Central Vermont Regional Planning Commission

Regional Plan Committee

November 19, 2024 at 4:00 pm

29 Main Street, Suite 4, Montpelier, VT 05602

To join Zoom meeting:

https://us02web.zoom.us/j/87815276521?pwd=Mmw5U080SGpCTUFNVHZFSERQUlI0dz09

Meeting ID: 878 1527 6521, Passcode: 783374

One tap mobile 1(929)436-2866 or 1(301)715-8592

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AGENDA

4:00 pm[2]	**Adjustments to the Agenda**
	Public Comment
4:05 pm	**Approval of Minutes**[3]
4:10 pm	**Energy Chapter review** (discussion)
5:30 pm	**Adjourn**

Next meeting: December 3, 2024

[1] Dial-in telephone numbers are "Toll" numbers. Fees may be charged to the person calling in dependent on their phone service.

[2] All times are approximate unless otherwise advertised

[3] Anticipated action item.

Energy Chapter Review- Regional Plan Committee Meeting 1 of 2

Approach to the chapter: The current enhanced energy plan (100+pages) was structured explicitly to follow the Act 174 standards (main audience Public Service Department & technical stakeholders). Hearing clearly the desire of this committee to have a plan that was more accessible to the general public, this iteration is substantially abbreviated, with much of the required material, especially town level data, provided as a supplement instead of integrated into the main text of the chapter (this supplement is currently being organized so excuse the lack of flow if you look at it!).

What you have:

- Abbreviated chapter draft
- Energy Infrastructure Excerpt
- Supplement (in progress)
- Placeholder Maps (due to move from server to sharepoint)

Key Discussions (will take general feedback at the end and please feel free to share additional feedback and/or meet with Sam as well- ***note we will on maps and siting next meeting***

Organization/Scope: integrate transportation targets into transportation chapter, keep infrastructure exceprt in infrastructure chapter, etc.? (see potential for integrating into other regional plan chapters in Table Below)

Table 1 Potential Integration into Full Regional Plan Update (2025) or leave in supplement! (at least integrate references)

Chapter	Components
Infrastructure	Introduction to Electric Infrastructure & Stakeholders, Distribution and Transmission constraints and improvements; Regional Trends, Grid Modernization and Resilience; other Energy Infrastructure
Transportation	EV &EVSE (existing), EV-&EVSE-ready regs/policies, transportation sector use, analyses and targets (Enhanced Energy Plan components); implications of electrification; municipal fleet inventories, policy changes, goals re electrification, efficiency, reducing VMT, etc.
Housing/Healthy Communities/Economy	RBES, Net Zero Ready by 2030, EVSE& Solar Ready, Energy Burden, Affordable Heat Act, Thermal Sector; CBES, renewable energy industry hub

- Is it at the right level? Is it still halfway to getting cut down/shifting primary audience? Are definitions and call-out boxes helpful or distracting?
- Highlights on municipal role/actions?
    - E.g. summary analysis of common municipal projects identified via MERP assessments and potential energy use & GHG emissions reductions and significant savings (challenge for some to electrify without on-site generation & storage)

New Policies/Potential

- High Efficiency Cord Wood Stove Targets and Policy

- Role of hydroelectric generation in Central VT moving forward (many up for FERC recommissioning which is a costly & lengthy process, but yet hydro makes up a significant portion of our current generation. What is the potential appetite for other types of hydro? For new hydro projects?
- Hydroelectric dams are perfect example of where RPC could be useful scale and perspective to balance priorities e.g. flood mitigation, energy generation, recreation, and minimizing/remediation negative ecological impacts of our infrastructure
- Policy to reduce future electric demand growth (Demand management, storage, wasteheat recovery, GSHP, Thermal networks/district heat):
    - Compare our goals and example goals (e.g. collaboration with ACRPC, TRORC, and RRPC)
- Local Reliability and Resilience
    - DU scale- outages (vulnerable high wind and heavy precip),
    - access to interconnection, demand management, special rates, incentives, etc

Methodological Choices/Decision Points:

- Residential LEAP targets as % of homes (account for change in rate of housing units based on housing targets?
- New Renewable Energy Generation Target
    - Interest in a second analysis which takes into account WEC's current interconnection moratorium (redistribute new renewable generation targets)
    - Distribution across tech type (future land use impact study)

The Plan for Next Meeting: focus on resource potential areas, siting energy infrastructure, and revisit Goals/Policies/Recommendations:

- Technology Type and Scale (policies, distribution of generation goal, etc.)
    - Balancing energy goals with other land use priorities including natural resources requires us to integrate energy much more so in development planning (especially housing and intentional growth areas)- where are the key places in the regional plan to ensure cross over (Housing Chapter, Land use Chapter- specific mentions?)
    - Small scale, distributed renewable energy generation (mostly solar) predominates in Vermont although this is the most expensive approach- how do we account for this? Ensure access for all? How can we adjust to higher up-front costs but lower operating and maintenance costs for mechanisms that would reduce future electric sector demand and thus shrink our new renewable energy generation targets? (geothermal, heat recovery)
- Revisit RPC constraints
- Preferred Siting and Preferred Project Characteristics
- Is there interest in developing a process to create siting guidelines based on project size and type that builds off of the municipal work going on right now on enhanced energy planning?
- Regional Strengths & Gaps
    - Target implementation
    - Energy infrastructure (rural infrastructure gap widening)
- Defining Substantial Regional Impact
- How do we fund and implement community scale and resource efficient decarbonization?

Enhanced Energy Element

3

1. Introduction

This chapter and its supplements, as well as relevant sections in the Infrastructure, Transportation, Natural & Working Lands, Climate, Housing, and Land Use chapters, constitute Central Vermont's Energy Plan; meeting the standards outlined in Act 174 (enhanced energy plan) in addition to meeting the statutory requirements for the regional plan energy element (Title 24, Chapter 117, section §4348a(a)(3)). The primary purpose of this chapter is to identify a path towards achieving our regional share of the State's overarching energy and climate goals in a manner consistent with our regional priorities, goals, and needs.

After a brief overview of statutory requirements and context of major state policies, this element will introduce some **key energy equity and stakeholder considerations in order to frame the more technical discussions that follow. These framing considerations are intended to ensure policies, recommendations, and implementation pathways center an energy transition that is both expedient and accessible to not only all our communities but all our community members.** The majority of this element is split into the three energy sectors: Electricity, Thermal, and Transportation each featuring current use estimations, followed by regional targets and analyses, key issues, and implementation pathways. The final section includes a more in-depth discussion of existing and future renewable energy generation (and supporting energy infrastructure) in the Central Vermont Region and includes mapping products and analyses, as well as next steps. These sections are intended to follow, broadly, the structure of the Regional Determination Standards for the determination of energy compliance.

2. State and Regional Context

The first comprehensive state energy plan was create in 1991, although Vermont's contemporary energy planning began earlier in response to the oil crisis of the 1970s. The most recent update of the State's Comprehensive Energy Plan (CEP) was completed in 2022, and Vermont's energy policy, codified in 30 VSA § 202a establishes the following goals:

"To assure, to the greatest extent practicable, that Vermont can meet its

Definition:

"Energy" refers to all forms used by people for transportation, thermal (heating space & water primarily), and electricity.

There are many different "units" of energy such as kilowatt-hours or gallons of gas, which can be converted and expressed in the common unit:

British Thermal Units (BTUs) or million BTUs (MMBTUs).

This allows us to compare across sectors but is often difficult to understand. Where possible, targets have been translated into more tangible metrics such as number of homes to be weatherized (based on an average savings in MMBTUs per weatherized house).

energy service needs in a manner that is adequate, reliable, secure, and sustainable; that assures affordability and encourage sthe state's economic vitality, the efficient use of energy resources, and cost-effective demand side management; and that is environmentally sound."

"To identify and evaluate, on an ongoing basis, resources that will meet Vermont's energy services needs in accordance with the principles of reducing greenhouse gas emissions and least-cost integrated planning, including efficiency, conservation, and load management alternatives; wise use of renewable resources; and environmentally sound energy supply.

"To meet Vermont's energy service needs in a manner that will achieve the greenhouse gas emissions reductions requirements pursuant to 10 VSA § 578 and is consistent with the Vermont Climate Action Plan adopted and updated pursuant to 10 VSA § 592."

The following Table summarizes more the more specific goals and targets established by the State of Vermont:

Table 2 Overarching State Goals and Policies

	2025	2030	2035	2040	2050
Comprehensive Energy Plan 30 V.S.A § 202a State Energy Policy	25% of energy needs from renewable sources		45% of energy needs from renewable sources		90% of energy needs from renewable sources
meet % of transportation demand from renewable resources	10% transportation demand 30% thermal & industrial demand	100% electricity demands (2032) carbon-free (≥75% renewable)		45% transportation demand 70% thermal & industrial demand (2042)	
Other goals		Weatherize 120,000 households relative to 2008 baseline	Zero-emission vehicles account for 100% of light-duty vehicle sales		
Global Warming Solutions Act: 10 V.S.A. § 578(a) GHG Emissions Reduction Requirements;	26% reduction GHG from 2005 levels (pursuant to United States Climate Alliance membership and commitment to 2016 Paris Agreement)	40% reduction from 1990 levels (pursuant to the CEP)			80% reduction from 1990 levels (pursuant to the CEP)
25 by 25 State Goal 10 V.S.A. § 580	produce 25% state energy consumption in-state through the use of renewable energy sources				
Building Efficiency Goals 10 V.S.A. § 581	reduce fossil fuel consumption across all buildings by 10% annually	Weatherize 120,000 housing units and reduce GHG emissions by 0.15 MMTCO2e (2031) Reduce annual	Increase weatherization services to low-income Vermonters by expanding number of units and/or scope of services provided (ongoing)		

		fuel needs & bills by an average of 25% in those housing units			
Climate Action Plan 10 V.S.A. § 592	Updating Pending	90,000 homes weatherized			
Renewable Energy Standard 30 V.S.A. § 8004 and 8005	Update pending:	100% Renewable for GMP&VEC (Tier I) 20% Instate Renewable by 2032 GMP&VEC (Tier II)	100% renewable all other DUs (Tier I) 20% Instate Renewable all other DUs (Tier II) 20% New Regional Renewable for GMP, 10% all other DUs (excluding large hydro; restrictions on biomass) 100% Load Growth from new renewables for GMP&VPPSA		

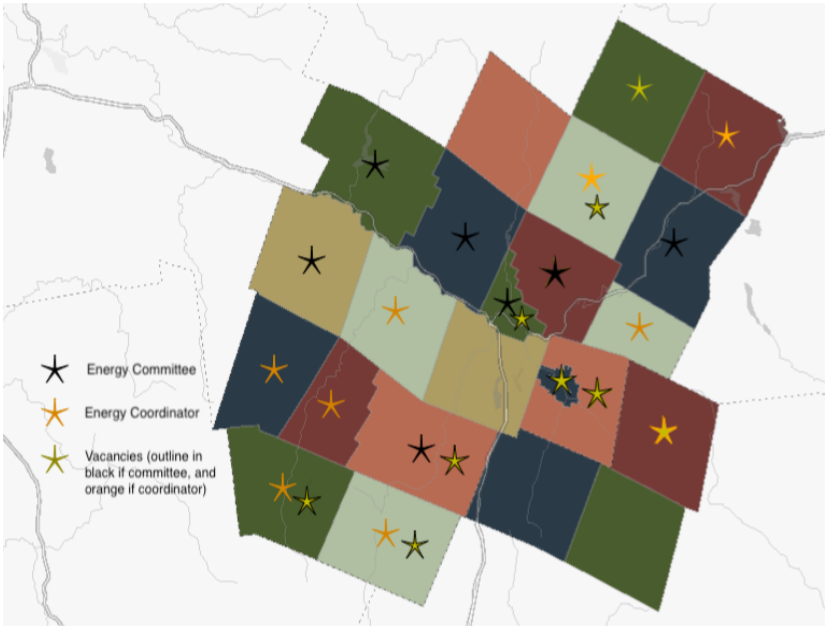
Act 174 Enhanced Energy Planning:

During the 2016 legislative session, the State of Vermont passed Act 174, an act related to improving the siting of energy projects. Act 174 outlines a path whereby regions and municipalities could receive "substantial deference"[1] for applications that seek to receive a Certificate of Public Good before the Public Utility Commission (formerly the Public Service Board) if certain considerations were incorporated into a regional or municipal development plan. Act 174 provides an avenue for regions and municipalities to have increased input in Public Utility Commission determinations for Certificates of Public Good regarding renewable energy generation facilities. Otherwise, a plan will receive "due consideration" in the Section 248 review process. Act 174 is categorized as enhanced energy planning and goes beyond what is outlined in 24 VSA 117 Section §4348a and §4382 respectively (see below for contents; supplement for details). In general, the requirements of Act 174, and updated in 2022 in line with the Climate Action Plan, work in conjunction with the existing statutory information required to be included in a regional plan's energy element (as described in 24 V.S.A. § 4348a(a)(3)). Furthermore, the standards outlined in Act 174 require regional and municipal plans to be consistent with the following State Goals, Policies, and Plans in Table 2.

The Central Vermont Regional Planning Commission first received a Determination of Energy Compliance (DOEC) through the Vermont Public Utilities Commission (PUC) with the 2018 Regional Energy Plan adopted as an amendment and Appendix A-7 of the 2016 Regional Plan. Since, 7 of municipalities have received determinations of energy compliance via municipal enhanced energy plans including Barre Town, Northfield, Waterbury, Waitsfield, Middlesex, Plainfield, and Woodbury, 1 municipality has a Net Zero Action Plan

[1] According to Act 174 of 2016, "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.

(Montpelier), 5 are currently in the Enhanced Energy Planning process (including Worcester, East Montpelier, Marshfield), and at least 5 more municipalities had developed drafts which were interrupted by the pandemic (and while they have not yet submitted their plans for approval, do include targets, maps, and preferred siting language in their existing town plans). Municipal breakouts of the Regional analyses and targets based State forecasting from the Low Emissions Analysis Platform (LEAP)[2], as well as a municipal breakouts of the mapping products to support municipal planning and implementation, will be posted and hosted on the CVRPC website once this plan has been reviewed and approved (drafts will likely be made available earlier over the course of 2024&2025, to support the 5+ municipalities currently working on their own enhanced energy plans).



PLACEHOLDER FIGURE 1: Town with Enhanced Energy Plans, Energy Committees and Coordinators (update Worcester, Barre Town, and Calais)

As of Winter 2024, Central Vermont has 17 towns with active Energy Committees and/or Coordinators and 3 towns with vacant or inactive Energy Committees or Coordinators (Figure 1). Energy Committees and Coordinators have varying roles:

- Advise town legislative and planning bodies concerning Town energy policy including enhanced energy planning, project development/review, etc.,
- Promote municipal energy efficiency and resilience, and lower energy costs,
- Develop municipal/community projects from renewable energy generation and storage projects to running WindowDressers Community Builds (see insert),
- Develop and implement community outreach, education, & neighbor: neighbor campaigns to provide residents and businesses with resources to reduce energy burdens, improve energy efficiency, and reduce greenhouse gas emissions.

CVRPC has noticed a significant increase in engagement with enhanced energy and other planning processes at the local, regional, and state levels in parallel with town participation in programs like Municipal Energy Resilience Grant Program (Act 172), the new incentives available through the IRA (Inflation Reduction Act), etc. as more towns see a role for themselves in project development while feeling urgency to reduce energy burdens and increase community resilience in the face of global climate change.

[2] a software tool for energy system modeling and emissions accounting, across residential, commercial, industrial, and transportation energy use

3.Key Issues

Energy Resilience, Reliability, and Independence

The increasing severity, frequency, and unpredictability of extreme weather in Vermont has greatly exacerbated existing rural infrastructure gaps, leaving many Vermonters, and the physical and social infrastructure they rely on, without reliable access to electricity. Washington County is tied for second most disaster-prone county in the US in terms of federal-disaster declarations due to extreme weather (Rebuild by Design). While extreme flooding is at the forefront currently, many of those events are localized winter storms characterized by high wind and heavy wet snow that causes up to 8 day outages in some of our most rural towns. Major electric utility companies have active, ongoing programs to improve system reliability and protect facilities from damage by ice, severe winds and other hazards. Typically, these programs focus on trimming trees to prevent encroachment of overhead lines, strengthening vulnerable system components, protecting equipment from lightning strikes and placing new distribution lines underground. Other major problems include closed roads and restricted transportation. The cost of these events is however worrisome, and CVRPC promotes both working with DUs to harden infrastructure but also to build local reliability at the community level.

Outages are a significant barrier to electrification in many of our communities and generators are one of the most common unfunded requests we hear from municipalities. Despite this, our communities are dedicated to climate and resilience planning, recognize the role of distributed renewable energy and storage, and support robust energy and GHG emissions goals. This past year, 19 out of the 20 municipalities in Washington County have received investment grade energy audits to 2 or more municipal buildings via the State's Municipal Energy Resilience Program (some applying in ankle deep water from the July 2023 flooding). As we develop and phase these key community facility projects (first building envelope/weatherization & HVAC, second on-site renewable energy & storage), we have recognized that many see increased costs associated with electrification without on-site renewable energy. Addressing this gap will be critical for a just transition in Central Vermont.

Furthermore, climate change was identified as major hazard, exacerbating vulnerability, amplifying risks, and increasing the frequency, severity, and unpredictability of most, if not all, of the hazards discussed (directly or indirectly) in our muncipalities' LHMSs:

- increased high wind events (and severity),
- severity and variety of invasive species,
- increased number and severity of hot and dry days increases risk of drought, wild fire, and threatens those who work outside, elderly residents, houseless residents, etc.,
- increased microbursts and possibility of tornados,
- COVID-19 pandemic has heightened the awareness of the impacts of infectious diseases, the intersection with shifting baselines, and with planning for climate change and an aging population.

ADD Climate Thread Boxes on AC and Cooling Load, role for EV&V2B, ConnectDER, onsite generation &s torage;
And on critical load back up in affordable and senior housing, at municipal faciltiies, etc (e.g. outlet per unit)

Energy Conservation **(MOVE FROM INFRASTRUCTURE? And Thermal Sector?)**

- Reduce future electric demand growth, reduce required investments in renewable energy generation and expanded electricity infrastructure by better integrating and prioritizing energy conservation measures: especially at the utility and community scale (demand management, storage and meter socket adapters, ground source heat pumps, thermal energy networks/district heat, & waste heat recovery)

Energy Justice & Accessibility

The Pathways & Implementation Actions are described in the goals and policies presented throughout this report; these provide the basis for how the region will meet our target goals, as well as additional regional and state goals in line with the Vermont Climate Action Plan and Comprehensive Energy Plan. CVRPC regional energy planning, in coordination with neighboring regions and the Department of Public Service, strives to integrate overarching goals and principles from the Energy Equity Project (EEP) in an effort to assess the potential impacts of the policies included herein (Enhanced Energy Plan Standard 10).

CVRPC has approached discussions of trends and key issues, and especially implementation pathways in this plan with intention to prioritize access, affordability, and participation considering folks most burdened by the impacts of climate change and the costs of energy in Vermont *first* (including folks with low or fixed incomes, residents of color, renters, electrically dependent residents, etc.). CVRPC has adapted the guiding principles and assessment rubric[3] from the Just Transitions sub-committee of the Vermont Climate Council to utilize in future planning as well as project development and prioritization processes. Often, short term upfront costs are evoked as an equity issue to programs and policies that in the medium and long term can have profound desired impact while barriers like access, mechanisms of incentives (e.g. reimbursement, loans, tax-incentives), and/or other frequently cited barriers are perpetuated. CVRPC, in partnership with THRIVE Community Health partners and our energy committees and coordinators, have been working with income based and recovery adder programs (e.g. with Efficiency Vermont) and the State in the development of programs like ChargeVT, to move towards upfront cost coverage, community-build, sliding scale match, and other mechanisms in coordination with revolving loan funds and/or community funds to lower barriers. At all scales it is increasingly important to consider the time frame used to determine least cost: longer term cost horizons are critical when considering the benefits and costs of a just transitions. Clean, affordable, resilient, and reliable energy is a critical component of building social as well as physical infrastructure and community resilience. It is an important time to leverage federal and state funding opportunities by building administrative and procurement capacity, establishing community benefit agreement models, and fostering community expertise sharing. Transitioning away from fossil fuels, promoting energy efficiency, weatherization, and renewables, while addressing energy burden will have direct and positive impacts for all Vermonters.

Energy burden is just one metric to consider when assessing potential impacts and needs. In Central Vermont, outages (frequency and duration), income, distribution utility, and fuel assistance uptake, are key recurring considerations throughout this report and the region. A series of new tools and metrics have been and continue to be developed at the State and Federal level with varying applicability to Vermont (inset below). CVRPC is committed to continue to engage with these tools and resources and integrate them into future planning.

Federal Indices/Programs	State Definitions	State Indices/Tools

• Justice40+/-
  • Energy Justice Mapping Tool- Disadvantage Communities Reporter
  • Climate and Economic Justice Screening Tool
	As defined by Act 154, environmental justice	▪ Vermont Environmental Disparity Index and Environmental Risk
		▪ Forthcoming Environmental

[3] Vermont Climate Council's Guiding Principles for a Just Transition

• EPA-EJ screening and mapping tool ▪ Economic Innovation Group's Distressed Communities Index (DCI) Interactive Map: relative distress scores and economic distress characteristics ▪ DOE's Low-Income Energy Affordability Data (LEAD) Tool ▪ Social Vulnerability Index Score (relative health burden; GMP used as part of their scoring) ▪ EIG's Opportunity Zone Activity Map, Distressed Energy Community, Disadvantaged Community	populations are "any census block group in which: (A) the annual median household income is not more than 80% of the State median household income; (B) Person of Color and Indigenous Peoples comprise at least 6% or more of the population; or (C) at least 1% or more of households have limited English proficiency."	Justice Communities Tool (S.248) ▪ Municipal Vulnerabilities Index (Climate Action Office) ▪ Vermont Community Index/Underserved Communities (AOA) ▪ Vermont Department of Health's vulnerability indicators

Most of these tools rely on American Community Survey data and the census tract resolution is often too coarse to be very useful. For example, using the Climate & Economic Justice Screening Tool (CJEST) associated with the Justice 40 campaign (which uses data from DOE's LEAD Score, the EPA's EJScreen, and ACS) only 1 Barre City Tract would qualify as disadvantaged in Central Vermont; although the improved energy justice map viewer with the 36 burden indicators could be useful in the context of project prioritization at the state and perhaps at the regional level, they do not provide useful insights for municipal scale planning. They are however, attached to eligibility for funding and technical assistance programs making these useful and important guardrails, albeit coarse ones. Meaningful community level asset inventories, needs assessments, sustained community engagement, and related efforts will be critical going forward to drive frontline community identification for prioritization--any of these could be included as pathway actions for implementation. Furthermore, establishing an iterative process where this is done regularly and to the project scale is a pathway that merits consideration.

The implementation actions identified in this section focus primarily in areas where the Central Vermont Regional Planning Commission is already working to support its member municipalities through energy, local land use, transportation, environmental, and health equity planning activities. To this end, implementation actions are aggregated from across this plan to establish consistency across the different programs and priorities; to ensure all the categories for implementation as noted above were adequately addressed, guidance from the Department of Public Service related to implementation was utilized. Where appropriate, the implementation actions and pathways identify who will be responsible for completing each action, the timeframe for when it should be completed, and an anticipated outcome that will help provide measures for success. These pathways serve as the basis for how energy planning will be incorporated into regional activities, with suggestions for municipalities as well.

Economic Needs & Opportunities

While Central Vermont is home to key members of the Clean Energy Industry, not only in Vermont but nationally, a significant challenge in the implementation of the region's energy goals is lack of workforce. Supporting workforce development at a rapid rate has to become a key priority for all those engaged with climate and energy planning. The Clean Energy Industry Report has tracked Vermont employment in the clean energy sectors since 2014. As of 2020, clean energy jobs made up about 6% of total employment in Vermont. Generally, the median wage for clean energy jobs (approx. $27/hour) is much higher than the statewide median wage (approx. $19/hour). Meeting our climate commitments via investments in energy efficiency and

clean energy can be a win for Vermont consumers, the Vermont economy, and Vermont workers. Updated public service report.

Landuse and Balancing Regional Priorities

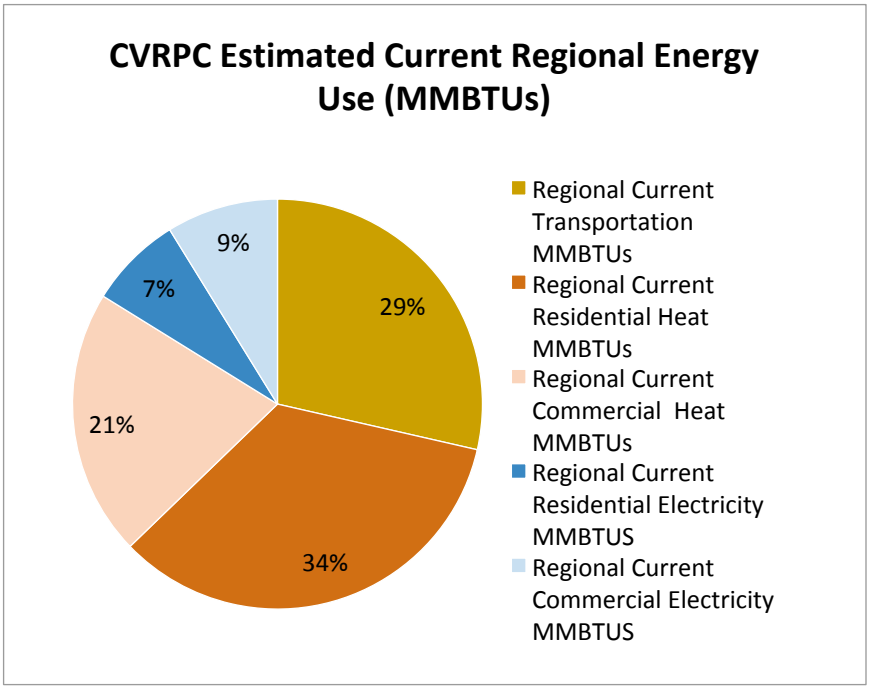
Towns and regions have experience with, and see the direct local impacts of, land use planning. This includes planning for shared and beneficial infrastructure of many kinds, such as roads and industrial and commercial developments. Energy infrastructure, including generators, similarly serves a public purpose, while also creating both costs and benefits that are not distributed evenly. Energy planning is not just about electricity generation, however. Over half of Vermont's energy use is for heat and transportation, and local and regional decisions regarding buildings, roads, and other built infrastructure also have significant energy implications. For example, building a home or commercial building in a particular location will have implications for the energy required to travel to and from that building for decades. Given the pressing economic and environmental challenges associated with the use of fossil fuels, all aspects of planning must be undertaken with energy implications in mind. Municipal and regional planning that addresses all of these factors will improve Vermonters' quality of life. Act 174 provides an opportunity for regions and municipalities – from the planning commissions and selectboards to energy committees and citizens – to shape and inform their own energy future, as well as the energy future of the entire state.

Rural development patterns directly impact transportation energy usage, especially regarding individual behaviors. With limited transit infrastructure, the region is dominated by single-occupancy fossil-fuel vehicles. Residents typically commute to disparate labor market areas, reducing opportunities for carpooling. VTrans offers guidance and grant assistance to municipalities who wish to establish park and rides on municipal, state, or leased property on or near state highways, as well as other TDM options. Mixed-use, higher density neighborhoods encourage more pedestrian and micro-mobility options.

4. Regional Energy Use Summary

Table 4 Estimates Current Regional Energy Use

Source: Municipal Consumption Worksheet Department of Public Service- ACS 5 Year Estimates



Sector	Current Regional Energy Use (MMBTUs)
Transportation (LDV)	**2,829,963**
Residential Thermal	3,386,790
Commercial Thermal	2,083,630
Total Thermal	**5,477,225**
Residential Electric	729,483
Commercial & Industrial Electric	872,505
Total Electric	**1,601,987**

Broadly across 2020-2023, the thermal sector is still the largest energy use at 57% including both residential and commercial space and water heating. Transportation is the second largest energy use in the region accounting for 27% of total usage although it is important to note this is limited to light-duty vehicles (commercial and medium- and heavy- duty data not available), followed by the electric sector at 16%.

The sections below focus on the electric, thermal, and transportation sectors one at a time, introducing current use, regional targets, key challenges, and pathways. However, it is important to consider inter-sector impacts and measures. For examples, the electrification of the transportation and thermal sectors is demanding a state wide rethinking of electrical efficiency targets and use trajectories (increasing), while geothermal and waste heat recovery systems can offset increasing electric thermal load; weatherization is a key precursor to fuel switching impacts, while fuel switching and HVAC retrofits should consider future potential project phases including on-site generation and storage, etc.

NOTA BENE- COULD MOVE MUCH OF THE ENERGY EXCERPT FOR THE INFRASTRUCTURE CHAPTER HERE (UTILITIES, EXISTING GENERATION AND INFRASTRUCTURE, EXISTING NEEDS/KEY ISSUE)

5. Thermal Sector- Residential

This section provides a coarse regional overview of current energy use in the thermal sector- space and water heating- in the residential and commercial sectors, followed by sector targets, and pathways to meet them. The residential thermal sector currently makes up the largest share of regional energy use (see table 4 above); the tables below provide a rough summary of fuel types and how homes are heated in the Central Vermont Region. These estimates are based on 2022 ACS 5-year estimates, which have large margins of error especially in rural areas and only identify one primary heating fuel while many residents use two or more (see Methodology Supplement for detailed discussion). Fossil fuels continue to be the predominant source of residential heating in Central Vermont with fuel oil the most widely used reported in 49% of CVRPC households (51% of owner-occupied and 43% of renter-occupied CVRPC households), followed by propane; together reported in 78% of the regions households (82% of renter-occupied homes and 77% of owner-occupied homes). Wood/biomass is used in approximately 14% of the regions homes (18% owner-occupied and only 4% renter-occupied homes). Variation across our region is high; in a quarter of the towns in our region wood is used in 34-43% of homes (see below for further discussion of wood heat). Approximately 6% of homes report electricity as their heat source, this is a slight increase from the previous plan which is interpreted as likely to be heat pumps, although the base % is likely to be residual electric resistance heat- as we track changes in electric heat into the future, it will likely increase with the adoption of air sourced and ground source heat pumps, although this may be obscured if they are used, as they often are, in combination with other heating sources (thus it will depend on if they are reported as primary or secondary sources). Lastly, due to large margins of error, it is difficult to determine if there are indeed less than 1% of households still using coal and without fuel; it is difficult to interpret the categories of solar and other, solar may refer to passive or active solar heating, or given the rise since the last plan it's possible respondents have installed solar panels and have heat pumps and are misidentifying their fuel type. The predominance of fossil fuel in the residential heating sector is a cost burden to our region's residents and contributes a relatively small

amount of in state labor to our economy (in comparison to cord wood or even electricity which keep more jobs and dollars local); there is a clear opportunity and responsibility across the region to consider fuel-switching (primary heating source or entirely), weatherization and other efficiency measures which will reduce fuel use and emissions contributions (see below).

Table 5 Current Regional Residential Heating Energy Use by Fuel Source

Residential Fuel Source	2020 ACS 5 Year Estimate				2015 ACS 5 Year Estimate			
	CVRPC Households	CVRPC % Households	CVRPC Square Footage Heated	CVRPC BTU (in Billions)	CVRPC Households	CVRPC % of Households	CVRPC Square Footage Heated	CVRPC BTU (in Billions)
Natural Gas & Propane	7,935	29%	12,927,060	776	5,983	22%	9,632,438	578
Electricity	1,534	6%	1,937,060	116	1,206	5%	1,494,263	90
Fuel Oil	13,376	49%	23,073,188	1,384	14,238	53%	24,431,228	1,466
Coal	15	<1%	29,352	1.8	66	<1%	132,664	8
Wood	3,875	14%	7,342,750	441	5,031	19%	9,493,439	570
Other (Solar +)	656	2%	1,117,591	67	392	2%	696,536	42
No Fuel	34	<1%	44,545	2.7	22	<1%	42,680	3
Total	**27,425**		**46,427,157**	**2788**	**26,938**		**45,923,248**	**2755**

Source: 2016-2020 5 Year American Community Survey; 2011-2015 ACS; DPO4, B25117, B25010

Table 6 Current Regional Residential Heating Cost Estimate

Fuel Type	Standard Unit	BTUs/Unit	Cost/Unit	Total Regional Current Costs	Source (cost/unit)
Fuel Oil, kerosene, etc.	Gallon	140,000	$4.133	40,869,208.29	Vermont Average Residential-EIA (March 2024)
Bottled, tank, or LP gas (propane)	Gallon	91,000	$3.575	30,470,927.14	Vermont Average Residential-EIA (March 2024)
Coal or coke	Ton	19,590,000	$500	44,949.46	VT newspapers and quote VT&NH suppliers
Wood (seasoned)	Cord	20,000,000	$350	7,709,887.50	(275 green-450 kiln dried) VT newspapers and quoted VT suppliers
Wood Pellets	Ton	16,400,000	$405		Vermont wood/pick-up; Energy Co-op of VT
Electricity	Kilowatt	3,412	$0.2109	3,939,594.36	**VT State Energy Profile, US**

hour		Energy Information Administration
Other Fuel	4,142,353.99	
Regional Total Cost	**$87,176,920.74**	

Tables 5, 6,& 8 are based on total occupied units, but there are many seasonal, recreation, and/or occasional use (2nd) homes across the region (2022 ACS 5-Year Average B25004 Vacancy Characteristics). Table 7, in the supplement, supplies an additional adder to take into consideration thermal use in these homes: 4,137 homes across the region accounting for approximately 97,201.5 additional MMBTUs of energy use (conservatively). While thus far fewer low temperature degree days in the winter has yet to result in reduced fuel consumption in the winter (without stable declining temperatures, residents may not adjust as naturally to cold temperatures), more frequent high temperature degree days are associated with increased heat-related health issues (VDH Climate Dashboard) including Central Vermont where few have adopted air conditioning and the threshold for health impacts is lower (86 as compared to 90 in Burlington). The increased use of air conditioning in the region will need to be assessed in future updates, as we continued to experience increasingly extreme storms, loss of stable seasons, and overall warmer, wetter conditions associated with Climate Change.

TABLE 8 Current Regional Residential Fuel Use by Type (see supplement for by Town)

% of Fuel Use by Tenure	**REGION TOTAL**					
	Owner Occupied		Renter Occupied		**Regional Total**	
	Totals	%	Totals	%	**Totals**	**%**
Utility gas	238	1%	337	5%	**575**	**2%**
Bottled, tank, or LP gas	5,108	25%	2,252	32%	**7,360**	**27%**
Electricity	548	3%	986	14%	**1,534**	**6%**
Fuel oil, kerosene, etc.	10,355	51%	3,021	43%	**13,376**	**49%**
Coal or coke	15	0%	0	0%	**15**	**0%**
Wood	3,613	18%	262	4%	**3,875**	**14%**
Other Fuel	491	2%	165	2%	**656**	**2%**
No fuel used	15	0%	19	0%	**34**	**0%**

Wood Heat

The Department of Public Service in the 2022 Comprehensive Energy Plan reports that 21%-22% of the total heating demand in Vermont is currently met by wood heat with cordwood alone supplying almost 18% of all heating (pp 193 VT CEP). While only based on 502 household participants (including approximately 100 in Washington county and a little over 50 in Orange County), the State's 2018-2019 Residential Fuel Assessment provides the most comprehensive, albeit intermittent, report on wood use. Approximately 35% of Vermont households report burning cordwood for primary (22%) or supplemental (13%) space heating during the 2018-2019 season (a steady rate since the 90s for primary heating %). In 2018-2019, Vermonters used over 400,000 cords of wood, averaging 6 cords per household using it as primary heat, and 2 cords per household using it as supplementary heat; those reporting wood pellets approximately half use as their primary heating (4 tons on average compared to 1 ton on average for those using it for supplementary heat). Approximately a third of

households and more than 2/3 of those burning wood report using woodstoves, approximately 8% wood pellet stoves, and very few fireplace woodstove inserts, wood furnace or boilers, or combination furnaces.

While previous iterations of the assessment found a correlation between more heating degree days and more wood consumption, this newest assessment found that the less severe winter season than average still resulted in more wood use than average. While the report does not posit an explanation, increasing unpredictable weather conditions and temperatures associated with our changing climate and our aging housing stock are likely key factors.

Central Vermont broadly follows Vermont trends: wood is widely used for residential heating with an estimated 47% of Vermont homes relying on it as their primary or secondary heat source (2018-2019 Heating Season Residential Fuel Assessment Report), increased popularity in schools (replacing fuel oil), and a recent jump in small commercial and residential buildings converting to pellet boilers or pellet stoves as a supplemental heat source (VT CEP pp159). While this section will focus mostly on residential wood heating, wood heating is also a key system in our regions schools, municipal buildings, and as part of some industrial processes. In Central Vermont, approximately 18% of owner-occupied and 4% of renter-occupied housing units use wood for a total of approximately 15% of occupied housing units in the region (Table 9, below). There are clear geographic and demographic trends across the region regarding wood use; wood makes up 34-43% of household heating sources along the north of our region including Calais, Marshfield, Woodbury, Worcester, and Cabot (as well as Washington), while the less densely populated municipalities throughout the rest of the region range from 15-26% (including Middlesex, Roxbury, Plainfield, Duxbury, East Montpelier, Orange, Fayston, Moretown, and Warren), with significantly less use in our density centers ranging from 4-14% in Barre City, Waterbury, Montpelier, Waitsfield, Berlin, Barre Town, Williamstown, and Northfield (see Table below).

Table 9 Current Wood Fuel Use in Occupied Housing Units by Town

	Owner Occupied		Renter Occupied		Total Occupied	
Orange	86	22.4%	0	0.0%	**86**	**20.4%**
Washington	169	34.2%	12	42.9%	**181**	**34.7%**
Williamstown	160	13.1%	0	0.0%	**160**	**12.2%**
Barre City	98	5.6%	48	2.4%	146	3.8%
Barre Town	393	12.9%	0	0.0%	**393**	**11.0%**
Berlin	88	9.2%	13	10.5%	**101**	**9.3%**
Cabot	181	35.4%	28	28.9%	**209**	**34.4%**
Calais	295	46.6%	14	15.6%	**309**	**42.7%**
Duxbury	130	26.9%	3	3.6%	**133**	**23.4%**
East Montpelier	239	24.3%	5	3.5%	**244**	**21.7%**
Fayston	78	18.6%	0	0.0%	**78**	**16.5%**
Marshfield	198	36.3%	28	42.4%	**226**	**37.0%**
Middlesex	177	25.0%	13	40.6%	**190**	**25.7%**
Montpelier	251	11.7%	14	0.8%	**265**	**6.9%**
Moretown	119	19.2%	3	2.9%	**122**	**16.9%**
Northfield	257	19.0%	0	0.0%	**257**	**14.2%**
Plainfield	114	30.6%	17	10.0%	**131**	**24.2%**
Roxbury	94	25.8%	14	21.9%	**108**	**25.2%**
Waitsfield	54	8.3%	11	5.3%	**65**	**7.6%**

Warren	116	18.5%	0	0.0%	**116**	**15.3%**
Waterbury	96	6.4%	0	0.0%	**96**	**4.4%**
Woodbury	94	35.6%	17	58.6%	**111**	**37.9%**
Worcester	126	38.1%	22	27.5%	**148**	**36.0%**

Source: 2022 ACS 5-year average B25117

Efficient wood heat (efficient stoves or automated boilers and furnaces) reduces greenhouse gas emissions and heating costs compared to fossil heat. Unlike heat pumps, for which the potential savings or costs do vary depending on utility territory among other factors, cost savings from the use of efficient wood and pellet stoves are often more straightforward (although automated wood pellet boilers do often depend on equipment purchase incentives to achieve pricey parity). Furthermore, cordwood in particular is readily available (although see challenges below); among households using wood heat (primary and secondary) over 1/3 report they themselves, an immediate family member, or a friend cut the wood personally, while approximately ½ report they purchased log lengths. Together, these characteristics make efficient wood heat a particularly important pathway for fixed and low-income residents in our region to reduce their costs and greenhouse gas emissions however not all forms of advance wood heat are equally in line with the state's goals for air quality, forest ecology, and energy (see Challenges starting page 196 2022 CEP, see the CEP for more on wood supply and current programs as well).

Wood heat has an additional role to play managing and reducing peak winter electrical loads, either stand alone or in combination with heat pumps, wood stoves provide opportunities for homes, schools, and municipal buildings to avoid peak electric costs during cold snaps as well as regular use. In addition to flexibility, advanced wood heat options can provide resilience benefits, again either stand alone or in combination with heat pumps; smaller and more affordable battery systems could also be integrated to provide backup power to advanced wood heat components which require less power than heat pumps to operate (the CEP and CAP note a potential role for advanced wood heat as part of the utility demand response programs to further reduce thermal electric loads especially when wholesale electricity prices and GHG emissions are at peaks).

Common perceived benefits of advanced wood heat are economic, tied to the idea that the use of wood keeps heating dollars in the local economy and supports forest-product jobs and businesses. While this was well-established by the Baseline Assessment of Wood Heating in Vermont (2016) for cordwood (updates can be found in the CEP and CAP), the same assessment found that over ¾ of bulk pellets burned in VT are imported from outside Vermont; at the time of writing there were only 2 pellet producers in the state. While pellets and chips may still be a viable choice for some, including many of our region's schools, municipal buildings, and some homes, there are added vehicle miles traveled and energy used in processing to account for. These considerations together with the availability and accessibility of cordwood, as well as the existing use, suggest cordwood remains an important option for central Vermonters, especially for residential heating. However, despite its commonness, much is produced by inefficient woodstoves. Thus, CVRPC supports the transition from fossil fuel heating fuels using not only heat pumps (air and ground sourced), but also strongly supports the conversion of inefficient wood stoves to advanced wood heat stoves to reduce air pollution emissions, reduce heating costs, amount of wood fuel used, and provide an accessible option for many Vermonters- our targets for the thermal sector reflect this commitment.

Commercial Thermal

Table 10 Current Regional Commercial Thermal (Heating) Energy Use

Commercial Establishments	Average Thermal Energy Used Per Establishment (MMBTUs)	Regional Commercial Thermal Energy Use (MMBTUs)
2231	934	2,083,630

Source: Municipal Consumption Tool, CVRPC & Department of Public Service using data from the Department of Labor

Most of the region's commercial/industrial energy usage can be attributed to space heating and process heating. There is less distinction between many of our region's businesses' buildings and the residential sector, though in more developed towns we do have more conventional commercial premises. Many of our region's schools are on wood heat, and several of our larger businesses have championed net-zero buildings and practices. Harnessing the expertise and capacity of our region's experts to mentor and support small commercial businesses to do the same may be a key way to implement our targets (see below).

Act 172 Municipal Energy Resilience Grant Program:
Regional Analyses in Progress

- Establish Energy Use Baseline for each town (municipal buildings & facilities)
  - Annual Energy use across sectors
  - Building Audit results
- Town and Regional Goals
  - Cost Savings
  - Resilience
  - Future Demand
  - GHG Emissions
- Resident Uptake Efficiency Measures

Thermal Sector Goals & Targets

Table 11 Residential Weatherization Targets

Regional **Residential** New Retrofits (Number of Housing Units)						
Scenario	**2020**	**2025**	**2030**	**2035**	**2040**	**2050**
Baseline Scenario	1,378	2,847	4,205	5,496	6,833	9,658
CAP Mitigation	2,202	7,758	13,314	16,767	20,219	27,125
Target % of Homes Weatherized*						
Baseline Scenario		10%		18%		30%
CAP Mitigation		28%		56%		85%

Table 11 identifies the number of existing residential structures in Central Vermont that would need to be weatherized in each of the target years to meet the State's energy goals (CAP Mitigation, Baseline scenario indicates business as usual). Targets are cumulative.

Weatherization

A portion of Central Vermont's housing stock is older and was constructed at a time when no specific codes existed for energy efficiency. Residential Building Energy Standards (RBES) and the Commercial Building Energy Standards (CBES) for new construction set minimum thresholds for energy efficiency. This will encourage new construction to address energy efficiency, however a lack of enforcement may hinder implementation.

Weatherization of our buildings across sectors is one of the most important pathways for our region; it is not only a key conservation of electricity and emissions reduction strategy but also has significant health and financial benefits Energy-burdened Vermonters spend disproportionately more of their income on energy especially heating, heating (and increasing cooling) that escapes through leaky windows, cracks in the doors, and poorly insulated building envelopes. Recent research on energy burden and the need for integrated low-income housing and energy policy shows multiple, interrelated health risks are linked to and intensified by energy burden[4]. For example, high and/or overdue energy bills can contribute to stress and mental health concerns, which can exacerbate adverse decision-making about heating/cooling, which can then further exacerbate health issues such as asthma, heart disease, and malnutrition, as well as physical inactivity.

In Central Vermont, there are 2 main entities involved with weatherization: **Capstone Community Action** provides weatherization for lowest income residents (see table below for number of homes weatherized per year in recent years), while **Efficiency Vermont** provides weatherization services and income-based incentives for other residents and businesses. (see supplements for savings and breakdown). Capstone Community Action administers Vermont's Weatherization Assistance Program in Central VT which aims to help low-income Vermonters save fuel and money by improving the energy efficiency, health and safety of their home while reducing carbon emissions. On average, the program makes about $10,000 worth of improvements per home, installs about 1,500 square feet of insulation, and reduces drafts by about 40%[5] (see table below for project counts).

> *"The largest barrier to low-income home weatherization continues to be the presence of vermiculite insulation, a material known for containing asbestos. Unfortunately, there are also many other structural issues present in Vermont's older housing stock which can prohibit Weatherization such as leaky roofs, wet basements, knob and tube wiring, and other structural issues. Historically, these issues would "defer" weatherization of a home indefinitely. Vermont's Weatherization Program has adopted a "zero deferral" policy in recognition that addressing non-energy related issues that otherwise prevent weatherization is a critical equity policy. OEO secured $125,000 of Vermont Low Income Trust for Electricity (VLITE) funds for vermiculite remediation and continues to leverage Zonolite Trust Funds. Additional funding to address deferral issues comes from the Vermont Community Foundation, as well as ARPA State Fiscal Recovery (SFR) funds."* **Performance Indicators for the Weatherization Assistance Program Report to the Vermont Legislature 2022**

[4] https

[5] https://legislature.vermont.gov/Documents/2022/WorkGroups/House%20Appropriations/Reports%20and%20Resources/W~Department%20for%20Children%20and%20Families~Performance%20Indicators%20for%20the%20Vermont%20Weatherization%20Assistance%20Program~1-28-2022.pdf

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. 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. The data below indicates the number of weatherization and energy efficiency projects completed per year across the Central Vermont, while this is not comprehensive, it provides some indication of progress.

Most weatherization assistance funds in Vermont are available to homeowners, and some to commercial properties as well; renters have been identified as a group underserved by the health, comfort, and financial savings associated with weatherization (see Energy Action Network Working Group on Renter Weatherization led by Rights & Democracy for more[6]). Rental housing represents about 30% of Vermont's housing stock- including 25% of occupied units in Central Vermont- and almost 75% of people who rent their homes have incomes under Vermont's median household income of approximately $63,500. Tenants often cannot weatherize their homes because it is cost-prohibitive, but also because major structural changes to a building must include a willing landlord to participate.

The Energy Action Network (EAN) estimated that Vermont needs to weatherize 13,400 homes each year (or at least 90,000 total) by 2030 to meet its climate goals (Efficiency Vermont); currently, less than 2,000 homes are weatherized a year in Vermont- Table 12 provides a summary of homes weatherized in Central Vermont and the profound savings and impacts these programs make. There are not comprehensive numbers of total homes weatherized nor are all projects reported below bring a home up to the same standard of weatherization, however they provide some sense of progress. At the current rate, weatherizing between 300-700 homes a year the region is on pace to meet the baseline scenario provided in Table 11 but falls short of our regional CAP target. There are several likely contributing factors to the nearly doubling of projects this past year including both severe residential damage in the July 2023 flood event and the additional state incentives/rebates expanded for affected properties, and the launch of major federal incentives provided via the Inflation Reduction Act which will expand both existing State programs and additional opportunities through 2031. For example, the **Home Energy Performance-Based Whole-House Rebates (HOMES) Program** will provide eligible households with rebates of $2,000 to $8,000 for whole-home energy-saving retrofits and weatherization such as improving insulation and methodically sealing air leaks. The region has a key opportunity through 2031 to support weatherization and draw down investments which will substantially improve the condition of our housing stock, improve health and wellbeing, and reduce energy burden on top of reducing fossil fuel use and GHG emissions. Additionally, affordable and expanded housing is a key priority for our region and municipalities, building these to energy code (and better yet, to stretch code or higher energy standards) will contribute to the region's weatherization targets.

[6] https://eanvt.org/network-action-teams/tenant-wx/; https://eanvt.org/network-action-teams/weatherization-at-scale-action-team/

Table 12 Summary of 2020-2023 Residential Weatherization (Efficiency Vermont projects include Home Performance with Energy Star, other weatherization projects, and residential new construction projects; their total savings include all measures) (see supplement for expanded table by Town)

	2020		2021		2022		2023	
Total Homes Weatherized (Capstone only)	78		143		112		173	
Performance with ENERGY STAR Projects (Efficiency VT)	136		123		70		329	
Weatherization Projects (Efficiency VT)	40		46		57		143	
Residential New Construction Projects	8		21		25		54	
Total kWh Saved (Capstone)	526.28		49,639.31		38,114.35		106,643.73	
Total MMBTUs Saved (Capstone)	2,680.07		2,843.15		5,220.97		6,915.32	
Total kWh Saved (Efficiency VT))*	3,476,376		471,560					
Thermal MMBTUs Saved (Efficiency VT)*	13,800		32,206		31,520			
	Capstone (Homes)	Efficiency Vermont (Projects)	Capstone (Homes)	Efficiency Vermont (Projects)	Capstone (Homes)	Efficiency Vermont (Projects)	Capstone (Homes)	Efficiency Vermont (Projects)
Regional Total	78	184	143	190	112	152	173	

Capstone Weatherization Central Vermont 2020-2023 (see supplement for totals by Town)

Regional Total (Year)	Total Homes	Multi Family Buildings	Multi Family Units	Single Family Homes	Occupants	kWh Savings	MMBTU Savings
2020	**78**	12	8	70	**146**	**526.28**	**2680.07**
2021	**143**	37	52	91	**257**	**49639.31**	**2843.15**
2022	**112**	37	32	80	**220**	**38114.35**	**5220.97**
2023	**173**	41	41	132	**326**	**106643.73**	**6915.32**

Weatherization of commercial and other buildings will also play a role in meeting our energy goals; focusing on municipal buildings and facilities, schools, and other key community buildings will also support community resilience and health. CVRPC is in the process of developing custom targets for the region based on municipal participation in the Municipal Energy Resilience Program and similar programs.

System Conversions (Fuel Switching)

Similar to weatherization and best following it, older existing buildings will commonly have outdated and inefficient mechanical systems that can be replaced and updated. These often include oil-based heating systems, propane, or inefficient wood-fired units. With advances in technology, cold weather heat pumps, high efficiency wood stoves, and other mechanical systems can provide significant efficiency improvements for existing buildings that reduce fuel use and thus cost and significantly improve the health of occupants. System conversion, and the building modifications sometimes required to do so, can however be a challenge for residents with low and fixed incomes.

Vermonters face on average a thermal energy burden of roughly 4%, while some communities face even higher upwards of 6-7%, with individual Vermonters greater still. Research by Efficiency Vermont shows that towns identified as most severely burdened by thermal costs tend to show low overall thermal spending but have household income well below the statewide median. Furthermore, Efficiency Vermont reports that household fuel use is correlated with income and whether a home is owner or renter occupied, with lower-income households disproportionately using fuel oil and inefficient resistance heating systems while owner-occupied homes are much more likely to heat with wood and less likely to heat with inefficient aged electric resistance than rental properties (163 CEP). Spending is relatively inelastic- consumers do not have a lot of control over the amount of energy they use on an ongoing basis.

As discussed above, there are a considerable number of income-based incentives, rebates, and programs for residents and business owners alike (Efficiency Vermont, Capstone Community Action, and now substantial federal programs- see the State Comprehensive Energy Plan or reach out to your local energy committee for a comprehensive overview). Increasingly, distribution utilities offer programs for income-eligible Vermonters to help lower the cost of energy and take part in the energy transition, this includes incentives for heat pumps, efficient wood stoves, and more for homes, businesses, schools, and municipalities. The High-Efficiency Electric Home Rebate Program will be another additional residential energy program run by the Department of Public Service through 2031 (IRA) to support existing incentive and technical assistance. This program will provide point-of-sale rebates to low- and moderate-income households for a variety of electric technologies, including heat pumps for space heating and cooling, heat pump water heaters, electric stoves and ovens, and electric service upgrades. Eligible households will be able to receive up to $14,000 for installing energy efficient electric equipment, including up to $8,000 for heat pumps, $1,750 for heat pump water heaters, and $840 for electric stoves. Complementary programs including Energy Efficiency Contractor Training Grants to support workforce development, and tax credits and direct pay options for homeowners, municipalities, and other eligible participants for energy efficiency home improvements, on-site renewable generation and storage, up to 30% are also available through 2032.

CVRPC continues to provide information and support to municipalities to promote these programs and opportunities, while working with administrating bodies to remove barriers for lowest income Vermonters and renters. As noted previously, new construction will generally include these high efficiency systems which will help address energy conservation. Additional Efficiency Vermont Efficiency Measures include appliances, lighting, motor controls, etc. and future, continuing these measures also importantly contribute to our targets as outlined below and for total residential demand as included in the supplement.

Table 13 Efficiency Vermont Regional Summary Selected Measures

	2020	2021	2022	Total

Heat Pump Water Heat Installations	260	321	307	**888**
Cold Climate Heat Pump Installations	618	711	817	**2146**
Wood Heating Installations	178	240	82	**500**
Total Regional Quantity Additional Efficiency Measures				
Air Conditioning Efficiency	299	269	371	**939**
Behavior	0	0	0	**0**
Cooking and Laundry	1,058	1,254	1,044	**3,356**
Flexible Load Management	0	17	9	**26**
Health and Safety	1	0	0	**1**
Hot Water	619	597	628	**1,844**
Lighting	34,390	12,661	10,467	**57,518**
Motors and Motor Controls	738	644	1,036	**2,418**
Office Equipment/Electronics	43	0	0	**43**
Refrigeration	1,381	1,352	774	**3,507**
Space Heating	1,632	1,158	1,073	**3,863**
Thermal Shell	535	539	66,260	**67,334**
Transportation	0	5	93	**98**
Ventilation	78	208	106	**392**
Water conservation	23	41	61	**125**

Tables 14- 17 Provide Thermal Targets for new Residential and Commercial Heat Pumps and Heat Pump Hot Water Heaters; the regional LEAP targets provided by the Public Service Department showing the Baseline trajectory and the Climate Action Plan Mitigation State approach (CAP) are available in full in the supplement. These original targets over emphasized the electrification of the thermal sector for the region and undervalue the role of efficient wood stoves. These targets were adjusted for the region (methodology in the supplement). Based on Table 13 above and the current pace of projects is maintained, CVPRC is likely on track to meet the heat pump target (approximately 1270 a year needed per year over the next 25 years to make the target), but only at around 1/3 of the adoption rate needed to meet the heat pump hot water heater. While on target for heat pumps, rising electric rates and particularly the ability of existing infrastructure and systems to integrate a large electric demand increase from the thermal sector are major concerns (see below for grid and infrastructure conditions and limitations).

Table 19 provides a new target developed by CVRPC in recognition of the role wood heating plays in the region and can continue to do so as part of our energy policy and goals, specifically cord wood. These targets focus on the conversion of aged and/or inefficient woodstoves (cord wood) to high efficiency replacements. These targets are based on the constants used in current use estimates (see above and supplement), Efficiency Vermont projections that advanced wood heat conversion reduces fuel use by approximately 1/3 which was further reduced to 2/3 fuel use per home based on weatherization and conversion of some wood heating use from primary to secondary heating source (thus reflecting an average per household of 5.69 cords

per year to 1.9 cords). While data on wood heating is coarse, see detailed discussion above, this target uses current use as a starting point at 2025, and strives for 20% of households to convert per target year through to 80% in 2050 (these leaves room for the unknown number of existing high efficiency wood stoves, etc). These targets increase the demand from wood per the LEAP targets provided by the Department of Public Service for the target 2050 but reflects a significantly lower estimation of demand in all previous years. CVRPC is working with the Department of Public Service and other partners to refine these LEAP targets to better reflect current use (see supplement). Despite this, the pairing of these targets for residential heating remain in line with the region's approach: a transition from fossil fuels and inefficient heating types (e.g. electric resistance) towards residential heating demand dominated by high efficiency electric and cord wood technologies (whether combined or not at a household level).

Table 18 CAP Mitigation Regional Residential Thermal Demand (Thousands MMBTUs)

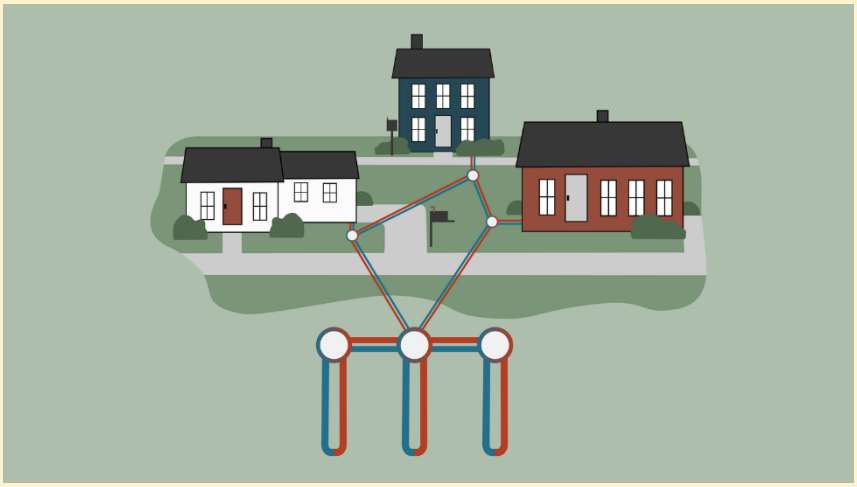
CAP Mitigation Regional **Residential** Thermal Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	120	264	376	487	595	633
HP	1	136	231	322	413	453
HPWH	2	23	49	76	103	104
Electric Resistance	40	29	21	14	8	7
~~Wood~~	~~910~~	~~733~~	~~535~~	~~400~~	~~286~~	~~182~~
Propane	475	375	273	183	101	67
Wood Pellets	225	69	57	50	45	42
Biodiesel	-	51	224	285	245	176
Heating Oil	1,140	827	404	140	-	-
Biogas	-	-	-	-	-	-
Natural Gas	-	-	-	-	-	-
Total	**2,870**	**2,318**	**1,869**	**1,544**	**1,272**	**1,100**

Table 19 Targets for Residential High Efficiency Wood Heat Conversions

	2025	2030	2035	2040	2050
Existing Wood (homes)	4000	3200	2400	1600	800
New High Efficiency Wood Heat (homes)	0	800	1600	2400	3200
% converted	0%	20%	40%	60%	80%
Total Cords Used	22730	19725	16691	13656	10621
Thousands MMBTUs	454.608	394.507	333.813	273.120	212.427

Weatherization and fuel switching are two core components of CVRP's multi-pronged approach to meeting thermal and electric sector goals but the above are also key for our region. CVRPC is working with municipalities, regional, and state partners to integrate these into the 2025 comprehensive regional plan update including energy targets and analyses (including Infrastructure, Housing, and Healthy Communities Chapters). NOTA BENE- I have short over arching blurbs on each of the blue boxes above- if you want to go the "Two Rivers" route of super high level and move most of the above sections also the supplements- we can do that!

Maximize Infrastructure Investments: Wasteheat Recovery



Many Vermont communities are taking advantage of new levels of state and federal funding to install, expand, and/or upgrade local water and wastewater systems. Integrating wasteheat recovery into wastewater systems is a terrific way to maximize the benefits of such an investment by recovering heat from wastewater to make potable hot water and to heat buildings (wastewater can also be used as a heat sink to cool buildings). Wastewater is a continuous and existing source of thermal energy; the average residential wastewater temperature is 70°F while commercial and industrial wastewater can be up to 140°F or higher. Heat recovery systems are simple, low maintenance, offer lower, predictable customer heating and cooling bills, and are scalable from one building/facility to much larger community or district thermal energy networks.

For more on how Thermal Energy Networks can be key opportunities to meet local infrastructure needs while reducing energy burden, GHG emissions, and thermal sector energy demand visit Vermont Community Geothermal Alliance for toolkits and more information.)

Tables 14-17

CAP Mitigation Regional **Residential** New Cold Climate Heat Pumps						
Technology	**2020**	**2025**	**2030**	**2035**	**2040**	**2050**
ASHP 2 Head	423	2,549	4,686	6,836	8,995	10,093
ASHP Central	658	3,964	7,311	10,705	14,155	15,727
ASHP HE	622	3,743	6,882	10,039	13,210	14,821
GSHP HE	77	463	851	1,241	1,633	1,832
Total	**1,780**	**10,720**	**19,730**	**28,820**	**37,993**	**42,473**

Regional **Residential** New Heat Pump Water Heaters (Number of Units)						
Scenario	**2020**	**2025**	**2030**	**2035**	**2040**	**2050**
Baseline Scenario	483	569	573	578	581	593
CAP Mitigation	483	7,046	15,213	23,465	31,809	32,196

Baseline Regional **Commercial** New Cold Climate Heat Pumps						
	2020	**2025**	**2030**	**2035**	**2040**	**2050**
New CCHP	316	960	1,827	2,333	2,580	2,710

CAP Mitigation Regional **Commercial** New Cold Climate Heat Pumps						
	2020	**2025**	**2030**	**2035**	**2040**	**2050**
New CCHP	316	5,682	11,298	17,184	21,120	21,977

CONSERVATION AND EFFICIENCY- Thermal Energy

Goals: Increase conservation of energy by individuals, organizations, and municipalities. Reducing the amount of energy needed to support existing and future systems is critical to reducing GHG emissions, operations costs, and energy burdens, while optimizing the use of renewable generation and storage.

1. By 2035, weatherize 16,767 housing units; 27,125 by 2050 (subject to change based on State LEAP modelling updates); identify a commercial building weatherization target, and weatherize all municipal buildings & facilities by 2050.
2. By, 2025, 30% of new buildings built to zero energy ready standards and 100% by 2030
3. By 2050, install 42,473 new cold climate heat pumps (both air-sourced and ground-sourced) and approximately 32,196 heat pump hot water heaters in the residential sector; and 21,977 commercial cold climate heat pumps.
4. By 2035, 50% of new residential, commercial, and industrial developments of 20,000sqft and above will use geothermal heating systems, and/or be part of a thermal energy networks and/or include wasteheat recovery.

Policies:

1. CVRPC supports an approach to electrification of residential thermal loads that includes not only air-source heat pumps, but also ground-source heat pumps, and, critically, where appropriate, in combination with high efficiency cord wood stoves.
2. CVRPC supports state efforts to provide additional funding for weatherization, and weatherization ready(e.g. health & safetfy), improvements, especially for low0 and moderate- income Vermonters.
3. New residential, commercial, and industrial developments subject to Act 250 shall not use fossil fuel combustion as a primary heating source
4. Developers of new residential, commercial, and industrial projects subject to Act 250 shall demonstrate due consideration of ground-source (geothermal) heat pumps as a method of heating and cooling. Developer must also demonstrate due consideration of heat recovery technologies such as Energy Recover Ventilators (ERVs) and heat recovery from large scale refrigeration, hot water-use, and/or industrial processes as applicable.
5. CVRPC supports net-zero energy construction throughout the Region.
6. CVRPC supports the creation of enforcmenet mechanisms to enhance compliance with Vermont's Residential and Commercial Building Energy Standards (RBES and CBES).

Strategy

Connect municipalities, including residents, businesses, and other interested parties, with organizations, state programs (including Weatherization Assistance Program), incentives/rebates (Energy Efficiency Utility and Distribution Utilities), and best practices in weatherization, HVAC, efficient design, appliances, lighting, decarbonization, etc.

- Programs and opportunities included in CVRPC weekly newsletters, and quarterly digests.
- Updated materials in town buildings.
- Collaborates with partners to increase regional participation and facilitates training and information sessions for municipalities and local energy champions.
- Support drawdown of IRA and other federal monies
- Maximize participation in income-based programs

(Partners Efficiency Vermont, Distribution Utilities, Capstone Community Action, VEEP (Vermont Energy Education Program), BGS (Buildings

and General Services) (Buildings and General Services), PSD (Public Service Department), VLCT, VCLN, VCRD (Vermont Council on Rural Development))
Coordinate and support municipal residential weatherization campaigns including WindowDressers Community Builds, Button Up!, establishment of revolving loan funds to cover up front costs for residents, etc. ● streamline outreach and recruitment ● connect municipalities and communities to existing resources and partners ● maximize incentive and rebate use; federal funding drawdown ● establish town: town leadership development for program expansion ● connect to stable funding sources (Partners include WindowDressers, Efficiency Vermont, Capstone Community Action, ReSOURCE)
Support existing, and the development of, municipal energy committees and coordinators to establish and implement municipal energy goals.
Provide technical assistance to municipalities and encourage municipal bylaws that promote energy conservation and the development of renewable energy resources
Support State, utility, and other energy and conservation program development to facilitate weatherization, fuel, switching, and increased energy savings and comfort within Central Vermont housing and other buildings stock ● Advocate for models that are most accessible for underserved residents especially low-income households, those on fixed incomes, and renters- that cover up front costs, minimal eligibility requirements and administration, and can meet acute needs (at point of failure) ● Promote program commitments for allocating program funds and benefits based on energy equity metrics
Develop a summary of needs and measures across municipal buildings & facilities via the Municipal Energy Resilience Grant Program assessment reports: • Establish municipal energy use baselines • Model project development and develop funding stacks • Support implementation

Goal: Promote climate-ready, resiliency, and energy efficiency in the design, construction, renovation, operation, and retrofitting of systems for buildings and structures. Energy efficient building designs provide benefits to the owners and occupants by reducing the amount of energy needed to heat, cool, and maintain the mechanical systems within the building. Establishing and promoting energy efficiency in design, construction, retrofits, and renovations will ensure new buildings and building practices will be more efficient into the future. These efficiencies can also lead to conservation of energy which can promote cost savings and affordability for owners and renters.

Strategy
Promote Vermont's Residential and Commercial Energy Building Standers (RBES/CBES) for new construction and existing building additions,

alternations, renovations, repairs, and retrofits. ● provide education and support to interested municipalities to adopt stretch code, hire code officials, and/or host educational training ● support regular state code updates and update necessary materials/trainings/best practices to newest adopted standards ● Host and facilitate building science/standards training and education opportunities for local officials, zoning administrators, and relevant workforce development groups to promote the distribution of code information to permit applications and ensure code compliance. ● Promote benchmarking for commercial buildings.
Work with municipalities to develop local energy codes, education programs, and/or promoting energy efficient site design, "net-zero ready"[7] best practices (e.g., solar/EVSE ready), and renewable energy generation and energy storage use in new construction projects that require an Act 250 permit (or writ large) ● Review local zoning bylaws and offer technical assistance to development review boards when evaluating the energy, climate, and health implications of site plans for proposed developments. ● Work with housing and energy efficiency organizations to promote and improve the regional supply of affordable, high efficiency manufactured housing, such as Zero Energy Modular homes. ● promote the use of landscaping for energy efficiency ● promote the use of incentives (e.g., density bonuses) to developments located in identified growth areas that exceed stretch code
Support municipal building and facilities to establish energy use baseline and tracking, identify energy efficiency, fuel switching, EVSE, renewable energy & storage, and resiliency measures, and support implementation
Support the identification of waste heat recovery opportunities, thermal resources, and the siting of infill development in proximity to maximize capture and use to reduce electricity load from electrification of heating sector ● Wastewater systems ● Grocery Stores, Ice Rinks, IT centers, food, and drink production/processing, etc.
Work with community organizations or existing businesses to identify available information regarding the use of landscaping for energy efficiency including the importance of tree canopies, pervious surfaces, and similar design practices.
Work with community organizations or existing businesses to identify available information regarding the use of landscaping for energy efficiency including the importance of tree canopies, pervious surfaces, and similar design practices.
Develop regional GHG emissions inventory.

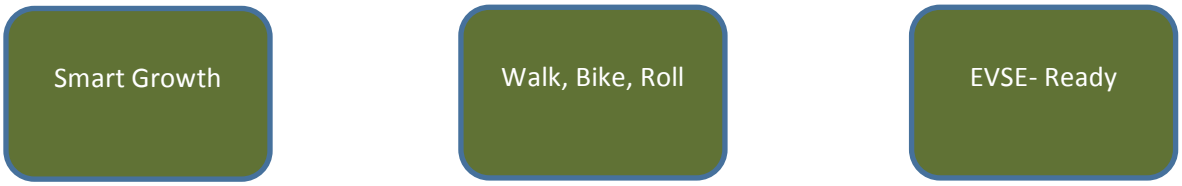
Goal: Identify ways to decrease the use of fossil fuels for heating.

[7] https://publicservice.vermont.gov/sites/dps/files/documents/VT%20Energy%20Code%20Roadmap11-19_8_FINAL.pdf

Strategy
Decrease fossil fuel heating and increase affordable electrification by working with Energy Committees and other Central Vermont Energy Network partners to raise awareness among homeowners, renters, landlords, developers, etc. on the benefits of fossil-fuel-free technology such as cold-climate heat pumps, advanced wood heating and geothermal systems. Examples include thermal-led combined heat and power (CHP), biomass district heating and biogas generation (capturing the methane produced by landfills or farms and using it instead of fossil fuels).
Support upgrade and trade-out programs and incentives for retiring outdated, higher-emission, polluting wood burning stoves and boilers.
Identify potential locations throughout the region that could benefit from district heating projects based on building density, proximity to resources such as biomass, or status as a use by right where applicable.
Work with interested municipalities to evaluate and amend, as necessary, local regulations to ensure district heating or similar centralized renewable generation facilities such as biogas or bio-digesters are permitted in appropriate locations.
Identify sources of renewable materials such as biomass, farm waste, or food waste (such as schools, restaurants, or food processors) to determine supply of alternative fuels that may be available for district heating or other heating alternatives for homes or businesses.
Support the identification of waste heat recovery opportunities, thermal resources, and the siting of infill development in proximity to maximize capture and use to reduce electricity load from electrification of heating sector e.g. Wastewater systems, Grocery Stores, Ice Rinks, IT centers, food, and drink production/processing, etc.
Work with state agencies to identify and inventory known sources and supplies of woody biomass that do not contribute to the spread of Federal or state identified invasive species, nor conflict with conservation and climate resilience goals, and make this information available to the public as appropriate.
Identify opportunities to integrate energy storage technologies such as on site generation & storage into capital planning projects to support micro-grid systems and diversify emergency back-up power resources. ● Provide opportunities for community education and engagement around the role of renewable energy generation and storage in emergency management (recovery & response) as well as the costs, benefits, and challenges associated with these technologies.
Due to the rural nature of Central Vermont, identify and map large farm operations that may provide a sustained source of materials that could be used for bio-digesters.

6. Transportation Sector & Land Use

Transportation is the second largest use of energy in Central Vermont, accounting for a little less than a third of total usage measured in MMBTUs (see Table 4). Fossil fuels account for approximately 94% of the energy statewide we currently use for transportation- a much higher share of fossil fuel dependence than in the other energy sectors. According to the 2024 Energy Action Network Annual Progress Report on Emissions, Energy, Equity, and the Economy, nearly 70% of Vermont's transportation climate pollution comes from the use of motor gasoline for on-road use of light-duty passenger vehicles. Thus, reducing our reliance on fossil fuels used for personal vehicles presents a key opportunity to reduce GHG emissions from fossil fuel use overall. As land use choices are inextricably linked with our transportation system, the transportation sector cannot be effectively nor sustainably addressed by individual choice, instead it is importance to recognized that Vermont's dispersed pattern of development- and how far we travel from hour homes to jobs, services, recreation, and one another is a key reason why our transportation energy demand (and burden) is so high. Vermont's historically dispersed settlement pattern still holds much appeal for many moving to the state, however, communities have been working hard to designate and develop small villages and downtowns, promote infill housing development and improve walk/roll-ability to shift residential development to intentional growth areas and focus infrastructure investment. The Land Use and Transportation chapters in this regional plan complement this section an have additional relevant policies and actions.



CVRP's Multi-Pronged Approach to the Transportation Sector includes Smart Growth, and Walk, Bike, Roll initiatives in addition to fleet electrification/EV adoption (see Land Use, Transportation, and Health Communities Chapters for more detailed discussion of smart growth and walk, bike, roll)

Ultimately, to achieve our comprehensive energy goals, transportation energy use must be reduced by embracing smart growth that directs development into existing centers, providing cost savings for households and municipalities while reducing the extent of development pressure on the environment and building physical and social infrastructures to support thriving communities (cite mention of Act 138, Complete Streets, and designation programs in other chapters).

If the following "call out boxes" are NOT integrated into the Land Use and Transportation Chapters, they can be included here in the text of the plan itself:

The following land use and mobility principles encourage not only reduced transportation energy consumption, but also offer important health equity benefits:

- Encourage the location of new development in or near traditional village and city centers to reduce both sprawl and the number of vehicle miles driven.
- Support transit-oriented development that fosters the expansion of public transportation, micro-mobility (e.g., bikes, e-bikes/scooters), and rail use.
- Encourage the construction of Park and Ride facilities to support carpool and rideshare efforts.
- Encourage the expansion of bicycle and pedestrian facilities such as safe sidewalks and bike lanes, as well as secure parking options for micro-mobility.
- Promote the development of EV charging stations (also known as electric vehicle supply equipment, or EVSE) in Central village centers and downtowns. Especially where resilience benefits can fill backup power gaps.

Additionally, improved telecommunications infrastructure in this region has the potential to reduce annual vehicle miles traveled (VMTs) by allowing more workers to telecommute.

Light-Duty and Fleet Electrification

Table 20 provides an overview of light duty (passenger) vehicles and use in the region. The vast majority of residents in the state, including Central Vermont, use personal vehicles for their daily travel needs. Approximately 3.5% of the 43,506 light duty vehicles in Central Vermont are electric vehicles (including all electric and plug-in hybrid electric vehicles registered by January 2024 (Drive Electric Vermont[8])). The total number of vehicles in the region has decreased slightly, while the number of EVs (Electric Vehicles) has increased quickly in the last few years, increasing by approximately 40% in 2023 alone coincident with the expansion of state, utility, and federal incentive programs.

Table 20. Current Regional Transportation Energy Use

Transportation Data	Regional Data 2022 5-YR ACS			Regional Data 2011-2015 (ACS)
Fuel Type	Internal Combustion Engine (ICE)	Electric Powered (EV)	**Total**	Internal Combustion Engine (ICE)
Total # of Light Duty Vehicles	41,989	1,517	**43,506**	45,584
Average Miles per Vehicle	12,500	9,000		287,500 (12,500/vehicle)

[8] http://www.driveelectricvt.com/buying-guide/why-go-electric

Total Miles Traveled	524,862,500	13,653,000	**538,515,500**	567,650,000
Total Use per Year	23,857,386 gallons	4,551,000 kWh		30,518,817
Transportation MMBTUs	2,701,858	15,528	**2,717,386**	3,396,000
Average Cost per unit	$3.37/gallon	$0.2109/kWh		$2.31
Cost per Year	$80,399,391	$959,806	**$81,359,197**	$70,488,465

Source: Municipal Consumption Tool (Department of Public Service) which uses Table DP04, 2022 ACS 5-Year Estimate used to estimate the count of vehicles associate with area housing units, and State DMV data averages; cost per gallon of gas was taken from EAN Annual Progress Report 2023. EV data was provided by Drive Electric based off DMV registrations as of January 2024. Comparable public transportation and medium and heavy-duty vehicle data is not available, additional information is provided in the Transportation Chapter.

Table 21. EV Registrations

	EV Registration Jan. 2023			EV Registration Jan. 2024			Increase 2023-2024	
	AEV	PHEV	Total EVs	AEV	PHEV	Total EVs	Count	%
REGIONAL TOTAL	588	497	**1085**	921	596	**1517**	**432**	**40%**

As of spring 2024, there are nearly 400 public EV charging stations across the state[9], though not widely distributed throughout Central Vermont. In Central Vermont public chargers can be found in Cabot, Plainfield, Middlesex, Berlin, Northfield, and Roxbury located at schools, municipal buildings, and food coops with; with higher density of chargers located in the Mad River Valley (many at ski resorts), Waterbury, and Montpelier (see map). While many EV drivers across the state charge at home (typically overnight), increasingly workplace and public charging infrastructure has been identified as key to support longer trips/commutes, visitors, or those without charging access at home. CVRPC continues to encourage municipalities and local businesses to install EV charging stations at convenient and desirable locations including workplaces, schools, community centers, recreation sites, libraries, multi-unit buildings, etc., where users could park for several hours in our regional downtowns, village centers, and other designated growth area (e.g. Vt Community Charging program[10]; become a host or solicit community hosts[11]).

Equity considerations must be thoughtfully integrated throughout ESVE planning process to ensure benefits and costs are fairly distributed. Historically, clean energy and transportation innovations have not been deployed evenly across communities -- resulting in higher energy burden and rural, lower-income communities being left behind. EVSE equity concerns that can come up include a project's affordability, accessibility, reliability, location, safety, and related employment and economic opportunities. Drive Electric's Charging Installation Guide provides thorough guidance and workflow for Vermonters and Vermont communities, CVRPC recommends when integrating EVSE into new builds and parking lot upgrades alike, that proximity to electrical panel, zoning setbacks, and other technical considerations are made in addition to including EVSE supported handicap spots.

[9] https://www.driveelectricvt.com/about-evs/charging-map?gad_source=1&gclid=CjwKCAjwtqmwBhBVEiwAL-WAYU8qVxhVDK55M5TSzltPA6SYiVI69Np0Ns-JkkqeFql6e-6UIHCP8xoCsgEQAvD_BwE
[10] https://www.chargevermont.com/
[11] https://survey123.arcgis.com/share/8c15711e4e404a7ca9ed3979640b0121

The VTrans NEVI (National Electric Vehicle Infrastructure) program and the U.S. Department of Transportation's Toolkit for Planning and Funding Rural Electric Mobility Infrastructure offers helpful equity planning considerations and strategies relevant to Central Vermont. When assessing where EV charging stations should be located, engagement with rural, underserved, and high energy burden communities is essential to prevent delayed and diminished access to clean energy and transportation infrastructure vital to a healthy economy. Furthermore EVSE-Ready requirements for new buildings can be explored at the municipal level (see Climate Change and Land Use).

According to the U.S. Department of Energy (DOE), over the long term, EV ownership is typically less expensive than ownership of fossil-fuel vehicles. Additionally, low operation costs make some EVs less expensive on a monthly basis compared to equivalent fossil-fuel vehicles (when the vehicle purchase is financed). Therefore, increased EV adoption in Central Vermont could contribute to community-wide reductions in transportation energy cost burdens. As stated by Drive Electric Vermont, "It costs less to own an EV. Plugging in is like paying $1.50 a gallon, and EVs need less maintenance than gasoline cars." Like fossil fuel vehicles, how cars handle in Vermont's winter and mud seasons varies from make to model. Opportunities for medium and heavy-duty vehicles are expanding; CVRPC strongly encourages municipalities and other fleet operators in the region to consider low diesel and alternative fuel options when replacing these in their fleet to take advantage of State and federal incentive programs[12].

Hidden Resilience Co-Benefits of EVs and EV Charging Infrastructure

Much of the discussion of EVs and EVSE focuses on GHG emissions & fossil fuel use reductions, as well as long term financial benefits to individual households and to the local economy. Perhaps the most appealing co-benefit for some, however, might in fact be that bidirectional EVs can be employed as mobile battery storage adding resilience benefits and demand-response capabilities to a community's building infrastructure and provide energy to external load (discharge) when paired with capable EVSE.

Bidirectional vehicles can provide backup power to communities through vehicle to building (V2B) charging as a microgrid, or provide power to grid through vehicle to grid (V2G) charging. Both V2B and V2G can complement other distributed energy resources (DERs), or supplement diesel generators as backup power and a mobile source at that! This is a particularly important aspect of EVs and EVSE for municipal operations (especially town garages), schools, libraries, and other locations that provide critical social and physical infrastructure on a daily, emergency, and recovery basis. Off-grid EV chargers- like Solarflect- can provide a relatively affordable option for municipalities, public entities, commercial properties, and even homes to support critical loads during outages!

[12] Drive Electric provides the most comprehensive and up to date snap shot of State, Distribution Utilitiy, and Federal incentives, rebates, and inclusions: https://www.driveelectricvt.com/?gad_source=1&gclid=CjwKCAjwtqmwBhBVEiwAL-WAYbmxAzFQ9-5GP2WHd7oP5AzQhS3OPMRCUhERxSZwW2b9d0Fv9rEvyhoCuDIQAvD_BwE , State Diesel Emissions Reduction Assistance Program https://dec.vermont.gov/air-quality/mobile-sources/diesel-emissions/vt-diesel-grant#:~:text=The%20Vermont%20Diesel%20Emissions%20Reduction,diesel%2Dpowered%20engines%20and%20the ; Vermont Clean Cities Coalition provides direct support to municipalities https://cleancities.energy.gov/coalitions/vermont#:~:text=The%20Vermont%20Clean%20Cities%20works,advanced%20vehicle%20technologies%20in%20transportation

Transportation Goals:

Goal: Promote the shift away from gas/diesel vehicles to electric or non-fossil fuel transportation options to reduce dependency on non-renewable fuel sources for transportation (33,359 EVs by 2050).

The tables below represent Central Vermont's share of the State targets of EV adoption (replacement of fossil fuel vehicles), required to meet our broader State energy and emissions goals (according to the current LEAP pathway model).. While Central Vermont is on track for our 2025 goal, and in fact surpassed it, targets increase rapidly thereafter. CVRPC continues to support municipalities, other fleet operators especially schools, and town energy committees to promote education and participation in State, Utility, and Federal incentive programs. See the supplement for additional transportation targets including medium- and heavy-duty vehicles and non-road energy demand and for the baseline (aka business as usual) comparison. CVRPC is working to pull together municipal fleet inventories to better adjust these targets and provide municipalities municipal fleet recommendations.

CAP Mitigation Regional **Passenger Car & Light Duty Truck EV and PHEV Stock** (Number of Vehicles)						
Vehicle Type	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Battery Electric	3	1,163	6,926	16,289	24,669	33,219
Plug In Hybrid	33	122	169	161	107	40
Total	**36**	**1,285**	**7,095**	**16,450**	**24,776**	**33,259**

Ready? You don't need a lot to get started:

- Vehicle Inventory (make & model, year)
- Annual data per vehicle: Vehicle Miles Traveled (VMT), Gallons of fuel used, MPG
- Replacement Schedule

To learn more about technical assistance and funding support for fleet electrification and EVSE CVRPC, Drive Electric, VTrans, and Vermont Clean Cities Coalition are all at the ready! Municipalities can develop fleet electrification and EVSE plans, host EV community events, and support local partners as well.

Strategy

Strategy
Work with municipalities to ensure land use regulations do not prohibit the installation of electric vehicle supply equipment (EVSE, aka charging stations) or similar alternative fuel technologies (such as biodiesel) and identify model language that can be considered by municipalities to support these uses
Promote EVSE ready building practices and retrofits (electrical panel needs); promote the use of EV Meter Socket Adapters to mitigate common obstacles to adoption and enable bidirectional EVSE for charging, vehicle to grid configurations, connection to solar and stationary storage, etc.
Consult with Vermont Energy Investment Corporation's Drive Electric program and other regional/state partners including VTrans, Vermont Clean Cities Coalition, and EmPower to coordinate multi-scale funding, program development, and implementation and stay up to date on current technology trends and opportunities to provide guidance to municipalities. ● Disseminate Drive Electric fleet electrification resources, funding, and technical assistance opportunities; participate in quarterly stakeholder meetings ● Conduct outreach and provide technical assistance to municipalities to participate in State EVSE and fleet electrification programs (via support to ACCD and DHCD (Department of Housing & Community Development), VTrans, and Drive Electric) ● Promote EPA (Environmental Protection Agency) Clean School Bus Program with schools and municipal champions; provide technical assistance around bi-directional options which can be integrated into back-up and emergency power plans ● Support and expand the use of electric powered buses and vans among the public and private transportation providers serving the region ○ including Meals on Wheels, MyRide, Gopher, and other rural transit programs centering frontline communities' needs
Identify businesses and municipalities in the region that operate large fleets of vehicles to provide assistance evaluating the possibility of integrating electric, low-emissions, and/or alternative fuel vehicles into their fleet
Provide training to local zoning and development review boards to consider infrastructure for alternative transportation in their review of site plans.
Support and encourage municipalities and businesses to install EV charging stations at convenient and desirable locations, such as in front of restaurants, stores, tourist and recreational destinations, and community sites like Town Halls and libraries, where users would want to park for several hours. Explore and pursue incentives to defray the cost of installation and administration so that users pay only for electricity. ● promote the integration of EVSE with solar generation including but not limited to solar carports
Support municipal transportation asset sharing and procurement: ● develop equipment and culvert inventories ● develop study and plan for regional sand/gravel resources to reduce costs and vehicle miles traveled especially in high demand conditions (mud season, disaster recovery, etc.)
Support DriveElectric and VTrans to maintain inventory of existing EVSE, condition, and recruit potential site hosts; identify infrastructure gaps and

Strategy
facilitate region-wide access for EV operators ● develop template criteria for EVSE location prioritization to improve access and equity
Support and expand access to fluid biofuels for use in commercial vehicles and heavy equipment in addition to electrification
Consider regulations that would EVSE to be included in large scale developments as appropriate

Goal: Promote the shift away from single-occupancy vehicle trips to reduce congestion, impacts to local facilities, and support alternative options for transportation needs.

Strategy
Promote Transportation Demand Management (TDM) and Ridesharing Programs: ● Promote and support the Go!Vermont program that links travelers to a variety of transportation resources and mobility options ● Develop recommended criteria for supporting public and ridesharing infrastructure integrating health equity recommendations such as curb cuts, cross walks, raised and sheltered bus stops/benches, accessible transit stop sitting, etc. ○ identify key gaps in accessibility of existing public transit infrastructure ● Work with regional partners such as VTrans to ensure inventories of park & ride locations and conditions are up-to-date and are consistent with the State Park & Ride Plan. This may include occupancy studies or user surveys to assess specific needs ● Identify Park & Ride facilities that are near or over capacity to ensure future planning will accommodate expansions, upgrades, modifications, or alternative locations are identified as appropriate ● Support employer programs to encourage telecommuting, carpooling, vanpooling, walking, and biking for employee commute trips (including flexible work hours, remote work options, discounted transit fair, health bonuses, etc.) ● Work with utility companies and municipalities to inventory and map infrastructure such as fiber optic cable to identify gaps that may prohibit information accessibility or telecommuting options
Follow the 2023 Vermont Transportation Equity Framework to help decision makers plan for and prioritize projects, ensure accurate representation in decision making, and enhance the equitable delivery of services.
Support regional infrastructure projects that provide commute alternatives including rail, multi-town greenways/paths, etc. Ensure continued support for inter-municipal and inter-regional public transit. ● Work with municipalities to evaluate and determine the feasibility of intermodal transit facilities in appropriate regional locations that can be supported by infrastructure, population, and resources.
Work with VTrans and Green Mountain Transit to identify future growth areas or development centers to ensure public transit will be

Strategy
accommodated in these locations including access to park & ride locations when appropriate.
Work with public transit providers and other partners to identify underserved communities including unhoused community members, rural areas, low-income neighborhoods, night shift work sites, etc. to identify transit opportunities in these locations (and connected to critical services)
Assist municipalities, regional partners, state agencies, and development community to identify incentives that encourage the inclusion of public transit in land development plans such as reduction in parking requirements, reduced local permit fees, or the like.
Develop clear policy to require large scale developments to consult transit providers regarding the need to include transit, multi-modal, and EVSE infrastructure within development proposals.
Work with regional partners and municipalities to establish a comprehensive transportation plan that incorporates policies and implementation regarding the expansion of public transit that considers locations of park & ride facilities; public facilities such as schools, libraries, health services, wrap around services (shelters, food banks/pantries, addiction recovery services) and government buildings; or other activity centers and uses throughout the Region and identifies possible funding sources to support implementation and the Region's future land use planning efforts.
Provide technical assistance to transit providers as appropriate regarding land use, infrastructure, and future planning considerations to help plan for service needs.

Goal: Facilitate the development of walking, biking, and rolling infrastructure to provide alternative and multi-modal transportation options for communities and to promote interconnection within the region's transit systems. Walking, biking, and rolling provide critical alternatives to motorized vehicle travel. Ensuring a safe, efficient, and convenient infrastructure exists to promote walking/biking/rolling is essential to the future growth and sustainability of the Region's municipalities. Furthermore, in addition to decreases in fossil fuel use and GHG emissions, there are substantial co-benefits to this infrastructure related to public health, accessibility, and emergency management.

Strategy
Provide technical and grant writing assistance to municipalities who plan for multi-modal transportation and better connectivity with alternative transportation modes. Prioritize implementing the strategies and priorities identified in the Vermont Health Equity Planning Toolkit that are relevant to the region. ● develop project prioritization criteria that integrate health equity considerations

Strategy
Working with municipalities to update municipal road standards (for maintenance and new construction) to reflect Complete Streets principles. ● evaluate local regulations and recommend changes as needed to come in line complete streets legislation (19 V.S.A §309d) (done?) ● provide regular updates and training to municipalities ● review state transportation projects to ensure Complete Streets are implemented
Develop model regulations to be evaluated by municipalities that require walk/bike/roll infrastructure in downtowns, village centers, growth areas, or locations that propose high density development patterns ● Ensure that site plans include adequate bike and pedestrian infrastructure and safety measures, through participation in the Act 250 hearing process
Work with municipalities and regional partners to developing a walk/bike/roll master plan: ● conduct gap analyses and high priority projects that connect residents with diverse needs to food assets, schools, public transit, libraries, etc. ● identifies implementation strategies and matching funding stacks ● coordinate with and integrate existing community-supporting organizations and non-profits; center underserved communities in decision making, prioritization, and planning Key partners include Capstone, Central Vermont Mobility Committee; Center for Independent Living, PrideRidesVT, FreeRide, LocalMotion, GMT, etc.
Evaluate land use patterns to ensure walk/bike/roll connection feasibility between key land uses such as schools, parks/greenways, commercial areas, and neighborhoods
Work with cycling advocacy groups such as Local Motion, FreeRide, and PrideRidesVT, by hosting safe on-road cycling workshops and raising awareness about the viability of micro-mobility (such as electric bikes and scooters).

7. Electric Sector-Current Use

The Central Vermont Region currently uses approximately 469,522[13] megawatt hours of electricity on an annual basis across the residential, commercial, and industrial sectors (see Table below for use by sector and supplement for use by town and by sector).

Table 26 Current Regional Electricity Consumption

CVRPC Electricity Consumption	2016 CVRPC Regional Plan	kWh Usage by Year (Efficiency VT)		
Sector	2016 Plan	2020	2021	2022
Commercial & Industrial	353,117,000	239,531,296	247,455,287	255,723,111
Residential	241,268,000	203,571,494	211,580,064	213,799,098
Total	**594,385,000**	**443,102,791**	**459,035,351**	**469,522,209**
Average Residential Use		6,520	6,734	6,765

Data Source: Efficiency Vermont Regional Summary Report for CVRPC, June 2023.

As a comparison to Central Vermont's 6,765kWh per year, the US average residential electricity usage was 10,632kWh in 2021, an average of about 886kWh per month (EIA). Electricity consumption is expected to increase as electrification continues to be a central approach of the State to meeting GWSA targets and transitioning away from fossil fuels given that Vermont is rapidly decarbonizing its electric sector resources (see Chapter 2 Infrastructure). Fuel switching in the thermal sector and switching to alternative fuels and electric vehicles in the transportation sector are both discussed in the following sections. As electric consumption is projected to rise, the most useful targets include those around energy efficiency and conservation, critical to ensuring electrification has the intended outcome from the ground up to the State's legally binding GWSA goals. It is of note, however, that since the 2018 Enhanced Energy Plan, reported electricity consumption in central Vermont has declined by approximately 20% overall (approximately 11% decrease in the residential sector and 28% in the commercial and industrial sectors)- it is difficult to know if this is associated with changes in usage over the pandemic, a lack of consistent reporting from the DUs to Efficiency Vermont, or evidence of the successful implementation of efficiency and conservation measures (see below). Most likely, it is a mixture of all three.

Existing electricity infrastructure is detailed in the Infrastructure Chapter excerpt. Efficiency and conservation measures are integrated into the previous two sections. Electricity efficiencies were embedded into the 20year load forecast used in the updated LEAP model, thus are not an output of their own (and why the Public Service Department removed the Electric Sector tab of the Analysis &

[13] incomplete demand data is known at least for Woodbury from Efficiency Vermont's annual regional data report; strengthening relationships with our Distribution Utilities directly will ensure more accurate and comprehensive data will underlie future planning efforts. This total is thus an underestimate of total demand (use).

Targets Tool). Additional targets will be made available at the regional and municipal scales via CVRPC's website once the Public Service Department determines an appropriate path forward for treating those targets. CVRPC did not find it necessary to add additional targets pre-empting a statewide, RPC-supported, approach is developed, given especially the focus on weatherization and efficient residential heating systems above that fits well with the region's vision and current approach.

Reducing Future Electric Demand Growth

*

8. LANDUSE: SITING ENERGY INFRASTRUCTURE

Several over-arching goals frame this section and supporting analyses. CVRPC acknowledges it has a role to play providing its share of renewable energy generation to meet State goals of meeting 25% of demand with renewable energy generated in state and 90% renewable energy by 2050-CVRPC integrated an assumption of 25% energy demand in state generation into its analyses underpinning this section of the plan. There are also significant local benefits if distributed energy projects are developed with intentionality and community collaboration:

Community Benefits

- Cost savings (direct & indirect)
- Creative ownership models; incorporate affordability, educational, and dual use programs
- Investment in physical and social infrastructure
- Meet increased demand and expand needs met (e.g. cooling & warming centers)
- Energy Resilience, Reliability,

Environmental Benefits:

- Support electrification of thermal and transportation sectors to go further faster and be accessibly to all
- Reduce fossil fuel use and GHG Emissions
- Resilience and Reliability (increased severe storms and outages)

Financial Benefits:

- Reduce Municipal costs (direct and indirect)
- Draw down funding for investment in social and physical infrastructure
- Reduce community energy burdens
- Municipal tax
- Resilience of operations

This section allows the region to consider land and resource availability for different types of renewable energy generation and thus their suitability based on size, type, and proximity to demand in addition to location based environmental and social considerations. This section combines resource information with specific known and possible constraints to the development of renewable energy generation at the State, Regional, and local levels. The mapping section also provides the opportunity to identify preferred locations for renewable energy development and areas that are unsuitable for development of any kind. In addition, the maps identify existing infrastructure to support renewable energy development. While we will continue to largely refer to renewable energy generation generally, or to specific types, often in combination with storage, these discussions also extend to the development of transmission and distribution infrastructure as well whether or not in association with a generation/storage project.

This plan is intended to be a starting point and not the only basis for siting and project development. CVRPC intends for these mapping products and targets to catalyze collaboration; CVRPC encourages municipalities and communities to take an active role in project development to support their needs and demonstrate the types of projects that work well for them within their existing and future visioning for their own community. Furthermore, CVRPC encourages developers and distribution utilities to reach out early and often when considering developing a project within the region and to work with communities and their priorities which may favor resilience and reliability concerns (integration with storage, ability to function as a micro-grid), alternative site choices, community benefit agreements to support municipal and/or residential energy programs, educational opportunities, dual use opportunities, etc. Preferred site (types), preferred project characteristics, land use policy, renewable energy generation targets, key issues and community priorities will be discussed below after a review of known and possible constraints.

Potential Municipal Roles

- Policy: update zoning and plans to remove barrier and integrate priorities
- Community Outreach: support local partnerships and share information; develop committee/coordinator role; project working groups, etc.
- Investment: participate/host project
- Ownership/Project Development

CVRPC and ACRPC Energy Planners led a three-part workshop series in 2023 on Municipal Solar- see for more information and resources: https://centralvtplanning.org/programs/energy/webinars-and-workshops/

Future Renewable Energy Generation

The siting and generation of renewable resources is a critical part to identifying whether or not the region can meet its share of the state's renewable energy goals by 2050. The following analyses determine where resources are available throughout the region to ensure no one municipality is unduly burdened with supporting more than should be reasonably anticipated. Finally, this information will better position the region and its municipalities to evaluate the renewable energy generation options that are available to meet these goals.

CVRPC's objective is to ensure that energy generation, distribution and transmission facilities are located, designed, and correctly sized to support the Region's community and economic needs, which increasingly means it must be reliable, resilient, and affordable as well as sustainable to reduce operational costs and Green House Gas emission contributions (further reducing long-term costs). At the State level, supporting policies and programs are being revisited to consider key issues including adequate electricity, affordability of rates, cost-effective and efficient use of resources, economic vitality, environmental justice and energy equity, reliability, security, sustainability and limiting negative environmental impacts. Many, if not all of these, apply to the

regional and municipal, as well as the state level. However, priorities may differ, given the unique characteristics of each region.

Long-term energy resilience (adaptability, affordability, and crucially reliability) is critical to supporting thriving communities in Central Vermont. CVRPC advocates for the regional and municipal scales to be considered in the planning of local generation and energy transformation policies, as local communities experience

- Increasing duration and frequency of outages (especially in our rural communities),
- Increasingly disparate electric rates and opportunities to invest in on site renewable generation and storage alternatives based on distribution utility territory and proximity to energy infrastructure,
- Increased reliance on municipal and community hubs to provide critical care and resources.

Investing in infrastructure choices that maximize co-benefits and energy efficiency in complementary infrastructure such as capturing waste heat and/or creating thermal energy networks will reduce demand on existing electric infrastructure and further support cost and emissions reductions.

Section 248 and Project Review

Renewable Energy Generation Resource Areas by Technology Type and Scale

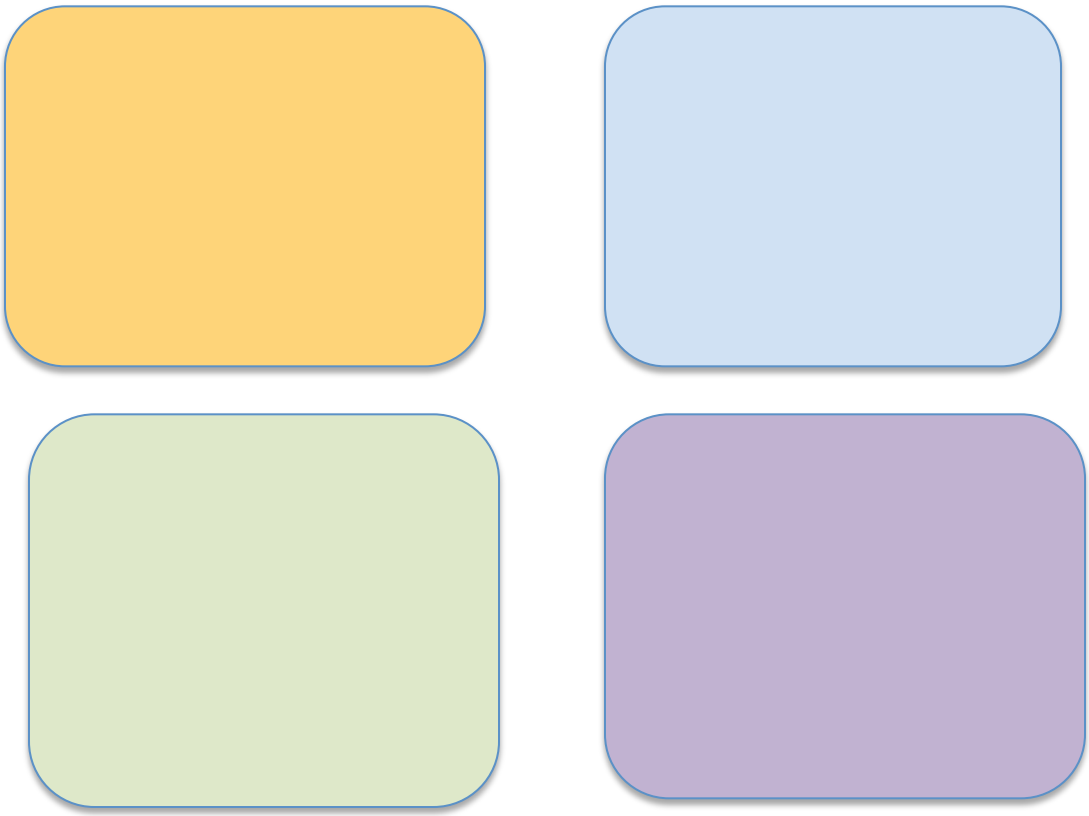
In order to better understand how the region can provide its share of renewable energy generation to meet the state goals of 90% renewable energy by 2050 and 25% of demand generated in state, the potential for renewable energy generation needs to be quantified. Table 29 provides an overview of the potential renewable energy generation for Central Vermont based on the prime and base resource areas that have been identified.

Renewable generation potential is calculated from mapping completed by the Central Vermont Regional Planning Commission and is based on the Regional Determination Standards and associated guidance documents developed by the Department of Public Service (including the Generations Scenario Tool). As discussed in the section on the electric sector, the region's 2022 electricity demand was 469,516MWh in 2022 according to Efficiency Vermont, which is projected to increase based on increase in demand from the electrification of the thermal and transportation sectors as described above, in addition to modest population increase. Offsetting this demand via weatherization and energy efficiency can be significantly boosted via storage, flexible load management, and importantly via opportunities to capture and utilize waste heat and integrate thermal energy networks into new building including housing, wastewater and water systems, and other new infrastructure (see thermal sector above).

The Central Vermont Regional Energy Plan identifies specific areas where resource areas exist for renewable energy generation. These areas focus on wind, solar, and hydroelectric as they are locationally constrained. Other renewable energy generation such as woody biomass, biogas, and other renewable technologies do not require specific conditions for the location of the generation facility, however they do require resources such as wood or other organics to provide the needed fuel- there are no existing such plants for renewable electricity

generation nor plans for them, however wood does play an important role in heating across our region, as could ground source heat pumps which will be considered in future updates to the mapping products.

Add back in further considerations by Technology TYPE



IMPLICATIONS FOR MUNICIPALITIES RE SCALE- RES UPDATES (REGIONAL TIER)!

Data re interconnectio

Known & Possible Constraints

Act 174 outlined a set of State known and possible constraints which extend to renewable energy generation project development in addition to other types of infrastructure and development. These constraints are integrated into regional and local map products along with additional regional and local constraints, to identify base and prime resource areas primarily, but not exclusively, for solar and wind development. These terms can be misleading- base and prime resource potential areas are not to be confused with preferred sites (see below) nor are they designated for development, they just identify the lack of conditions that would prohibit or seriously complicate renewable energy development when evaluating land use potential. These map products are intended as a starting point in early project development and foremost to assess the region's ability to meet renewable energy targets and integrate energy planning into broader land use planning (see below). In coordination with the RPCs, the Department of Public Service, Vermont Center for Geographic Information, and the Agency of Natural Resources have created statewide layers that represent the best available known and possible constraints detailed in the Act 174 Energy Planning Mapping Standards for Regional and Municipal Plans (available in the Act174 tab of DHCD's Vermont Planning Atlas):

Base (e.g., ground mount solar and wind)- identifies areas that have no known constraints, but 1 or more possible constraints,

Prime (e.g., ground mount solar and wind)- identifies areas that have no known nor possible constraints.

In addition, they developed a Rooftop Solar Potential layer, which accounts for roof orientation and size (though not existing generation, roof age, nor condition). These layers account for technical suitability factors, such as slope and orientation, elevation and wind speeds, and access and proximity to grid-related infrastructure. These layers and data inputs serve as the basis for further CVRPC analyses which integrates regional constraints, regional and municipal considerations, regional data, and priorities to develop the resource potential area map products, calculate available land resources while balancing other priority land uses, etc.

Constraints are separated into two main categories: known and possible. Known constraints are land characteristics that are unsuitable for development including the development of renewable resources (see Summary Table below). Similarly, the State identified a list of possible constraints, which identify areas where additional analysis would need to occur in order to determine if development of renewable energy resources (or any development) is appropriate (e.g., has minimum negative impacts). In some cases, conditions may be prohibitive, but in others the conditions may be suitable for renewable energy development on a project-by-project and site-specific basis. The supplement provides definitions for the known, possible, and regional constraints that are included on the maps and discussed here. These definitions include source information and, in several instances, provide insight to the inclusion of the constraint.

Table 27 Summary of State Known and Possible Constraints

State	
Known Constraints	Possible Constraints
• Vernal Pools (confirmed) • DEC River Corridors • FEMA (Federal Emergency Management Agency) Floodways • State-Significant Natural Communities and Rare, Threatened and Endangered Species • National Wilderness Areas • Class 1 and Class 2 Wetlands • Regionally or Locally Identified Critical Resources	• Vernal Pools (potential and probable) • (Prime) 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 (DWA) • Highest Priority Interior Forest Blocks, Connectivity Blocks, Physical Landscape Blocks, Surface and Riparian Areas (ANR) • Hydric Soils • Regionally or Locally Identified Resources

See Supplement for Descriptions of State Known and Possible Constraints; Act 174 Planning Atlas for layer sources.

In addition to the State's known and possible constraints, CVRPC identified additional regional possible constraints in the development of the previous plan consistent with the region's land use policies in general. While these constraints are considered possible; they were integrated unilaterally into all map products and

layers as they did not unduly constrain the potential layers. CVRPC intends to conduct further analysis in collaboration with municipalities to refine these regional constraints and clarify local constraints for comprehensive integration. CVRPC is also developing a pilot thermal energy resource map to support the consideration of thermal energy networks (thermal sector, not for electricity generation; focused on existing buildings & facilities, not geothermal potential).

Table 28 Summary of Regional Possible Constraints

Regional Possible Constraints
• Elevations Above 2500 ft: excludes rooftop and associated with existing development • Slopes Greater than 25%: excludes rooftop and associated with existing development (unless presents new concerns for landslides) • Municipal Owned Lands; excludes rooftop and associated with existing development • 250ft Lake Shore Protection Buffers, excludes rooftop and hydroelectric facilities

CVRPC is working to integrate local constraints into mapping products, as a number of towns are currently in the process of developing their first enhanced energy plans, this process is timely and local constraints will be more comprehensively integrated in the Fall 2024/2025 regional plan update. This will allow the municipalities to use local insight and knowledge to evaluate and establish their own criteria for identifying locally preferred or unsuitable locations and they are encouraged to do so not only in broad site types but to the parcel level where it supports their energy goals- this can include siting for all resource technology types. Furthermore, CVRPC is in the process of developing a tool for municipalities to use during their own Enhanced Energy Planning processes to determine the potential impact of adding additional constraints or better yet, preferred sites to the maps. CVRPC is furthermore, committed to integrating mapping tools into the project review process and the project development process to support quick evaluations for discussions including highlighting areas with different numbers of possible constraints, working to identify preferred sites, mapping existing preferred site types and project characteristics, etc. Local Constraints include:

- slightly lower elevation maxima (1800ft in Northfield, 1700ft in Waitsfield),
- prohibit development in specific conservation, forest reserve, and historic districts (Fayston, Northfield, Waitsfield), active farmland (East Montpelier, Northfield, Waitsfield), and flood hazard areas and river corridors (East Montpelier),
- discourage placement in green fields.

Additional local considerations/policies:

- no limitation on siting residential scale projects as long as owner will take reasonable measures to site/screen ground-mounted installations to minimize visual and noise impacts (Berlin),
- limit projects from exceeding 1 acre, scaled to meet approximate proximate demand (Calais),
- preferences for screening.

Changes to regional priorities, as well as municipal and state priorities, are likely to impact constraints (and preferred siting) in the future as we comprehensively reassess how to maximize meeting our goals associated

with housing needs, forest and land conservation, and flood and climate resilience in addition to renewable energy development,

New Regional Renewable Energy Generation Potential & Targets

Table 29. Potential New Regional Renewable Energy Generation

	Existing Renewable Generation (MW)	Multiplier (distribution across technology type)	Incremental Regional Capacity Target (MW) 25% In- State			Resource Available (MW)	Prime Land Available (Acres)
			2025	2035	2050		
Ground Mount Solar	47.17	25%	5.1	18.5	31	1500.4	10,503
Rooftop Solar		50%	10.6	38.3	64.2	162.7	244
Wind	0.24	20%	2.7	9.9	16.5	867.6	34,795
Hydroelectric	26	5%	0.3	1.1	1.9	1.9	N/A
Biomass (Wood, methane, farm biogas)	0	0		0		0	0
Totals	73.42	100%	18.8	67.7	113.6MW	2532.7 MW	45,452 Acres

The constraints outlined above have been evaluated to ensure sufficient resource area exist to meet the region's share of the state's renewable energy targets. As noted, the regional constraints are included as "possible" therefore development of renewable resources could occur in these locations after an analysis of the specific site has been concluded. Additionally, multiple technologies could be used to meet the region's target, the distribution of new generation across technology type was set based on precedent for the type in the area, technical difficulty and cost, as well as community appetite- a conservative estimate[14] was used to reflect previous trends but it should be noted that CVRPC has found community members and municipalities to be open to a diverse range of technology types, with especially scale but also project location and community benefits to be key determinants of support (see Infrastructure Chapter and for an in depth discussion Fall 2023 CVRPC SAY WATT: The Future of Vermont Electricity Report).

Table 30 Incremental Regional Targets for New Renewable Electric Energy Generation (MWh)

Target Year	2025	2035	2050
New Renewable Electric Energy Generation (25% In-State)	26, 957	97,196	163,094

14

New Renewable Electric Energy Generation (50% In-State)	264,211 (2032)	388,034 (2040)	445,307

Source: Central Vermont Regional Planning Commission & Department of Public Service (via Generation Scenarios Tool, see methodology in supplement). Municipal breakouts available online May 2024.

These analyses and tables show that Central Vermont has more than sufficient potential renewable energy resources available, even with a conservative estimation, to meet 25% of demand met by in-state renewable generation (different distributions across technology type are also certainly possible**). This includes sufficient resource available for each technology type for each municipality**. Maintaining this at the municipal level becomes more difficult if rooftop solar is changed to account for more than 50% of the share of new generation, although certainly CVRPC supports refining this analysis to add different distributions by municipality and maximizing our strengths across the region. If that in-state amount is raised to 50% we do over run our existing resource potential for rooftop solar and hydroelectric with the current distribution of generation across technology types. The Generations Scenario Tool analyses do not take into account storage and offsetting electric demand from the thermal sector via cord wood, waste heat recovery, and geothermal which all key pieces of Central Vermont's approach to the energy transition. These would reduce the incremental energy targets required and total new renewable energy generation capacity needed which further emphasizes CVRPC's confidence that as a region we can not only achieve but comfortably exceed a 25% match if we wanted to set a regional target concerning a % of our regional demand in the future. Lastly, the potential energy generation for Central Vermont could increase if we include biomass, biogas, and methane, however we do not currently have any such sites located in the region, therefore calculating a potential for generation would be difficult.

There are significant challenges to meeting these goals and targets however when it comes to our energy infrastructure. It should be noted that the Department of Public Service was unable to provide some capacity information for substations in our region based on a lack of data from Distribution Utilities. The capacity targets for Calais, Orange, Plainfield, Washington, and Williamstown exceed the distribution headroom allotted for that town in the tool. Barre City, Berlin, Cabot, Calais, East Montpelier, Middlesex, Montpelier, Northfield, Washington, and Worcester all show concerns that the capacity targets exceeds grid headroom. CVRPC is working the Department of Public Service, Distribution Utilities, and other RPCs (Regional Planning Commission) to assess the severity of these limitations and ensure that missing data is provided and not contributing to these shortcomings. Limitations particularly in our distribution infrastructure are a known and significant challenge for Central Vermont and will be discussed below (and at great length in the planned Winter 2025 additional update).

Finally, the Central Vermont Regional Energy Plan supports the development of renewable energy generation technology that will not result in an undue adverse impact on the built or natural environment or conflict with identified regional policies. Similar to constraint mapping, it was decided that the region should not limit the extent to which municipalities can plan for their energy future. Due to the diverse nature of Central Vermont, including urban and rural areas, there was no way to develop a consistent regional policy that would be equitable to all the municipalities, therefore all renewable energy generation types (both current and developed through future advances in technology or innovations in the industry) may be considered for application in Central Vermont.

Preferred Sites (Types and Project Characteristics)

Thus far regional and municipal plans have not identified sites to the parcel level as preferred for renewable energy generation, instead defining site types. With the first round of the municipal enhanced energy plans entering their first update phase and a number of towns developing new plans, CVRPC is working with municipalities to best maximize on the opportunity to define additional, and for the first time, map, preferred sites and shape the form and benefits of implementation in our region. We anticipate optimizing the utility via specificity of these planning efforts for all stakeholders will have lasting impacts on investment in and across our region (including the deployment of storage and 3-phase power) and thus the reliability, resilience, affordability, and accessibility of our energy infrastructure, the energy burden of our residents, and the ability for our communities and businesses to thrive (in addition to meeting our regional demand and contributing towards the state's energy and climate goals).

Did you know?

Proposed projects between 150kW-500kW must be a preferred site to participate in net-metering.

Most Regional and Town Plans use the State Preferred Site list as their "base", frequent additions are noted to the right. The Region adopts the state's preferred site list and provides additional preferred site types and project characteristics below. These are in line with the region's broader land use approach to reducing GHG emissions and conserving energy while investing in shared community infrastructure including encouraging smart and intentional growth; reducing dispersed development that would disrupt forest blocks and wildlife corridors, working lands, and further exacerbate rural infrastructure gaps. Regional preferred sites and project characteristics also prioritize encouraging projects that would be collaborative with local communities and meet existing needs especially regarding resilience and reliability. This includes encouraging projects sited at or near critical social and physical infrastructure, paired with storage, and structured to either directly engage with a local off taker or have explicit community benefit agreements[15]. Limiting vegetation impact and encouraging projects to employ construction techniques to reduce the embodied carbon of projects are further in line with regional and state energy and conservation goals.

State Preferred Sites	Additional Regional Preferences
• Rooftops and Impervious Surfaces (e.g. Parking Lots) • Gravel Pit, Quarry, or Similar Mineral Resource Extraction Site (Lawful and Reclaimed) • Brownfield Sites • Sanitary landfills	• Proximity to use: density centers including designated downtowns, village centers, new town centers, growth centers, and neighborhood development areas; commercial and industrial areas; adjacent to large farms • Schools, Libraries, Municipal buildings facilities, and critical community spaces,

[15] Dual land use opportunities (agrivoltaics), educational opportunities, community solar, low income programs, component of lease payment to community revolving loan fund to support upfront costs of residential weatherization, integration of meter adaptors to add micro-grid operation options.

• National Priorities List (e.g. Superfund Sites) • On same parcel or directly adjacent to customer allocated more than 50% of the net-metering system's electrical output • **A site identified in municipal plan or joint letter of support from municipality and RPC (Regional Planning Commission)**	• Solar Carports • Location served by existing roads and energy infrastructure (e.g. 3 phase) OR addresses existing gap • Designated a preferred site in Town Plan or by Town leadership (as consistent with broader planning)
Preferred Regional Project Characteristics	
• Minimize vegetation impact especially forest clearing and fragmentation; plant screen trees & pollinator habitats • Combined with storage; micro-grid potential or functions • Creates dual land use opportunities (e.g. agrivoltaics) • Includes design/build techniques that reduce embedded carbon of program (e.g. alternatives to concrete pylons) • Engage community in development process (early) • Local off-taker and/or community benefit agreement	

Figure 7 PLACEHOLDER shows State Preferred Sites as a "base"

Libraries are critical physical and social infrastructure in the region. There are 14 libraries found throughout our region (11 municipal, 3 incorporated). In addition to library and educational services, our libraries provide community members with internet, computer, and printer access (including 24-hour Wi-Fi in most cases), reliable food distribution and meals, provide bike repair/rentals, art and school supplies in addition to educational programming, resources on mental and physical health, support navigating state and federal resources, free tax services, social meeting rooms and clubs, and more. Furthermore, libraries offer cooling and warming during business hours, and increasingly, adopting policies for extended use during extreme weather conditions.

Libraries are an essential resource for all community members especially those with acute needs in day-to-day, emergency, and recovery conditions. Our regions libraries are thus considered important community stakeholders with significant insight into local needs as well as ideal locations for community infrastructure investment including but not limited to: flood mitigation, sidewalk/recreation projects, on-site energy generation and storage projects, and more.

So where are projects being located?

Many of the projects in terms of numbers are small residential scale (many rooftop but not all)- important to consider that siting guidelines are best developed with clear references to different scales.

Total from State Energy Programs	MW	# Projects	
Generation <15kW Category I	14.69856	2233	Many are rooftop as residential scale
Generation 15kW to <150kW (Category II)	6.56739	184	Generally includes Municipal/Community Scale (not limited to)
Generation 150kW to <500kW (Category III)	6.18665	23	Currently have to be preferred sites to participate in net metering
Generation 500kW+	22.944	23	Most Standard Offer projects are 1-2.2MW
Total (not regional total):	50.3966	2463	

Noted trends in current project development (Figure to be added)

- projects that have been co-developed by municipalities/schools are often preferred site types and are typically smaller from residential to community scale,
- projects that are developer/DU led typically are larger, many do develop at least some green field space, some are on landfills/gravel pits

CVRPC thus identifies a critical need to connect stakeholders and their planning processes:

- work with Distribution Utilities to establish annual data updates for local and regional planning processes, understand short, medium, and long term infrastructure improvement plans, and provide regional summaries for integration into integrated resource planning efforts
- encourage towns to highlight opportunities and mechanisms for project development in town plans and website; encourage Dus and developers to consult towns and town plans early on in project development

Proximity to existing energy infrastructure with interconnection capacity (and for projects larger than 15kW 3 phase power) is a known priority for distribution utilities and many developers to reduce their short-term project costs and manage system limitations. While some municipalities do and may list these as additional

preferred site criteria[16], the region does not limit preferred sites by these technical considerations but instead encourages closer collaboration with our distribution utilities:

- 3 phase power is not available throughout our region's designated growth centers, excluding some of our more rural designated areas adds additional barriers to the very locations where renewable energy generation projects might could play an even more important role supporting local economic and community development (see Figure 2 Infrastructure Excerpt),
- Known capacity and interconnection concerns (see below) have already resulted in significant curtailment of projects especially in the southeast quarter of our region; focusing on concentrating projects in the fewer and fewer areas without such constraints is an incomplete and short-sighted approach that may unduly burden communities with remaining capacity while also severely limiting many of our municipalities and their residents from not only meeting their energy goals but drawing down federal and state investment to support energy infrastructure, energy resilience, and energy independence in their communities.

Thus below, this plan highlights both those "low-hanging" interconnection opportunities that DUs and developers may find most suitable to encourage community engagement and project development, and encourages DUs and developers to consider community needs and project priorities in their planned infrastructure improvements and potential expansions.

CVRPC acknowledges there is a tendency for preferred sites at all scales to favor small and medium projects, while this is in line with many municipal and community preferences and many regional priorities, it requires new models for how projects may be aggregated to take advantage of economies of scale, for local and state investment, as well as increased capacity at DUs for interconnections and load demand management (which may be viewed as both an opportunity and burden). It is also important to remember that preferred site designation is required for projects 150kW-500kW to participate in net metering and while we have comparatively few projects at this scale in our region (see below, approximately 23) they do provide approximately 10% of our region's existing generation. **Not having preferred site status does not prevent the project from being implemented, it just excludes it from the financial incentives providing via the net-metering program**. The best way for projects of this scale (and really all projects but especially this scale and larger) to attain preferred site status is to outreach early and often with the town and community including local energy committees and coordinators. Furthermore, CVRPC does encourage municipalities to work with local landowners and the broader community to consider potential and parcel-specific opportunities for large projects- only 23 projects out of the region's 2463 and counting renewable energy generation projects are 500kW and more, yet they contribute 1/3 of our region's total nameplate generation. As the state continues to electrify and move towards 25% of demand produced by in state renewable energy generation, it is important to consider and direct where these large scale projects may be located and how they fit into local and regional visioning of our communities. To this end CVRPC has begun to analyze potential resource areas (Figures above) to identify contiguous areas that may meet basic technical requirements and facilitate community conversations around development and use for renewable energy generation.

[16] For example Middlesex and Northfield Enhanced Energy Plans do include language such as within 1 mile of 3-phase power and locations served by existing roads and energy infrastructure; CVRPC supports municipal inclusion of these technical priorities with due consideration

Did you know?

Black, Indigenous, People of Color, (BIPOC), as well as low-income, and rural Vermonters have largely been left out from major economic, social, and environmental benefits associated with investments in climate resilience and renewable energy infrastructure. BIPOC Vermonters were seven times more likely to have gone without heat in the past year, over two times more likely to have difficulty affording electricity, and seven times less likely to own solar panels than white Vermonters (Act 154 Sec 1.10), while rural and low-income communities consistently carry the highest energy burden.

CVRPC is updating both resources used to support project review at the regional level and materials to support municipal and community project development- want to learn how to get involved and change these trends in our region for the better? Get involved with your local energy committee, planning commission, and reach out to your RPC town representative!

Key Issue: Grid Capacity and Infrastructure Needs

In addition to identifying and calculating possible generation of renewable energy based on resources and constraints, the analyses and mapping attempted to incorporate existing infrastructure and data. Three phase power and substations are included in the resource potential maps, distribution and transmission data was integrated into the Generations Scenario Tool, and additional data such as customer count and composition, use data, existing generation projects, and outages were requested and summarized. There are significant gaps in publicly available data and the data supplied to and requested by CVRPC for planning purposes. It will be important to have accurate and up-to-date inventories of existing facilities to ensure upgrades or improvements are targeted to most effectively support additional electric loads on the grid. CVRPC is working diligently with stakeholders to remedy these gaps as well as update standards and works towards regular data sharing. The following section summarizes some of the key known issues throughout specifically our electricity infrastructure with the caveat that the following update will include a more comprehensive treatment and focus on enhancing energy resilience and reliability in Central VT:

- Flexible resources and load management,
- strategic deployment of storage in the region,
- offset future demand with storage, wasteheat recovery, and geothermal,
- non-fossil fuel based back up power options,
- and micro-grid development.

Some Central Vermont communities have extremely limited or no three-phase power but do have prime resource areas to support renewable energy development. While, as previously noted, smaller generation projects (including residential and some municipal and small businesses) can typically be accommodated by single transmission even when not located close to load, but medium and larger scale projects rely on three phase power. In data provided by the Public Service Department, Central Vermont's transmission capacity is limited to approximately 41.5 MW with transmission grid upgrade costs estimated at $40.1 million (see supplement). Again, there are significant and rapidly evolving opportunities to mitigate some, but certainly not

all, of these upgrades and costs. While CVRPC conducts further analyses to help municipalities understand how these limitations may impact their own energy planning, the region also recognizes that significant investment in our energy infrastructure is required to support thriving communities in our region and these costs should not be born by those who are already most burdened by infrastructure challenges which furthermore limit their access to draw down federal and state funds to participate in a just transition. CVRPC again emphasizes the importance of integrating energy into land use planning and working with energy stakeholders to ensure that that energy planning not only is consistency with local regulations and visioning but accounts for targeted growth and likely demand.
Further engagement with VELCO's Long Range Transmission planning process, our Distribution Utilities' integrated resource planning processes, and the State's own energy planning will strengthen these efforts at all scales. The Department of Public Service highlights this, including the role of RPCs, in the 2022 Vermont Comprehensive Energy Plan (pg 87).

Resilience and Reliability

The State's "Electrify Everything" approach does raise specific concerns for some of our municipalities and communities given these interconnection limitations, rural infrastructure gaps, and annual longer term outages.

CVRPC continues to advocate for wider scale policies and programs to address reliability and local resilience (the most recent Renewable Energy Standard Update included a series of technical analyses, none of the scenarios modeled yielded significant reliability benefits). CVRPC also supports municipalities, affordable housing partners, community groups, and businesses to consider integrating on-site energy generation, storage, and back-up power into their capital improvement planning.

There are several substations that presently pose significant barriers to expanding renewable generation in our region (brief summary below). For the substations in GMP territory, substation transformer capacity can be viewed on their Solar Interconnection Map[17] which highlights circuits based on having at least 20%, less than 20%, less than 10%, or severe limitations (higher costs and delayed interconnections)(although two GMP feeders that serve Roxbury, Northfield, and Woodbury are blank due to lack of data from municipal utilities). For other distribution utilities, it is harder to plan in real time based on potential technical limitations due to lack of publicly available data. While our region has approximately 267.5MW of Distribution Headroom according to data supplied by the Department of Public Service in the Generations Scenario Tool which is well above our Capacity Target for 25% in state generation, although not sufficient for the 50% in state generation scenario. While this headroom is ample at a regional glance, there are issues at the municipal scale including, as noted above, that Calais, Orange, Plainfield, Washington, and Williamstown have capacity targets that exceed their distribution headroom. These town's capacity targets exceed provided distribution headroom by less than 1MW in 3 cases (Calais, Orange, and Plainfield), by 1MW in Washington, and by 4.2MW in Williamstown which hosts 2 of the region's largest solar arrays (utility owned). Depending on the size of the proposed projects, these may or may not present significant interconnection barriers but are representative of the longer term challenges we face in implementing our energy goals. Distribution headroom is not provided for Northfield, Roxbury, and

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

Woodbury. CVRPC continues to work with DUs on data gaps and to integrate their Integrated Resource Planning into regional and municipal planning and project development and to advocate that regional and municipal energy planning and goals in turn are considered in their Integrated Resource Planning Processes. Key issues included:

- Many substations across our region, regardless of utility territory, must be upgraded to address transmission ground-fault overvoltage (TGFOV) concerns (see figure below), these are subject to an additional Tariff fee of $47 per kW of AC capacity authorized by VT PUC Docket #19-0441-TF.
- Two such systems in WEC (Washington Electric Coop) territory have issues that are so severe that they are currently objecting to any further interconnection and the risk that it could adversely affect system stability and reliability. This severely impacts the portions of Barre Town, Berlin, Northfield, Orange, Roxbury, Washington, and Williamstown that are in WEC territory. Existing substation voltage regulators and transformers have to be upsized which in turn requires support structure adjustments. A timeline has not been established for such a project.
- Summer loading in the Woodbury Lakes area creates a sizeable circuit imbalance and an imbalance on the Hardwick Substation transformer for several months of the year, converting from a V-phase to a full three phase feeder along with additional reliability improvements is including in Hardwick Electrics 2021 Integrated Resource Plan.

In the short term, costs of additional renewable energy infrastructure will be lowest in areas that do not have TGFOV tariff fess and with substation transformers that have at least 20% capacity remaining (although the tariff fees are a key mechanism for paying for necessary updates to DU infrastructure). In the long term many of these infrastructure upgrades are necessary and inevitable; again, better coordination among planning efforts can help our region transition and make sure no one is unduly burden by cost or left out.

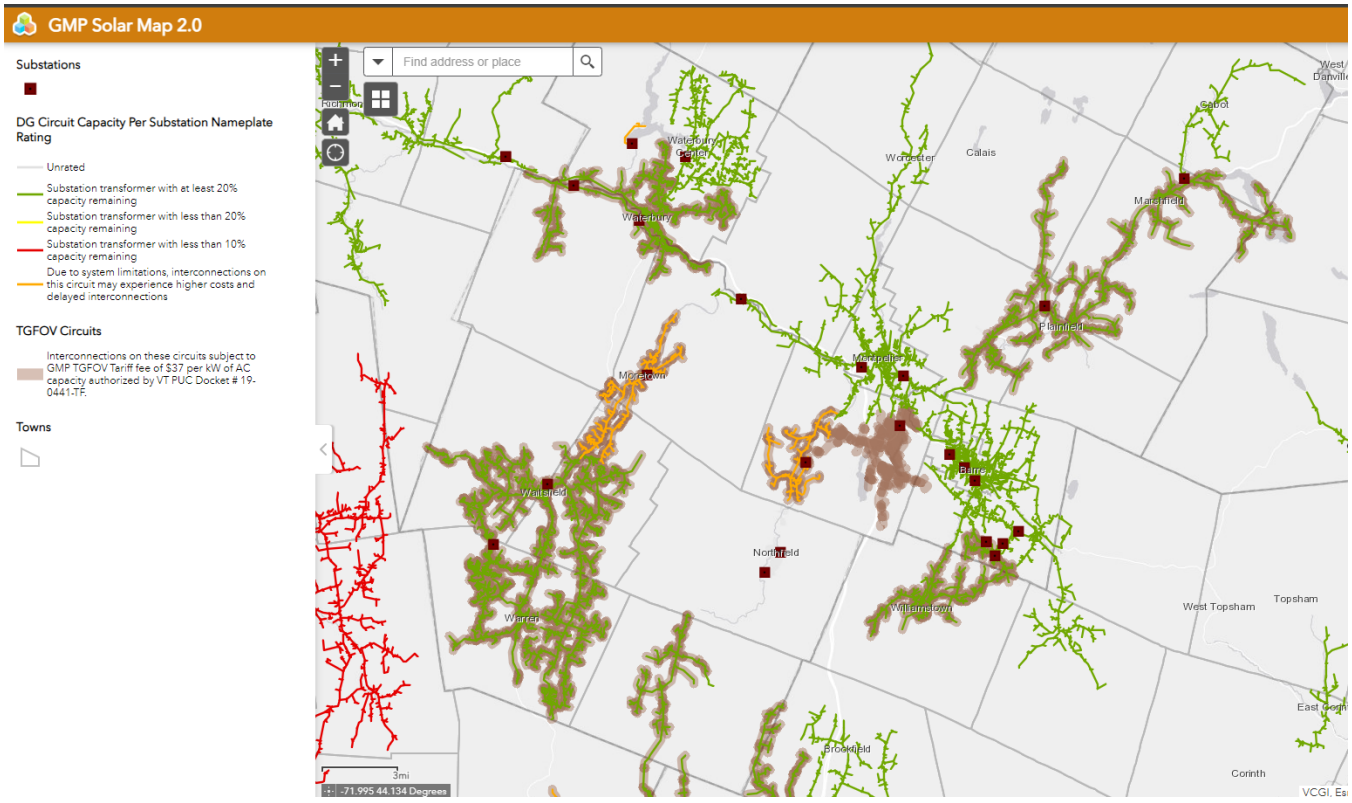


Figure 8 : Snapshot of CVRPC territory via GMP's Solar Map- lines circuits with brown shading have transmission ground-fault overvoltage (TGFOV) concerns, those in yellow have less than 20% capacity remaining.

Storage is another key and rapidly changing area for future planning[18]. At the grid scale most storage is generally currently 3-6hours of very big amounts of energy, while critical to keep continue power supply at the transmission and distribution scales, these don't address many of the reliability and resilience, not to mention seasonal, challenges we face in Central Vermont. Diversified and complimentary generation sources- for example solar with daytime and summer peaks paired with wind with night and winter peaks- is one component of planning for seasonality and reliability and important to keep in mind when thinking about the types of infrastructure to plan for. Distributed storage, smaller scale typically chemical storage (battery) tied to renewable generation is currently the dominant approach in our region. DUs are integrating grid tied storage systems at the customer scale; ensuring that this approach allows for the provision of back-up power in outage events for those with on-site generation is a key way that Central Vermont can enhance resilience in our region and ensure every community has the ability to meet critical needs and operations.

Changes in Technology

As noted previously, the state's comprehensive energy plan and subsequently the Central Vermont Regional Energy Plan are both written with electricity as the primary power source. This direction includes renewable energy technology that exists today such as wind, solar, hydroelectric, biomass, and biogas. As technologies change and advancements are made in both efficiency and sources of renewable energy generation, the region's municipalities will need to be flexible and adaptable to these changes.

With this in mind, the Central Vermont Regional Energy Plan acknowledges and recommends consideration for changes in technology that do not limit renewable energy development to known sources. This concept will need to be continually revisited to ensure current technologies are considered and outdated technologies are not recommended. Examples of CVRPC's commitment to working on solutions that fit well for different communities in our region include our emphasis on exploring the role waste heat recovery and geothermal can play in energy conservation and reducing thermal electric demand, continued emphasis on cord wood and efficient wood stoves over pellet and wood chips as key accessible and affordable sources of residential heat, and a fierce determination to emphasize the need for local reliability and resilience considerations at the broader scale of state and NE regional energy planning. CVRPC is committed to helping municipalities explore fossil fuel free alternatives to back-up power which have the added benefit of capitalizing on existing funding to meet a common municipal demand that lacks existing funding. Furthermore, CVRPC sees great potential in the application of existing technologies includes bi-directional EV chargers, power storage, mobile solar generators, and Meter-Socket Adapters to be integrated into existing and new energy systems across our region at all scales to transform our region into one dotted with micro-grid capabilities. This is key as we face increasingly extreme weather and storm events, resulting in many of our communities experiencing outages of longer duration (up to 8 days) annually (See Climate Chapter for the role of on-site generation and storage in municipal buildings and facilities and Community Resilience Hubs).

[18] The Vermont Public Utility Commission had an excellent series of Energy Storage Systems Workshops in late Fall 2023, for an excellent introduction to energy storage technologies, the role of energy storage in transforming the grid, storage policy at the state and federal level, interconnection, and more access them at https://energy.sandia.gov/programs/energy-storage/policy-and-outreach/regulatory-webinars/vermont-public-utility-commission-energy-storage-systems-workshops/.

Highlight on Meter Socket-Adapters

Meter Socket Adapters	Solar MSA	EV MSA	IslandDER MSA
Function	interconnects solar PV to the home	connects Level 2 EVSE to the home	connects multi-DER configurations: ● Solar PV ● EVSE ● Energy Storage Systems
Common barrier addressed:	● connecting to problematic/difficult to access service panels ● expensive service upgrades due to overfill ● undersized service panels	● mitigates undersized service panels that require costly replacement ● enables bidirectional EVSE for charging and vehicle to grid (V2G) configurations ● data-out version enables multi DER applications including solar+stationary storage	● avoids problematic service panels and costly service upgrades ● enables bidirectional EVSE for charging and V2H V2G, V2X applications ● streamline, most cost effective whole-house disconnect during grid outages for microgrid operation
Future directions:	● data out feature enables solar + storage for advanced grid functions ● devalued net-metering (NEM 3.0) ● partial-home backup		

Pathways: Development and Siting of Renewable Energy Resources

Strategy
Develop summary of municipal distributed energy projects established via the Municipal Energy Resilience Grant Program assessment reports: • Support project development and implementation
Develop siting and project guidelines based on project size, type, and community needs.
Assist interested municipalities to review regulations and develop updates as appropriate that would support the development of community scale infrastructure for renewable energy generation, storage, and micro-grids.
Support municipalities to identify and understand the co-benefits complementary infrastructure such as capturing waste heat and/or creating thermal energy networks can provide which will reduce demand on existing electric infrastructure and further support cost and emissions reductions. • Identify project opportunities and resources for implementation, • Develop thermal energy resource map to support the consideration of thermal energy network (focused existing building and facilities, proposed projects, and potential for infill.
Conduct further analyses in collaboration with municipalities to refine regional constraints and clarify local constraints so they can also be integrated into local and regional mapping.
Develop preferred siting map: • State preferred site types • Regional preferred site types • Municipal preferred site types • Additional preferred parcels (develop hosting interest form and community based process)
Develop tool for municipalities to use during their own Enhanced Energy Planning processes to determine the potential impact of adding additional constraints or better yet, preferred sites to the maps.
Integrate mapping tools into the project review process and the project development process to support quick evaluations for discussions including highlighting areas with different numbers of possible constraints, working to identify preferred sites, mapping existing preferred site types and project characteristics, etc.
Develop resources for towns and developers, which identify opportunities to maximize goals associated with housing needs, forest and land conservation, flood and climate resilience, and renewable energy development and energy infrastructure.
Work with the Department of Public Service and other RPCs to integrate straoge and thermal sector offsets to forecasted electric demand (via

Strategy
advanced woodheat, waste heat recovery, geothermal, etc) into modeling and generations scenario tool.
Work with municipalities, distribution and transmission utilities, the Department of Public Service, and others to support the deployment of storage, extension of 3-phase power, the hardening and/or advanced reconductoring of electric lines, etc. targest both those most burdened by reliability and resilience issues (typically more rural residents) as well as our designated growth areas.
Work with Distribution Utilities to establish annual data updates for local and regional planning processes, understand short, medium, and long term infrastructure improvement plans, and provide regional summaries for integration into integrated resource planning efforts.
Encourage towns to highlight opportunities and mechanisms for project development in town plans and website; encourage DUs and developers to consult towns and town plans early on in project development.
Analyze potential resource areas to identify contiguous areas that may meet basic technical requirements and facilitate community conversations around development and use for renewable energy generation.
Better coordination among planning efforts can help our region transition and make sure no one is unduly burden by cost or left out: • Integrate energy into land use planning and working with energy stakeholders to ensure that that energy planning not only is consistency with local regulations and visioning but accounts for targeted growth and likely demand; • Advocate for broader policies and programs to address reliability and local resilience; • Supports municipalities, affordable housing partners, community groups, and businesses to consider integrating on-site energy generation, storage, and back-up power into their capital improvement planning; • work with DUs on data gaps and to integrate their Integrated Resource Planning into regional and municipal planning and project development and to advocate that regional and municipal energy planning and goals in turn are considered in their Integrated Resource Planning Processes
Support municipalities establish fossil fuel free alternatives to back-up power which have the added benefit of capitalizing on existing funding to meet a common municipal demand that lacks existing funding. • Provide support and education around existing technologies including how bi-directional EV chargers, power storage, mobile solar generators, and Meter-Socket Adapters can be integrated into existing and new energy systems across our region at all scales to transform our region into one dotted with micro-grid capabilities.