wind, hydro, or biomass). Some municipalities may be able to achieve their targets with a single technology; for example, South Burlington's ~~2024~~2022 Climate Action Plan states that it is possible and recommended to meet its targets exclusively through rooftop solar. However, this is not possible for every municipality, and regardless, actual renewable generation facilities developed in any municipality will likely include a variety of technologies. Regardless, at a regional level there is sufficient land area available for renewable electricity facilities to meet the regional target ~~using any technology exclusively~~.

As shown in Table ~~28, the PSD tool indicates that nearly~~21, every municipality within the region has sufficient land area available for renewable electricity facilities to meet its targets through one or more technologies. ~~The only exception~~However, it is ~~Essex Junction, whose electricity demand is disproportionately higher relative to its land area due to the presence~~noted that the consumption figures (and thus the renewable generation targets) for Essex Town and Essex Junction include that of GlobalFoundries~~,~~ (a ~~major electricity consumer and regionally important~~microchip manufacturer~~,~~ located in Essex Junction ~~would be unable to meet its targets through any mix~~). GlobalFoundries (GF) uses approximately 400,000 MWh of ~~technologies. Essex Junction is allocated a higher proportion~~electricity annually (representing about 8% of the ~~regional target relative to its land area because~~consumption of the ~~high amount~~entire state of ~~energy consumption at Global Foundries (which by itself consumes %~~Vermont) and is also the state's largest for-profit employer. Due to its unique needs, GF has petitioned the Public Utilities Commission to create its own self-managed utility rather than a customer of ~~the region's electricity).~~Green Mountain Power[1]. While Essex Town and Essex Junction theoretically can still meet their renewable generation targets given their available land resources, even factoring for the consumption of GF, it is expected that this will be offset at a regional and statewide level through generation facilities in many locations, rather than solely within these municipalities.

Overall, the region is in a good position to increase renewable energy generation. CCRPC will track progress towards meeting the renewable energy targets and will revisit the targets when the ECOS Plan is updated to ensure that the targets align with current population, land available for renewable generation, and electricity consumption data.

Commented [DS49]: Not sure if we want to back this up with a table from the PSD tool, which could be done would take up a lot of real estate here.

Commented [MN50R49]: @Darren Schibler it might be helpful to add in the energy resource area acreages, how much energy potential is produced as a comparison to the target to show the data behind esj not being able to achieve target.

Commented [DS51]: Also not sure if it's worth mentioning this at a regional level, or if it should just be addressed in Essex Junction's EEP.

Commented [MN52R51]: @Darren Schibler fine for now. ESC will have some suggestions.

Commented [DS53]: How do we want to discuss this issue? Options:
1. If we can figure out how much electricity GF consumes on its own, we can take that out of EJ's target specifically and just distribute that demand across the whole region.
2. If we can't figure out GF's consumption, we can simply note that the excess generation provided by other municipalities (like Burlington and Milton) will achieve the regional target, and EJ doesn't have to worry about this. This might require a conversation at PAC.
3. Say that we'll try to site a high-output renewable facility (such as a wood chip plant) within EJ. Probably too ambitious to put on paper.

Commented [MN54R53]: @Darren Schibler I think this is fine for now. The ESC will likely have some thoughts on this issue.

[1] Cotton, Emma. "Public Utility Commission allows GlobalFoundries to set up its own electric utility." *VT Digger*. Retrieved 7/17/2023 from https://vtdigger.org/2022/10/24/public-utility-commission-allows-globalfoundries-to-set-up-its-own-electric-utility/

TABLE ~~27~~20. MUNICIPAL RENEWABLE ENERGY TARGETS.

Municipality	Weighting Factors (33.33% each)			Total Targets by Year (MWh)			Existing Renewables (MWh)	Incremental Targets by Year (MWh)		
	2020 Population	2021 Electricity Use (MWh)	Acres Available	2032	2040	2050		2032	2040	2050
Bolton	1,301	7,911	3,205	7,792	10,309	11,474	794	6,998	9,515	10,679
Buel's Gore	29	246	1,827	3,000	3,969	4,417	10	2,990	3,959	4,408
Burlington	44,743	317,617	3,668	102,946	136,200	151,581	334,817	~~-231,871~~ ✓	~~-198,617~~ ✓	~~-183,236~~ ✓
Charlotte	3,783	21,586	21,113	41,405	54,779	60,965	11,257	30,148	43,522	49,708
Colchester	17,524	128,420	5,487	47,441	62,765	69,853	16,393	31,047	46,371	53,459
Essex Town*	11,504	344,140	5,038	65,585	86,770	96,569	11,994	53,591	74,776	84,575
Essex Junction*	10,590	316,798	343	53,469	70,741	78,729	25,853	27,616	44,887	52,876
Hinesburg	4,698	38,387	13,331	32,184	42,579	47,388	6,154	26,030	36,426	41,234
Huntington	1,934	7,486	9,074	17,962	23,764	26,447	1,741	16,221	22,023	24,706
Jericho	5,104	23,333	6,304	19,616	25,953	28,884	8,308	11,308	17,645	20,575
Milton	10,723	77,239	14,119	46,090	60,977	67,864	83,646	~~-37,556~~ ✓	~~-22,668~~ ✓	~~-15,782~~ ✓
Richmond	4,167	19,706	5,308	16,333	21,609	24,050	5,973	10,360	15,636	18,076
Shelburne	7,717	56,692	11,260	35,084	46,417	51,659	8,618	26,466	37,799	43,041
South Burlington	20,292	200,330	4,444	58,360	77,211	85,931	32,465	25,895	44,746	53,465
St. George	794	3,209	1,727	4,189	5,542	6,168	801	3,388	4,741	5,367
Underhill	3,129	11,999	11,851	24,515	32,434	36,097	2,709	21,806	29,725	33,387
Westford	2,062	8,677	5,747	12,954	17,138	19,074	1,406	11,548	15,732	17,667
Williston	10,103	120,456	9,468	43,349	57,352	63,829	35,001	8,349	22,351	28,828
Winooski	7,997	42,856	357	16,201	21,435	23,855	18,613	~~-2,411~~ ✓	2,822	5,243
Chittenden County	**168,194**	**1,747,086**	**133,671**	**648,475**	**857,945**	**954,833**	**606,554**	**41,922**	**251,391**	**348,279**

Sources: VT Department of Public Service, VCGI, and CCRPC.
**Note:*

TABLE 2821: TOTAL ENERGY POTENTIAL BY TECHNOLOGY AS A PERCENT OF INCREMENTAL GENERATION TARGETS

Target Year: 2050	Incremental Target (MWh)	Total Energy Potential (MWh)	All Resources	Prime Solar	Base Solar	Rooftop Solar	Prime Wind	Base Wind
Bolton	10,679	40,94644,806	383420%	32%	37%	1046%	8%	296%
Buel's Gore	4,408	20,606637	468%	5%	8%	01%	13%	442%
Burlington	-183,236✓	75,469181,104	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Charlotte	49,708	267,598289,030	538581%	11%	82%	1255%	7%	426%
Colchester	53,459	100,072180,664	187338%	30%	30%	41191%	13%	73%
Essex Town	84,575	96,081157,721	114186%	20%	30%	1992%	1%	43%
Essex Junction	52,876	19,38967,848	37128%	6%	6%	24116%	0%	0%
Hinesburg	41,234	176,271194,208	427471%	49%	48%	1255%	26%	294%
Huntington	24,706	112,235119,136	454482%	37%	29%	836%	79%	301%
Jericho	20,575	93,185118,014	453574%	72%	66%	32153%	22%	261%
Milton	-15,782✓	198,025246,536	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Richmond	18,076	73,59887,171	407482%	65%	38%	2196%	98%	185%
Shelburne	43,041	151,748191,446	353445%	24%	41%	25117%	25%	237%
South Burlington	53,465	86,273211,916	161396%	7%	14%	62297%	7%	72%
St. George	5,367	21,61024,071	403448%	28%	29%	1258%	41%	292%
Underhill	33,387	155,796167,207	467501%	56%	51%	944%	11%	339%
Westford	17,667	86,10795,538	487541%	104%	83%	1568%	27%	258%
Williston	28,828	146,049243,163	507843%	64%	39%	88425%	56%	259%
Winooski	5,243	10,82829,507	207563%	58%	15%	95451%	13%	26%
Chittenden County	**348,279**	**1,931,88644,806**	**555767%**	**59%**	**69%**	**57269%**	**37%**	**333%**

Sources: VT Department of Public Service, VCGI, and CCRPC.

This table shows the potential energy that could be generated using the full land / rooftop extent of each renewable technology (and all technologies combined) relative to the incremental municipal targets in Table 2820. Green cells indicate that there is sufficient area to meet targets with a given technology, while red cells indicate there is not enough. Using the county as an example, 555767% for All Resources means that the county 5.557.76 times more resource area than it needs to meet the 2050 target. However, it could notonly meet the59% of its target through any one technologyprime solar alone except base wind. N/A indicates that a municipality has met its target but can still contribute to meeting the overall county target.

Constraints and Suitability Methodology

Natural Resource Constraints

The Department of Public Service's energy planning standards establish known and possible constraints to identify potential areas for the development and siting of renewable energy, storage, transmission, and distribution resources and areas that are unsuitable for siting those resources. Constraints are grouped into the following categories: state known constraints, local known constraints, state possible constraints, and local possible constraints. Development should be located to avoid state and local known constraints, and to minimize impacts to state and local possible constraints.

The state/local known and possible constraints and their associated policies constitute the land conservation measures that might be given substantial deference by the Public Utilities Commission in the ~~section~~Section 248 process for permitting renewable energy generation. The accompanying policies for local and state constraints are discussed in Strategies 4, 6, and 7 of the ECOS Plan

Areas that represent known state/local known constraints are removed from wind and solar energy resource areas to estimate the amount of primary or 'prime' energy resource available for siting renewable energy generation and associated infrastructure. Prime energy resource areas are areas that a free from local/state known constraints.

Areas that represent possible state/local constraints are NOT removed from wind and solar energy resource areas. Instead, they are included with wind and solar energy resources areas to constitute secondary or 'base' energy resource areas. Base energy resource areas are areas with high solar and wind potential and a presence of state/local possible constraints.

See ~~table X~~Table 22 below for the list of state known and possible constraints.

While the first Chittenden County enhanced regional plan was being developed in 2017-2018, CCRPC went through a process with municipalities and the Long Range Planning Energy Subcommittee to identify local natural resource constraints that might be given substantial deference in the context of particular project review under section 248. While there was some overlap between the constraints identified by each municipality, no constraints emerged as being universal restrictions to development across the county. Therefore, no regional natural resource constraints were added.

These local constraints are included in the ECOS Plan due to their importance at the local level. For a local constraint to be identified, supporting text in an adopted municipal plan or municipal land use regulation such as zoning regulations or subdivision regulations must align with the classification of known or possible constraint below. To be consistent with the energy planning standards, constraints must be equally restrictive of all development, not just renewable energy development.

The local constraints identified in this plan are not an exhaustive list of every development constraint. Therefore, CCRPC will continue to work with municipalities to complete or update energy plans. CCRPC will also continue to review municipal plans through CCRPC's *Guidelines and Standards for Confirmation of Municipal Planning Processes and Approval of Municipal Plans*. CCRPC will check to ensure that any local policies don't preclude municipalities from meeting their energy generation targets and complying with the state energy goals.

Known Constraints: Zoning districts or resource areas where development is prohibited with no exceptions. Typically, phrases such as "development *shall not* take place" are used to denote these areas.

Possible Constraints: Zoning districts or resource areas such as those in which:

- Development is not completely prohibited, but impacts of development should be "minimized", "avoided," "limited," "avoided *where possible,*" mitigated or similar.
- Development is allowed only following conditional use review.
- The goals of the zoning district are such that large-scale energy development may not be appropriate, such as scenic overlay districts.

TABLE 22. LOCAL/STATE KNOWN AND POSSIBLE CONSTRAINTS*

Bolton	Burlington	Charlotte	Colchester
Known Constraints: • Surface Water Setbacks • Wetland Buffers • Slopes 25% or more **Possible Constraints:** • Conservation District • Slopes 15% to 25% • Forest District • Town Owned Land	**Known Constraints:** none identified **Possible Constraints:** • View Corridors • Burlington Country Club property • City-owned parks and Centennial Woods	**Known Constraints:** none identified **Possible Constraints:** • Shoreland Setback and Buffer Area • Surface Waters, Wetlands, and Buffer areas • Special Natural Areas • Wildlife Habitat • Historic Districts, Site, and Structures • Slopes greater than 15% • Land in Active Agriculture • Water Supply Protection	**Known Constraints:** • Slopes 20% or greater • Wetlands and Surface Water Buffers **Possible Constraints:** • Shoreland Overlay District

Essex	Hinesburg	Jericho	Milton
Known Constraints: • Slopes Higher than 20% **Possible Constraints:** • Scenic Resource Protection Overlay District • Resource Protection District • Slopes 15%-20% • Core Habitat • Habitat Blocks	**Known Constraints:** • Slopes Higher than 25% **Possible Constraints:** • Slopes (15-25%) • Core Habitat	**Known Constraints:** • Well Protection Area Overlay District • Natural Resource Overlay District • Primary Conservation Areas **Possible Constraints:** • Secondary Conservation Areas	**Known Constraints:** None identified **Possible Constraints**: • Town Forest and Municipal Natural and Rec Areas w/Management Plans • Habitat Blocks 8-10 • Encumbered Open Space

Richmond	Shelburne	South Burlington	Underhill
Known Constraints: • Slopes equal to or greater than 35% **Possible Constraints:** • Wetlands and associated buffers • Water Supply Protection Areas • Surface Water Buffers	**Known Constraints:** None identified **Possible Constraints:** • Significant View Areas • Lakeshore Buffer • Archeologically Sensitive Areas (not mapped)	**Known Constraints:** • Wetlands and buffer • River Corridor • B2 • Very Steep Slopes greater than 25% **Possible Constraints:** • Habitat Block and Corridor Overlay District • Slopes 15% to 25% • SEQ Natural Resource Protection Area	**Known Constraints:** • Above 1,500 ft. Elevation ~~**Possible Constraints:**~~ • ~~Slopes 15% or greater~~ • ~~Mt. Mansfield Scenic Preservation District~~ • ~~Wetlands and associated buffers,~~ • ~~Surface Waters and buffers~~

		• B1 500-year Floodplain	**Possible Constraints:** • Slopes 15% or greater • Mt. Mansfield Scenic Preservation District • Wetlands and associated buffers. • Surface Waters and buffers

Westford	Williston	State	State

Known Constraints:
• Slopes 25% or greater
• Deer Wintering Areas
• Ledge Outcropping
• Flood Hazard Overlay
• Water Resources Overlay
 	
Possible Constraints:
None identified
	Known Constraints:
	• Water Protection Buffers
	• Primary Viewshed Areas
	• Slopes 30% or greater
	
	Possible Constraints:
	• Slopes 15% - 30%
	• Conservation Areas/Natural Communities
		Known Constraints
		• FEMA Floodways
		• DEC River Corridors
		• National Wilderness Areas
		• State-significant Natural Communities and Rare, Threatened, and Endangered Species
		• Confirmed Vernal Pools Class 1 and 2 wetlands (VSWI and advisory layers)
			Possible Constraints
			• Potential Vernal Pools
			• Agricultural Soils + Hydric Soils
			• Act 250 Ag. Soil Mitigation Areas
			• FEMA Special Flood Hazard Areas
			• VT Conservation Design Highest Priority
			  ○ Interior Forest Blocks
			  ○ Connectivity Blocks
			  ○ Physical Landscape Blocks
			  ○ Surface Water and Riparian Area
			• Protected Lands (State fee lands and private conservation lands)
			• Deer Wintering Areas

* Not every constraint to development in Chittenden County is reflected in the regional energy planning process. Some municipalities did not request any local constraints. CCRPC did not receive requests from Buel's Gore, Huntington, St. George, or Winooski. In the case of Winooski, it was determined that local constraints were not needed as the local constraints were sufficiently addressed by the state's constraints.

Suitability Methodology

Constraints represent areas in which development, including energy generation, is restricted. However, areas in which development is generally appropriate still have different levels of *suitability* for different types and scales of renewable energy generation. This may be due to conflicts between energy generation and other types of planned development, or infrastructure capacity issues. Therefore, we have incorporated considerations of scale into our siting suitability policy statements in strategy 4.

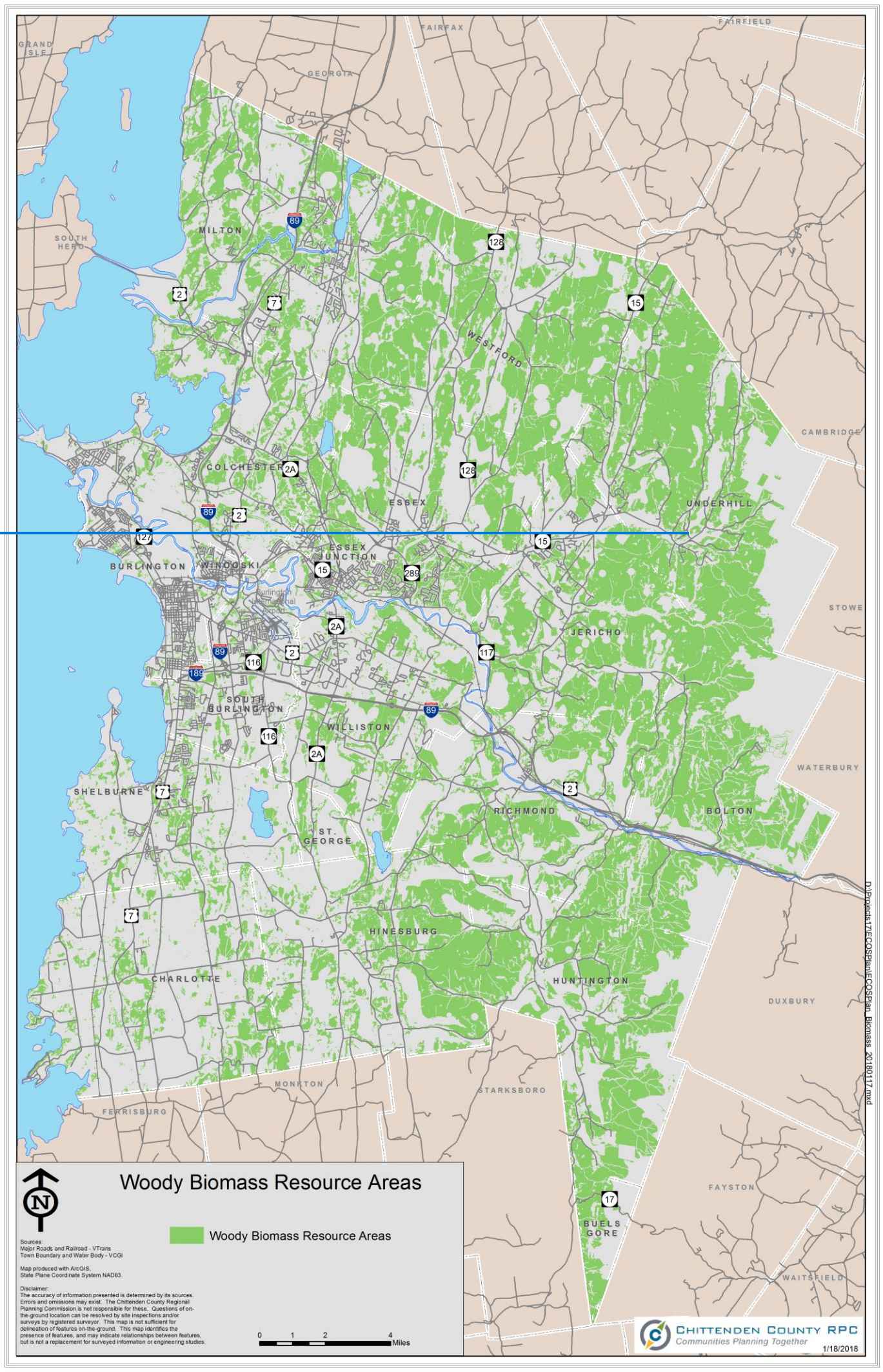
4. Forest Block Evaluation

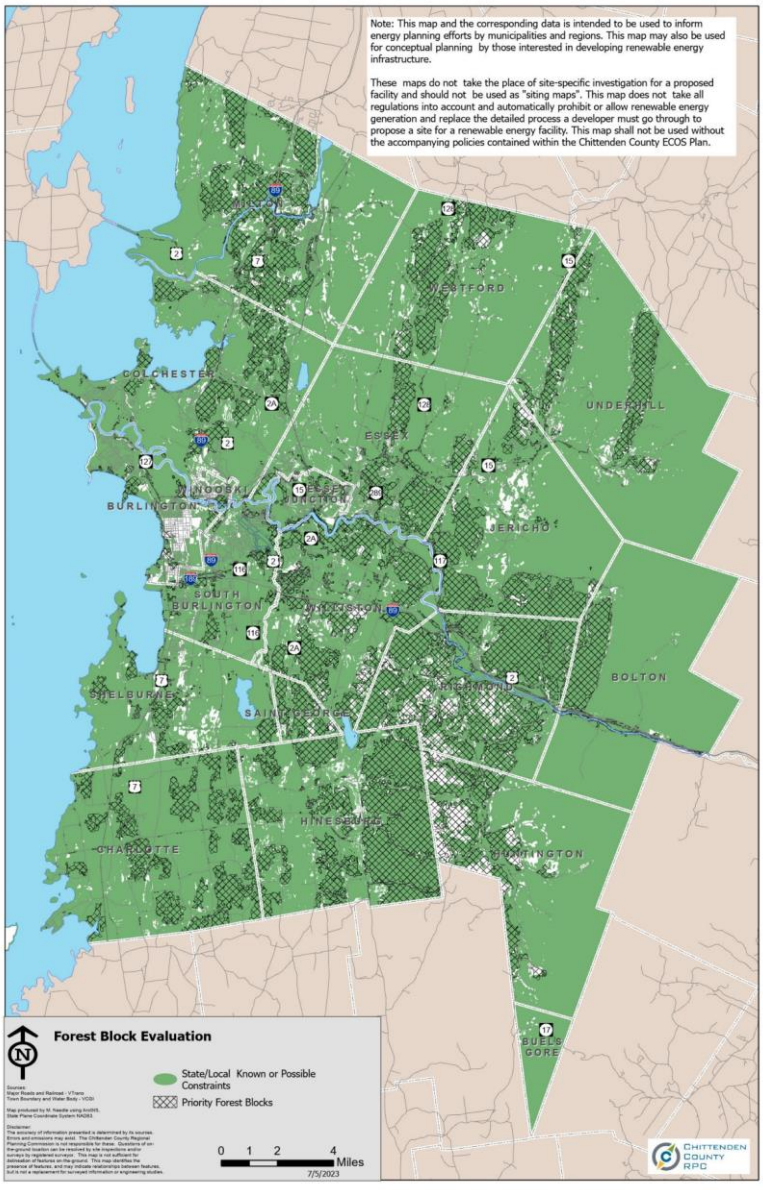
The energy planning standards require an evaluation of whether forest blocks or habitat connectors should be treated as a possible constraint. CCRPC conducted an overlay analysis of all state/local known and possible constraints included in this plan with priority forest block areas from the Agency of Natural Resources' Vermont Conservation Design. CCRPC determined that ~~a majority~~most of the priority forest block areas are treated as possible constraints already in the ECOS Plan due to the inclusion of local constraints with some exceptions in Westford, Jericho, Richmond, and Huntington (see white hatched areas on the following map below). Although the state/local constraints are combined into one color, each individual natural resource constraint is associated with an accompanying policy either directing renewable energy generation away from the natural resource or calling for mitigation. Huntington did not request local constraints in the ECOS Plan which explains why the map is showing a gap. However, the ECOS Plan contains a strategy or policy statement encouraging the decrease in subdividing significant habitats and identifies regionally important forest blocks as Vermont Conservation Design's highest priority and priority forest blocks.

Map 1 shows "woody biomass resource areas" in Chittenden County. The McNeil Generating Station in Burlington is the region's largest user of biomass for energy generation. Most of the wood fueling the McNeil Station in Burlington comes from within 60 miles of the station and is a byproduct of other forestry operations. At full load, approximately 76 tons of wood chips are consumed per hour (about 30 cords). This far exceeds Chittenden County's abilities to produce biomass. A study conducted in 2010 showed that even if Chittenden County's entire annual wood harvest was put towards the McNeil Station, and all non-constrained forest land were harvested at a comparable rate, the McNeil Station could only run for 57 days on wood from Chittenden County. Large amounts of available wood can be found in other parts of Vermont, and neighboring counties in New Hampshire, Massachusetts and New York.[2] Wood products from both inside and outside Chittenden County will likely continue to provide fuel for the McNeil Station and other biofuel heat and electricity needs. Please keep in mind the woody biomass resource areas do not account for state/local known constraints.

[2] https://www.biomasscenter.org/images/stories/VTWFSSUpdate2010_.pdf and https://www.burlingtonelectric.com/more-mcneil

MAP 1-WOODY BIOMASS RESOURCE AREAS, THIS MAP MAY NEED TO BE UPDATED TO SHOW CONSIDERATION OF FOREST BLOCKS AS POSSIBLE CONSTRAINT IN COMPARISON TO ALL POSSIBLE CONSTRAINTS TO SATISFY STANDARD F.




Note: This map and the corresponding data is intended to be used to inform energy planning efforts by municipalities and regions. This map may also be used for conceptual planning by those interested in developing renewable energy infrastructure.
These maps do not take the place of site-specific investigation for a proposed facility and should not be used as "siting maps". This map does not take all regulations into account and automatically prohibit or allow renewable energy generation and replace the detailed process a developer must go through to propose a site for a renewable energy facility. This map shall not be used without the accompanying policies contained within the Chittenden County ECOS Plan.
WESTFORD
COLCHESTER
UNDERHILL
ESSEX
ESSEX JUNCTION
BURLINGTON
JERICHO
SOUTH BURLINGTON
WILLISTON
BOLTON
SHELBURNE
SAINT GEORGE
HINESBURG
CHARLOTTE
HUNTINGTON
DUELL GORE
Forest Block Evaluation
State/Local Known or Possible Constraints
Priority Forest Blocks
0 1 2 4 Miles
7/5/2023
CHITTENDEN COUNTY RPC