CHITTENDEN COUNTY RPC
Communities Planning Together

Energy Sub-Committee

July 10, 2023
6:00 to 8:00 PM

Remote Access ONLY Meeting via Zoom

Please join the meeting by clicking: https://us02web.zoom.us/j/88551593216

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

Agenda

1. **Welcome**

2. **Approve May 25, 2023**
   Please review the minutes of the May 25, 2023 Meeting here

3. **Renewable Energy Generation Target (Darren Schibler)**
   Please see the ECOS Plan supplement 6 methodology for establishing renewable energy generation targets. The discussion of this methodology starts on page 13.

4. **ECOS Plan Energy Key Trends and Issues, Strategies and Actions, and Supplement 6 (Melanie Needle, Darren Schibler)**
   Please review the energy related sections of the ECOS Plan contained in the packet and come prepared with comments. The sections of the ECOS Plan included in the packet have been edited to include the committee's comments to date. Our discussion will focus on any additional edits that are needed. Please keep in mind that we have one more meeting. The last meeting scheduled for 7/24 will be when the committee considers whether to forward the draft energy sections to the Long Range Planning Committee for their review before it goes to the CCRPC Board in the fall.

   As a reminder, the purpose of the energy goal and key trends/insights section of the ECOS Plan is to describe existing conditions within the energy sector, discuss progress made towards meeting our energy targets, and review challenges and opportunities with meeting the ECOS Plan's energy goal and strategies. The ECOS Plan strategies are CCRPC's action agenda for implementation. Strategy 2 focuses on the land use goal of encouraging a majority of new growth in a compact development pattern within our areas planned for growth. Energy Strategy 4, Action a. focuses on the implementation work CCRPC does in the electric and heating sectors. Strategy 4, Action b, and the actions f. and h. Strategy 6 and Strategy 7, are intended to be the siting policies related to avoiding or mitigating impacts to natural resources from renewable energy generation development. However, no edits were made to these strategies, so they were not included in the packet.

5. **Next Steps:**
   a. Next Meeting July 24, 2023
   b. Long Range Planning Committee (LRPC) Meeting August 8, 2023

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

X. ENERGY AND GREENHOUSE GAS EMISSIONS REDUCTION

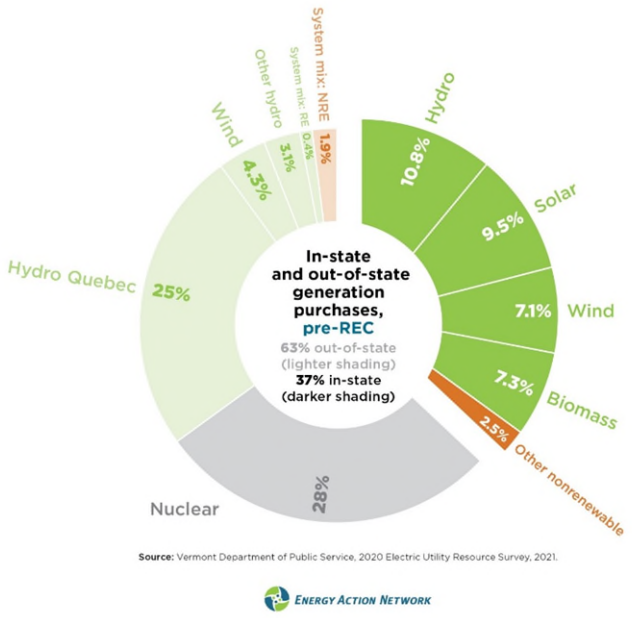
Energy Goal: Move Chittenden County's energy system toward cleaner, more efficient, and renewable sources in a manner that is accessible to all and does not unfairly burden any groups, communities, locations, or economic sectors, and benefits public health, the natural environment, economic development,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

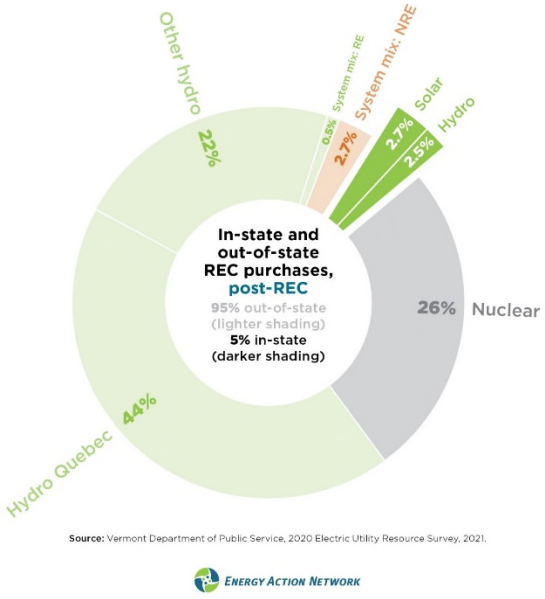
Key Issues/Trends/Insights

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

Energy Overview

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





- The price of energy is forecasted to continue increasing in the future, which will result in an additional burden on the County's residents and businesses, especially for low or fixed income households. Reducing energy consumption and generating on-site renewable energy are ways to mitigate the increasing costs of energy.
- Vermont, and the County, relies heavily on gasoline and diesel for transportation. However, gasoline usage for transportation has decreased due to improved fuel economy standards and the inclusion of electric vehicles in the light duty sector. According to the Energy Information Administration, between 2012 and 2021, motor gasoline consumption decreased by almost 11% or from 7,409 to 6,606[45] thousand barrels.
- Chittenden County is home to an international airport and a National Guard base. Transportation fuel consumption in the County not only includes gasoline, diesel, and compressed natural gas, but also aviation gasoline and jet fuel.

Weatherization and Energy Efficiency

- Weatherizing homes has an immediate impact on people's lives and promotes energy efficiency and a cleaner environment. Once a home is weatherized, there is an average annual energy savings of 31%, which puts much-needed money back into the pockets of people who need it the most. Weatherization is a critical anti-poverty program for low-income households that also promotes environmental justice and health equity. For example, weatherization programs reduce carbon emissions and assist in the removal of environmental hazards such as lead, asbestos, and vermiculite. These environmental hazards are typically found in buildings located within Chittenden County's disadvantaged neighborhoods, as defined by the Federal Justice40 Initiative.
- The 2022 CEP and the State Climate Action Plan calls for an ambitious target to weatherize 120,000 homes by 2030 statewide to meet carbon reduction goals and to protect the health and financial security of Vermont's most impacted communities. According to the LEAP analysis, Chittenden County would need to weatherize XX% of homes by 2025 and XX% of homes by 2050. According to the 2022 Vermont Energy Action Report, 31,338 homes have been weatherized statewide as of 2020. To meet the state's weatherization goal, the Energy Action

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

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

Fuel Switching and Electrification

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

- The Metropolitan Transportation Plan (MTP) anticipates a significant mode shift from driving to biking or walking, including the use of electric bikes (e-bikes). Improving the region's active transportation infrastructure will be necessary to support this transition.

- **Heating.** It is necessary to shift the heating sector away from fossil fuel use. Promoting air source and geothermal heat pumps (powered by a renewable electric grid), in addition to sustainably harvested wood/biomass systems, biogas and geothermal heating systems, is key to meeting the Global Warning Solutions Act requirements and the 2022 CEP goals. However, low income, BIPOC, and renter households are likely to experience barriers and be burdened by the cost of transitioning to heat pump technology or any technology because of the cost of upfront investments to retrofit buildings. Additionally as noted in the 2022 Vermont Energy Action Network Annual Report, natural gas costs less than electricity[1] so customers are not likely to save money by replacing existing natural gas heating systems with heat pumps . Buildings switching from fuel oil or propane to a heat pump system will save customers money and protect customers from price volatility as the cost of electricity is less than fuel oil or propane and is less susceptible to price fluctuations. Net-zero buildings and heat pumps as the primary fuel source in new buildings will help the region meet its goal of shifting the heating sector away from fossil fuels.

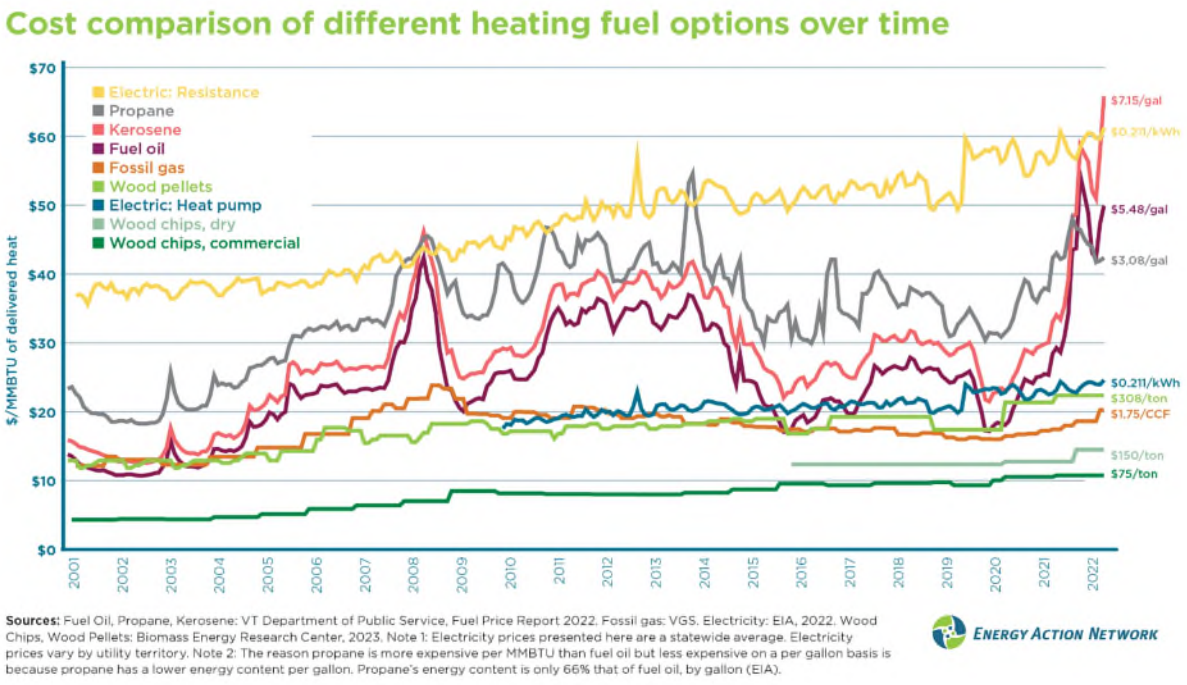


Figure sourced from 2022 Vermont Energy Action Network Annual Progress Report, page 27.

- VGS's comprehensive strategy for NetZero by 2050, with an immediate goal of reducing GHG emissions for customers by 30% by 2030, is critical to achieving the State's energy and climate goals. Expanding renewable natural gas to make up 20% of the supply mix by 2030 is also part of VGS's strategy.

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

Renewable Energy Generation

- As of 2022, Chittenden County generates 606,554 MWh of renewable energy from a range of non-fossil fuel based, renewable energy production sites owned by utilities, private parties, and municipalities. Reliable, cost effective, and environmentally sustainable energy availability is critical to support the economy and natural resources of Chittenden County.
- **Equitable Access to Renewables.** However, the environmental and cost saving benefits of renewable energy generation are not always equally accessible. Impacted communities may be left out or burdened by renewable energy generation programs because of not owning homes or living in multi-unit buildings. Community solar is one way to increase access to renewable energy generation because zero upfront investment is needed and participating in community solar programs does not require solar panel installations.
- **Grid Resilience.** As we transition to more renewables, grid resilience is valued by both residents and business, especially because Vermont's weather and landscape patterns make us vulnerable to grid outages. When storage is coupled with distributed energy generation it can provide a source of backup power and also offer the potential to minimize loads at peak times, thereby reducing energy costs compared to the use of centralized power plants.
- **Renewable Electricity Standard.** A Vermont law passed in 2015, Act 56, established a renewable energy standard (RES) which requires Vermont's electric utilities to source 55% of their retail electricity from renewable sources by 2017, 75% by 2032, and 90% by 2050.
    - Among the three electric utilities that operate within Chittenden County, Green Mountain Power's supply is now 100% carbon free and 68% renewable now and will be 100% renewable by 2030. Burlington Electric Department's portfolio is also 100% renewable. Vermont Electric Co-op plans to meet or exceed its RES obligations by 2030.
    - While the region's baseline electricity consumption overwhelmingly comes from carbon-free and even renewable sources, during peak demand times that exceed renewables' capacity the demand must be met with imports from the New England (NE) System Mix. To meet the demand, peak electricity is mostly provided by natural gas generation, which is a source of greenhouse gas emissions.
- As part of Act 56, electric utilities also need to work with customers to reduce fossil fuel and decrease carbon emissions from transportation and thermal heating by offering new innovative programs and services to their customers. The electric utilities subject to Act 56 are offering innovative products for electrification and incentives to meet the statute and deliver innovation.
- Vermont's rural nature offers challenges for the transmission and distribution of energy. It is important to maintain and develop an energy production, transmission, and distribution infrastructure in Chittenden County that is efficient, reliable, cost-effective, and environmentally responsible. Current energy distribution projects include: Extension of 3-phase power in south Hinesburg along VT116 by Green Mountain Power; and the City of Burlington and partners are planning to advance a district heating system using McNeil's waste heat for distribution to the University of Vermont Medical Center. See the CEDS Project list in Supplement 4 for cost estimates, funding sources and proposed timelines for these projects.
- The cost of electricity is impacted by the distance it travels. When electricity is transmitted over long distances a significant amount of electricity is lost. Locating distributed generation near electric loads reduces transmission losses and could result in more cost-effective retail electricity rates.
- Every three years, Vermont Electric Power Company (VELCO), the State's transmission utility, completes a Long-range Transmission Plan. This plan identifies transmission-constrained areas and reliability concerns. The plan also identifies potential infrastructure projects that may be needed to address identified concerns. The 2021 Long-range Transmission Plan identifies several projects within Chittenden County, and in areas immediately adjacent to the County, that will likely need to be installed over the next decade due to anticipated growth in electric demand due to mass electrification and due to the State's increasing reliance on distributed

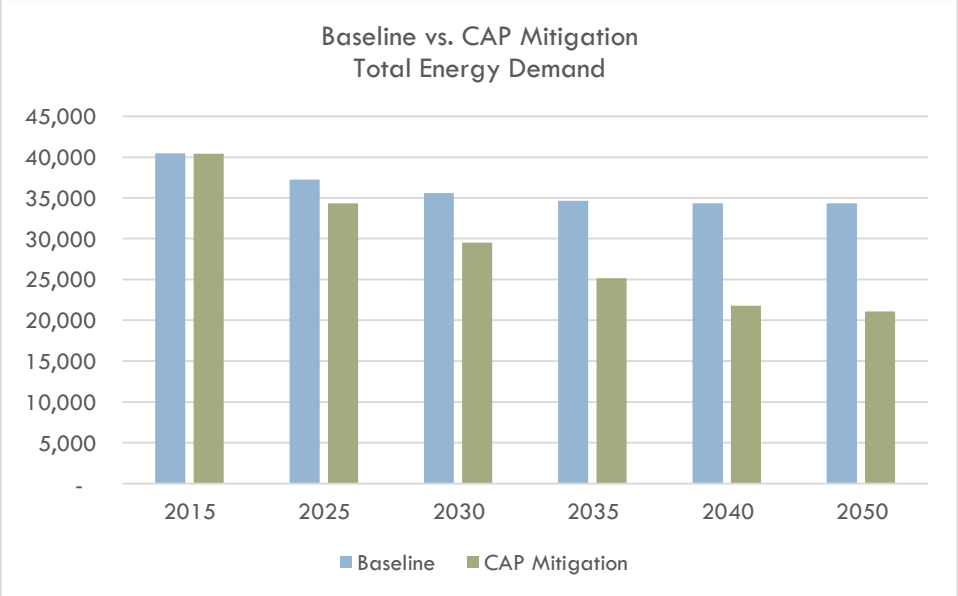
generation (see pages 38-39). Adequate transmission and distribution grids that are able to accommodate the planned increase in electricity use, and reduces energy loss, are necessary to meet the goals of this section.

Energy and Land-Use Planning

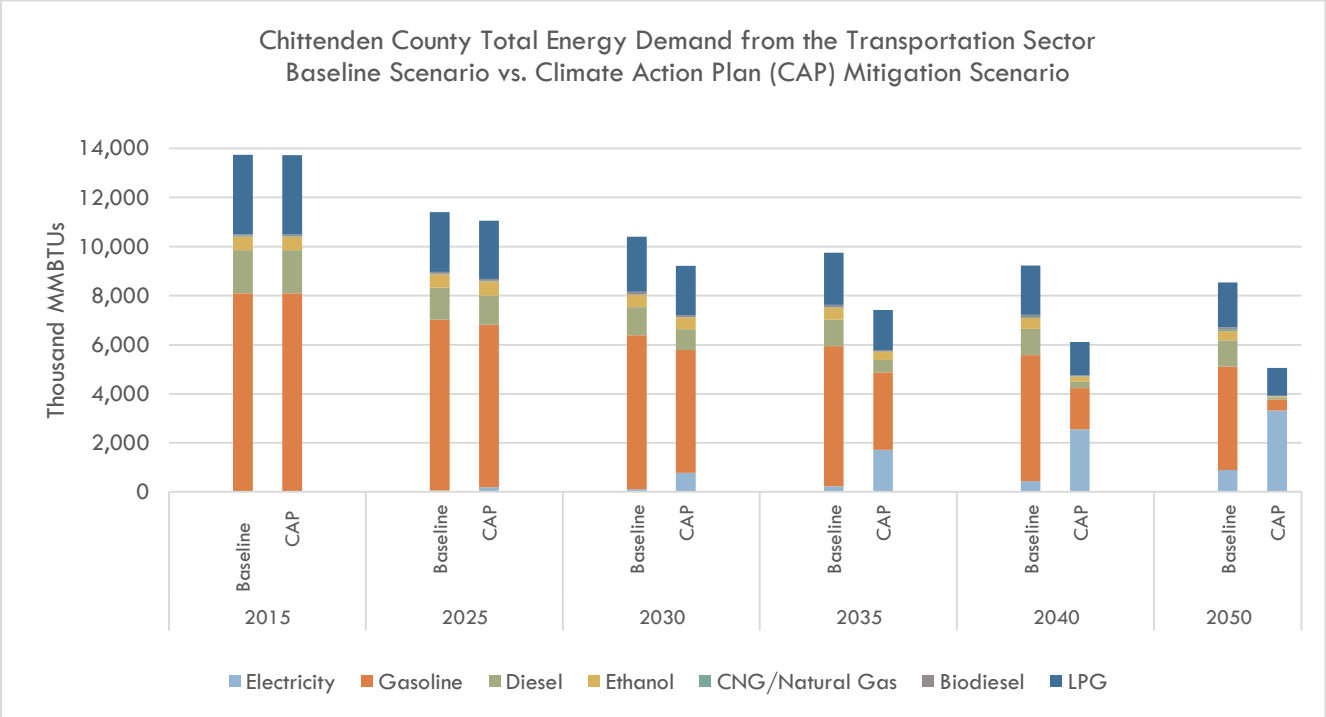
- **Compact Development Patterns.** One of the most impactful ways to reduce greenhouse gas emissions is to enable more compact walkable neighborhoods in the region's areas planned for growth. Chittenden County, perhaps more so than other regions of the State, can achieve great energy efficiency and GHG benefits because of development density and infill development goals.
    - Energy Efficiency. Compact walkable neighborhoods encourage smaller building footprints with lower heating and cooling needs, promotes efficient travel that is less dependent on cars and provides more opportunity for walking, biking, and transit.
    - Conservation for Carbon. Compact development also decreases development pressure on Vermont's working and natural landscapes, preserving land for existing and future carbon sequestration and storage. Maximizing use of rooftops and other previously developed sites for renewable energy generation also achieves this goal.
    - Electric Load Efficiency. Dense population centers make distributed generation easier because energy can be produced near significant numbers of customers. Additionally, portions of the county's dense land use pattern may allow for innovative energy solutions, such as district heating and microgrids.
- **Enhanced Energy Planning.** In 2016, the Vermont Legislature Enacted Act 174 to improve energy planning and give town and regional plans greater weight or "substantial deference" in Public Utility Commission (PUC) proceedings. As of 2022, Bolton, Burlington, Charlotte, Colchester, Essex Junction, Huntington, Jericho, Richmond, Shelburne, Williston, Winooski, Hinesburg, Underhill, and Westford have adopted enhanced energy plans.
    - Development Constraints. One element of enhanced energy planning involves identifying and mapping restrictions on development, which under Act 174 must be applied equally to renewable electricity generation projects as well as other forms of development. While this is generally good policy, there may be circumstances where ground-mounted solar panels or wind turbines could be developed without creating negative impacts. Further study and consideration of these policies is warranted to find workable solutions for responsibly siting renewables amidst these constraints. This will reduce competition between renewables and other forms of development which have greater impacts on protected resources.
    - Furthermore, the current PUC Rule 5.700 imposes standards and requirements on wind energy that have the effect of prohibiting its development. CCRPC supports regulatory changes to make wind power more viable for several reasons. First, it is complementary to solar in terms of its generation profile. Second, it can provide local low-cost electricity for Vermont rate payers. Host communities' benefit from increased property taxes and jobs. Wind generation in Vermont can also reduce Vermont's strong dependence on external electricity providers, such as Hydro Quebec, to supply our electric needs in an increasingly electrified world.

Energy Analysis and Targets

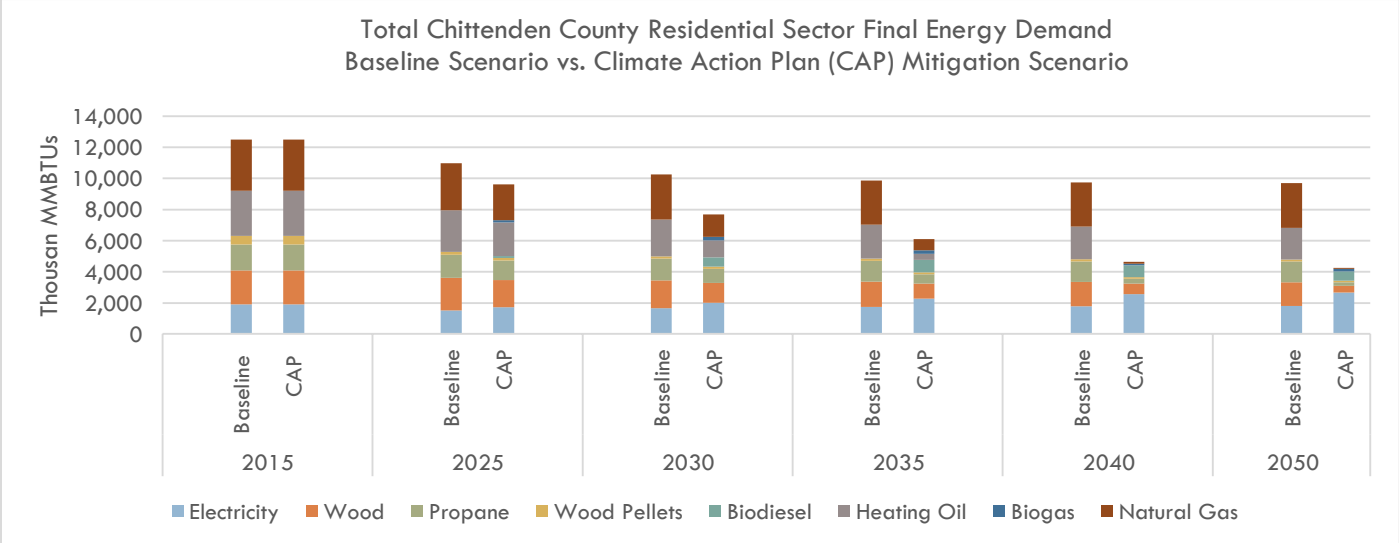
- As part of the development of Vermont's Comprehensive Energy Plan (CEP) and Climate Action Plan (CAP), the Stockholm Environment Institute (SEI) and Northeast States for Coordinated Air Use Management (NESCAUM) developed a scenario model of Vermont's energy consumption to construct pathways to meet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



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

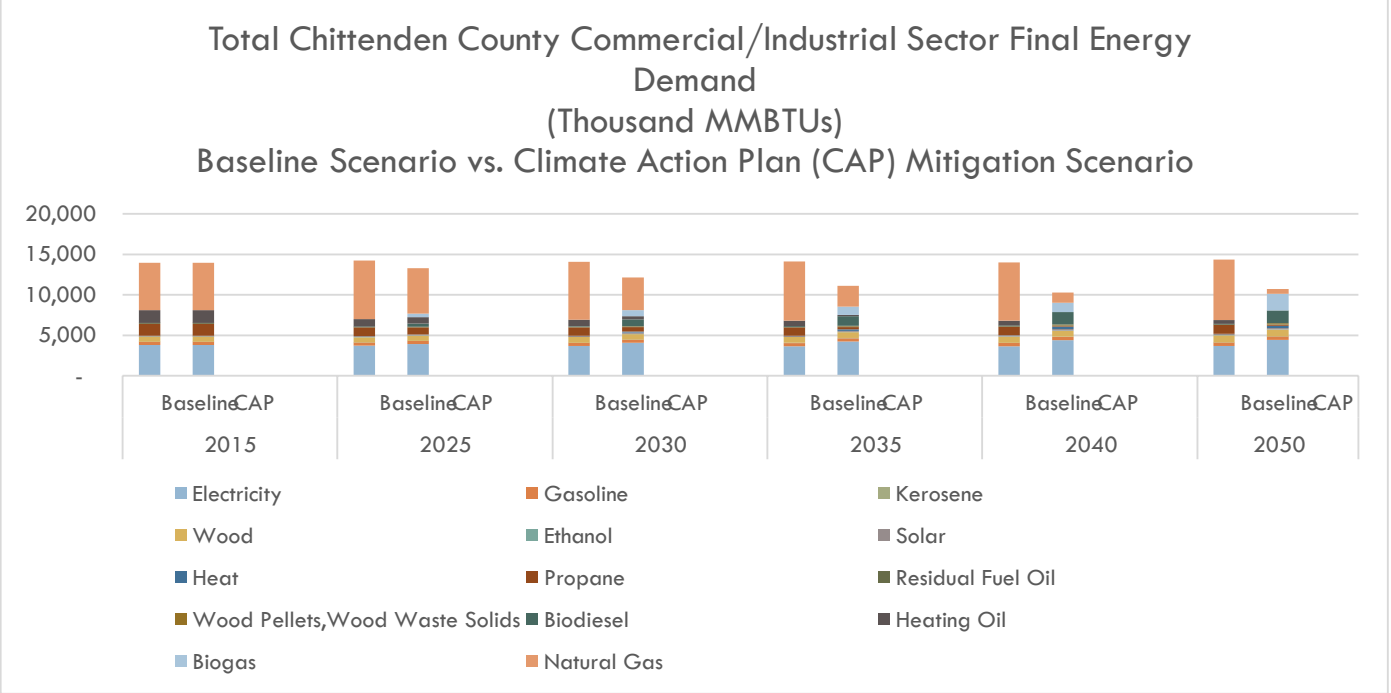


- Based on the LEAP Climate Action Plan Mitigation Scenario,thermal energy use in Chittenden County homes is projected to decrease by 64% from 2025 to 2050.Electricity demand will increase by 140% between 2025 and 2050. Natural gas, fuel oil, and propane will virtually be eliminated. Residential buildings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



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

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



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

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

Target Year	2032	2040	2050
Total Renewables Target	648,475	857,945	954,833
Existing Renewables (2022)	606,554	606,554	606,554
New Renewables Target	41,922	251,391	348,279

Key Indicators

Additional indicators can be found on the ECOS Scorecard.

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

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

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

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

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

Actions

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

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

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

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

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

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

4. State/Local Permitting Coordination & Improvement

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

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

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

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

- Meet the Global Warming Solutions Act greenhouse gas emissions (GHG) requirements:
  - 26% reduction from 2005 levels by 2025
  - 40% reduction from 1990 levels by 2030
  - 80% reduction from 1990 levels by 2050
- Weatherize 120,000 Vermont homes by 2030 (relative to the 2008 baseline)
- Meet 90% of Vermont's energy from renewable sources by 2050
  - Intermediate goals of 25% of energy from renewable sources by 2025 and 45% by 2035.
  - In the transportation sector, 10% of energy needs will be from renewable energy by 2025, and 45% by 2040. Zero-emission vehicles account for 100% of light-duty vehicle sales by 2035.
  - In the thermal sector, 30% of energy needs will be from renewable energy by 2025, and 70% by 2042. Weatherizing 120,000 households by 2030. Achieve net-zero ready construction for newly constructed buildings by 2030.
  - In the electric sector, be 100% decarbonized and at least 75% renewable by 2032.

b. **Municipal Assistance**

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

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

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

c. **Transportation**

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

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

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

d. Thermal Sector Partnerships

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

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

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

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

e. Renewable and Resilient Electricity

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

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

iii. Support in-place upgrades of existing facilities, including existing renewable energy generation, storage, transmission lines, distribution lines, substations, and energy storage as needed to reliably serve municipalities and the region with a resilient and low-carbon electric grid that supports a growing renewable electricity economy and low electricity costs.

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

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

ii. Factor in societal costs and benefits in calculating the cost of the net-metering program to utilities, which may help broaden participation in the net-metering program among lower-income households.
iii. Establish a tiered system for net-metering rates in which utilities pay a lower premium rate to facilities over a certain size (such as 500kW) to encourage larger projects to use this program.
iv. Increase the maximum size of net-metered projects (currently 500kW) for public and non-profit entities to encourage them to maximize development of renewable energy sources.
v. Advocate for the Public Utility Commission to open the rule making process on Rule 5.700, Sound Levels From Wind Generation Facilities, to reassess existing sound standards with the intent of allowing all sizes and scales of wind energy generation possible in Chittenden County.

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

Constraint Policies: Ground mounted renewable energy generation is constrained in certain areas due to state and local restrictions on development.

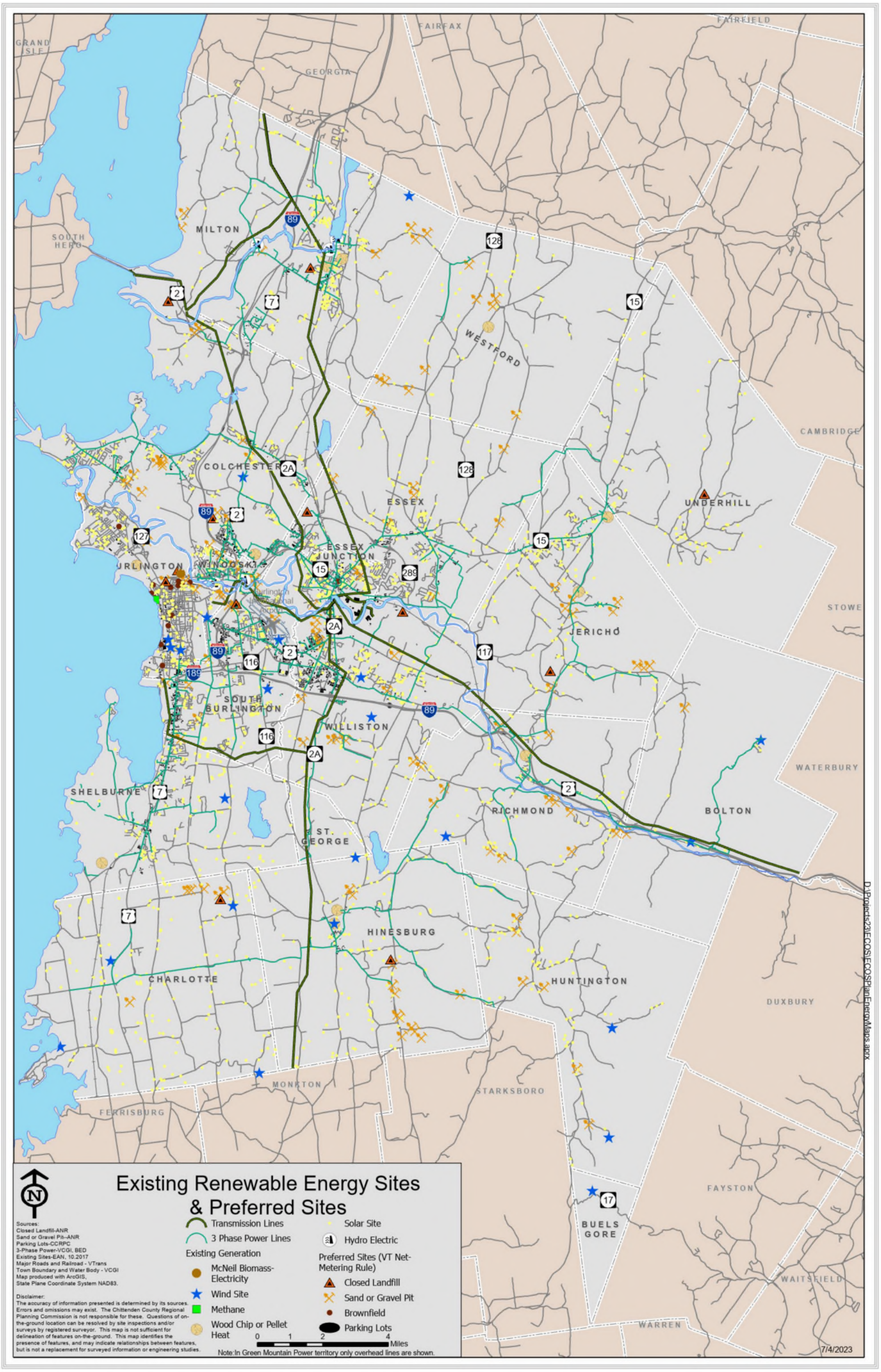
i. Site renewable energy generation to avoid state and local known constraints and to minimize impacts to state and local possible constraints, as defined in Strategy 3, Action 1.f, and Strategy 4, Action 1.f, and Action 2.e. Renewable energy generation sited on existing structures or parking lots complies with this policy.
ii. Site ground-mounted solar development in accordance with setback standards as defined in 30 V.S.A. §248(s) and municipal screening requirements adopted in accordance with 30 V.S.A. §248(b)(B).

Suitability Policies: After considering the constraints referenced above and found in Supplement 3, different levels of suitability exist for different scales and types of renewable energy generation depending on location within the County. To determine an appropriate location for a facility, first review the constraints above and then look at the polices below to determine how and where CCRPC encourages renewable energy generation facilities. CCRPC recommends the location of renewable energy generation facilities in accordance with the relevant guidelines below. Inability to meet these guidelines does not necessarily preclude the ability to develop renewable energy generation development.

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

iv. Locate renewable energy generation in areas designated by a municipality in an adopted plan for such use, including specific preferred sites for solar (state preferred sites are mapped on Map 5).
v. Locate solar generation (including but not limited to net metering) on previously impacted areas (such as, parking lots, previously developed sites, brownfields, State regulated landfills with post-closure certification, gravel pits/quarries, or on or near existing structures).
vi. Locate ground-mounted solar larger than 15 kW AC (except for parking lot canopy solar installations) and wind turbines with a hub height larger than 30 meters (98 ft.) outside of state designated village centers, growth centers, downtowns, new town centers, neighborhood development areas, and historic districts on the State or National Register.
vii. To mitigate load growth, integrate renewable energy generation facilities in a manner that allows infill to be the priority within areas planned for growth but outside designated areas mentioned above.
viii. Locate wind generation in areas with high wind potential, such as the prime and base wind potential areas shown on Map 7.

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



Note: This map and the corresponding data is intended to be used to inform energy planning efforts by municipalities and regions. This map may also be used for conceptual planning by those interested in developing renewable energy infrastructure.

These maps do not take the place of site-specific investigation for a proposed facility and should not be used as "siting maps". This map does not take all regulations into account and automatically prohibit or allow renewable energy generation and replace the detailed process a developer must go through to propose a site for a renewable energy facility. This map shall not be used without the accompanying policies contained within the Chittenden County ECOS Plan.

MILTON
WESTFORD
COLCHESTER
ESSEX
UNDERHILL
WINOOSKI
BURLINGTON
ESSEX JUNCTION
JERICHO
SOUTH BURLINGTON
WILLISTON
BOLTON
RICHMOND
SHELBURNE
SAINT GEORGE
HINESBURG
CHARLOTTE
HUNTINGTON
BUELS GORE

State and Local Development Constraints

- State Known Constraints
- Local Known Constraints
- State Possible Constraints
- Local Possible Constraints

0 1 2 4 Miles

5/18/2023

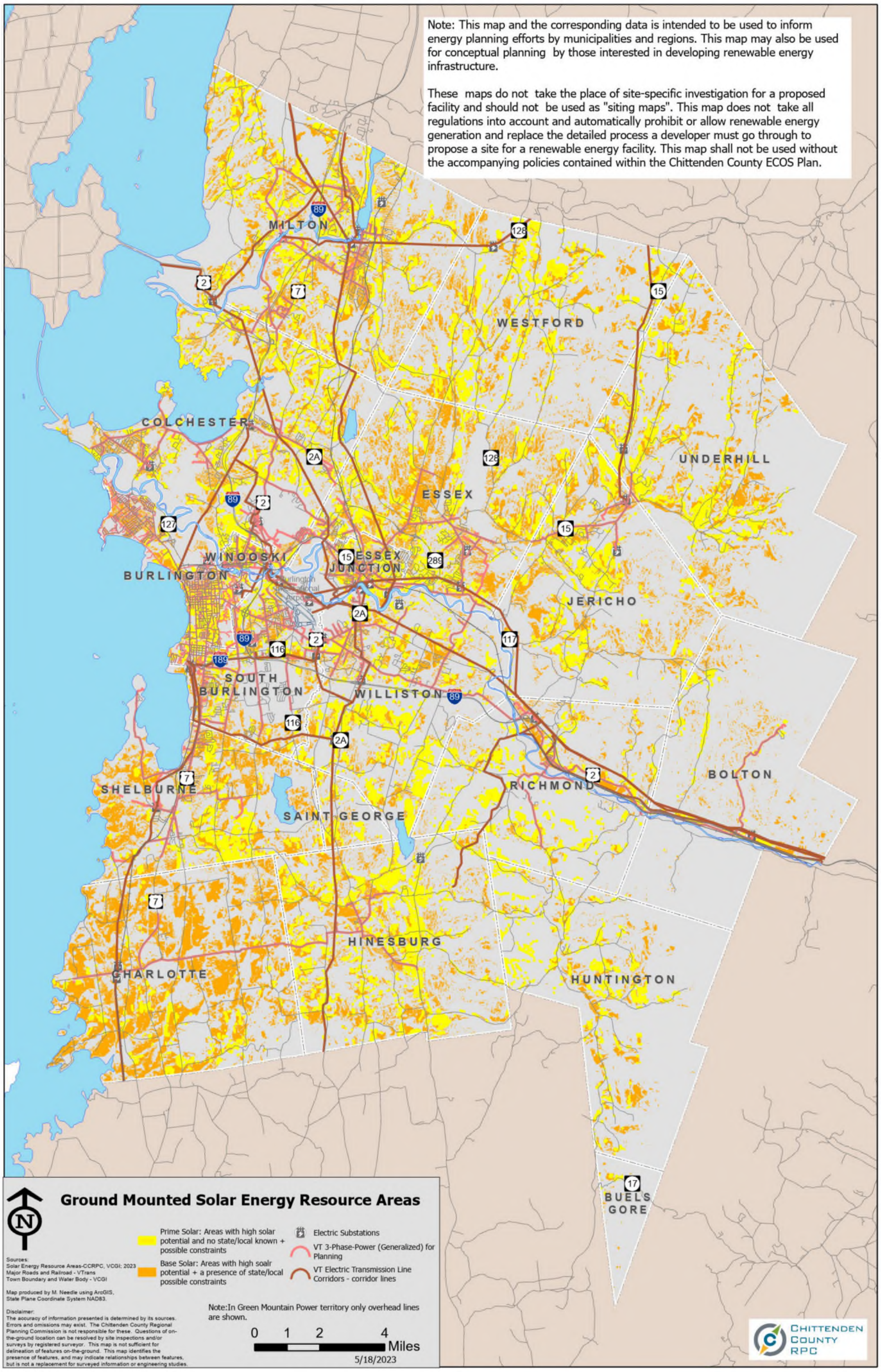
Sources:
Major Roads and Railroad - VTrans
Town Boundary and Water Body - VCGI

Map produced by M. Needle using ArcGIS,
State Plane Coordinate System NAD83.

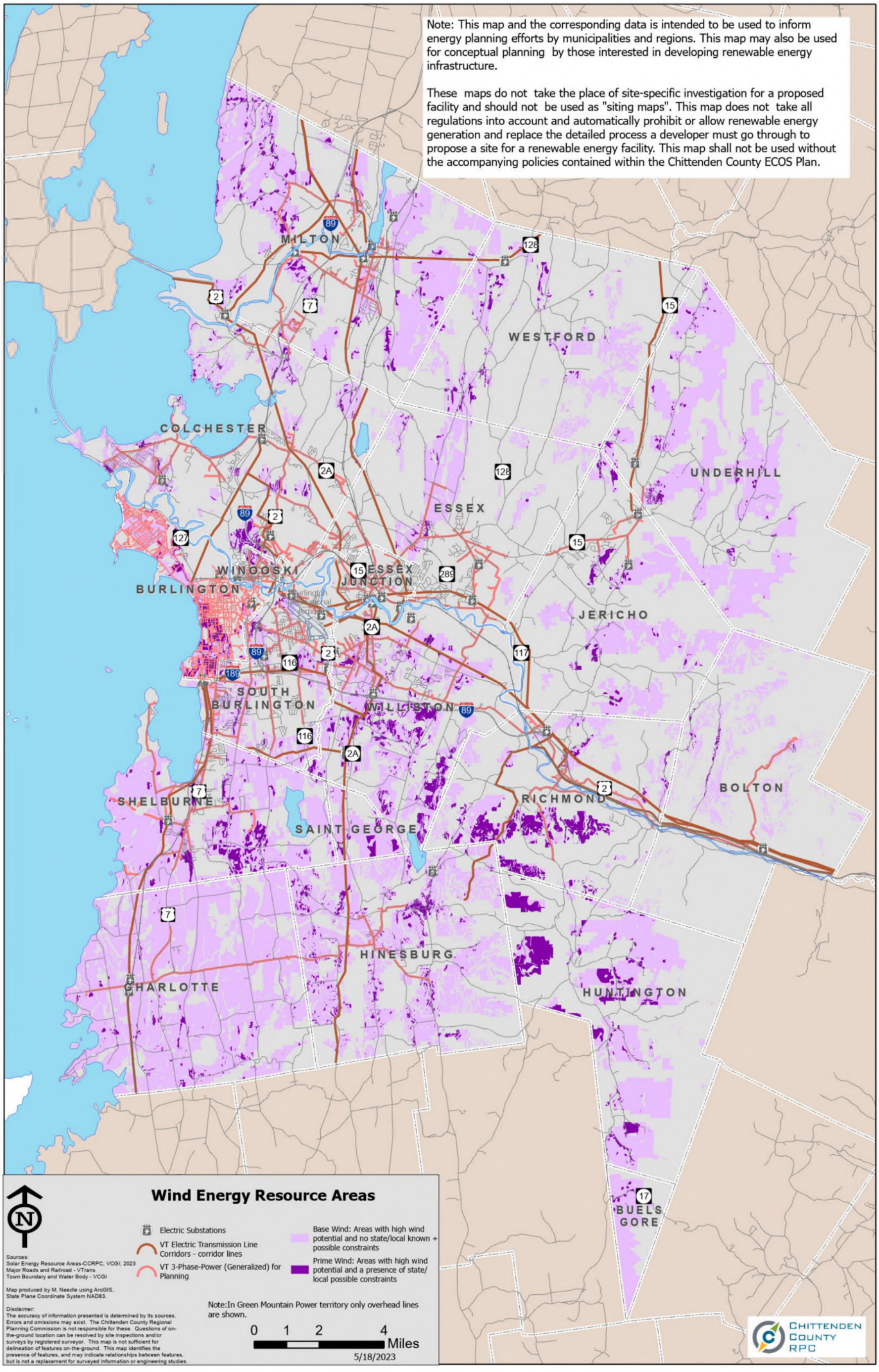
Disclaimer:
The accuracy of information presented is determined by its sources. Errors and omissions may exist. The Chittenden County Regional Planning Commission is not responsible for these. Questions of on-the-ground location can be resolved by site inspections and/or surveys by registered surveyor. This map is not sufficient for delineation of features on-the-ground. This map identifies the presence of features, and may indicate relationships between features, but is not a replacement for surveyed information or engineering studies.

CHITTENDEN COUNTY RPC

MAP 6 – SOLAR GENERATION POTENTIAL



b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MILTON
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BURLINGTON
ESSEX JUNCTION
JERICHO
SOUTH BURLINGTON
WILLISTON
SHELBURNE
SAINT GEORGE
RICHMOND
BOLTON
HINESBURG
CHARLOTTE
HUNTINGTON
BUELS GORE
Wind Energy Resource Areas
Electric Substations
VT Electric Transmission Line Corridors - corridor lines
VT 3-Phase-Power (Generalized) for Planning
Base Wind: Areas with high wind potential and no state/local known + possible constraints
Prime Wind: Areas with high wind potential and a presence of state/ local possible constraints
Note:In Green Mountain Power territory only overhead lines are shown.
0 1 2 4 Miles
5/18/2023
Sources:
Solar Energy Resource Areas-CCRPC, VCGI; 2023
Major Roads and Railroad - VTrans
Town Boundary and Water Body - VCGI
Map produced by M. Needle using ArcGIS, State Plane Coordinate System NAD83.
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CHITTENDEN COUNTY RPC

2024 Chittenden County ECOS Plan

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

For a healthy, inclusive, and prosperous community

Chittenden County RPC
Communities Planning Together

GBIC
Good Jobs In A Clean Environment

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

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

TABLE OF CONTENTS

Energy Analysis, Targets, & Methodology

INTRODUCTION

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

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

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

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

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

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

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

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

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

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

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

1. EQUITY ASSESSMENT

The Department of Public Service's energy planning standards requires that the potential equity impacts of the land use, energy efficiency, renewable energy generation, and transportation policies be assessed to help ensure the transitions required to meet Vermont's renewable energy goals and GHG requirements work to make energy more accessible and democratically managed for all Vermont communities.

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

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

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

2. CURRENT ENERGY DEMAND

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

Transportation Energy

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

TABLE 1. CURENT CHITTENDEN COUNTY TRANSPORTATION ENERGY USE

Current Chittenden County Transportation Energy Use		
	Total	Percent
Total pleasure cars or trucks	126,284	100.00%
Total Fossil Fuel Burning	123,101	97.47%
Electric Light Duty Vehicles	3,183	2.52%

All-Electric Vehicles	*1,755*	*1.39%*
Plug in Hybrid	*1,428*	*1.13%*

Sources: Efficiency Vermont RPC Report, June 2023; VT DMV (November 2022)

Thermal Energy

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

TABLE 2. CURRENT THERMAL ENERGY USE FROM NATURAL GAS

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

TABLE 3. CURRENT THERMAL ENERGY USE

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

Weatherization

The State of Vermont's energy goals include a goal to weatherize 120,00 homes by 2030. The best available data source for home weatherization is Efficiency Vermont. 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. Table 4 below indicates the number of energy efficiency projects completed. It is not intended to represent the number of homes weatherized.

TABLE 4. RECENT RESIDENTIAL ENERGY EFFICIENCY PROJECTS (NEEDS TO BE UPDATED ONCE WE GET BED DATA TO BE INCLUDED WITH RPC ENERGY REPORT

Recent Residential Energy Efficiency Projects			
	2020	2021	2022

Home Performance with ENERGY STAR® Leads	
Home Performance with ENERGY STAR® Projects	
Total Residential Projects (includes Home Performance with ENERGY STAR® projects)	
Source: Efficiency Vermont RPC Report, June 2023; BED	

Electricity

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

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

	2022
Residential Electric Energy Use (MWh)	~~425,335~~
Commercial and Industrial Electric Energy Use (MWh)	~~1,483,006~~
Total Electric Energy Use (MWh)	~~1,908,341~~
Source: Efficiency Vermont, Burlington Electric Department	

Current Renewable Energy Generation

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

TABLE 7. EXISTING RENEWABLE ELECTRICITY GENERATION

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

Source: Vermont Department of Public Service Distributed Generation + Survey, January 2023 (with corrections by CCRPC).

**The total existing renewable energy generation varies from the existing renewable energy generation reported in the renewable energy targets sections due to variations in the way the data is counted. These sites represent facilities that have been permitted.*

3. ENERGY TARGETS

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

In order to support enhanced energy planning at the regional and municipal levels, the Department has undertaken an effort to "regionalize" final energy demand outputs from the statewide LEAP modeling for four core sectors: residential, commercial, industrial, and transportation. This section includes a simple disaggregation of those results for the residential, transportation, and commercial sectors based on key drivers of energy demand. The targets are derived from the **Central GWSA Mitigation ("CAP Mitigation")** scenario developed to meet the state's GHG reduction requirements. These targets show

the direction and magnitude of change needed meet local, regional, and state energy goals and are not intended to be used in a regulatory context.

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

Transportation Energy Targets

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

TABLE 8. ELECTRIC VEHICLE TARGETS

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

TABLE 9. TRANSPORTATION ENERGY DEMAND

Chittenden County Total Energy Demand from Transportation Sector (Thousand MMBTUs)					
Fuel	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	178	771	1,714	2,555	3,323
Gasoline	6,639	5,018	3,154	1,677	448
Diesel	1,188	844	511	278	78
Ethanol	568	479	333	194	52
CNG/Natural Gas	21	17	11	6	2
Biodiesel	84	84	66	45	18
LPG	2,375	1,998	1,622	1,350	1,133
Total	11,053	9,210	7,410	6,105	5,054

Thermal Energy Targets, Commercial/Industrial Sector

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

TABLE 10. PROJECTED COMMERCIAL/INDUSTRIAL THERMAL ENERGY USE

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

TABLE 11. COLD CLIMATE HEAT PUMPS IN THE COMMERCIAL SECTOR

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

Thermal and Electric Energy Targets, Residential Sector

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

TABLE 12. PROJECTED RESIDENTIAL THERMAL ENERGY USE

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

TABLE 13. HEAT PUMPS IN THE RESIDENTIAL SECTOR

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

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

TABLE 14. TOTAL ENERGY DEMAND IN THE RESIDENTIAL SECTOR

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

Renewable Energy Generation Targets and Potential

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

TABLE 14. RENEWABLE ELECTRICITY GENERATION TARGETS

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

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

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

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

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

TABLE 15. LAND AVAILABLE FOR WIND AND SOLAR GENERATION

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

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

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

TABLE 16. PROJECTED RENEWABLE ELECTRICITY GENERATION POTENTIAL

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

Sources: VCGI, CCRPC and the Department of Public Service

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

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

Calculating Existing Generation and Generation Potential

Existing Electric Energy Generation

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

Ground-Mounted Solar Energy Potential

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

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

Wind Energy Potential

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

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

Rooftop Solar Energy Potential

Rooftop solar potential data is sourced from the Vermont Center for Geographic Information (VCGI) dataset named *Town Rooftop Solar Potential – Act 174 2022*. As explained in the release notes, these estimates use a solar radiation GIS model based on a LiDAR-based digital surface model to determine the total surface area of rooftops suitable for solar photovoltaic panels (accounting for slope, aspect, shading of nearby objects, and minimum size of rooftop). To obtain total system capacity in Megawatts, the resulting roof area is multiplied by 1.5 acres per MW under the assumption that the average rooftop system can produce 3 kW per 200 square feet of panels. Finally, total energy production is estimated using the formula below.

Rooftop MWh of energy = (number of MW) * (0.145 capacity factor) * (8760 hours per year)

Calculating Renewable Energy Generation Targets

Regional Renewable Electricity Generation Target

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

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

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

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

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

Municipal Renewable Electricity Generation Targets

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

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

The targets are technology neutral, meaning that they can be met with any mix of technologies. It is important to note that a municipality may choose to meet its target through a variety of different renewable energy technology types (e.g., wind, hydro, or biomass). Some municipalities may be able to achieve their targets with a single technology; for example, South Burlington’s 2024 Climate Action Plan states that it is possible and recommended to meet its targets exclusively through rooftop solar. However, this is possible for every municipality, and regardless, actual renewable generation facilities developed in any municipality will likely include a variety of technologies. Regardless, at a regional level there is sufficient land area available for renewable electricity facilities to meet the regional target using any technology exclusively.

As shown in Table 28, the PSD tool indicates that nearly every municipality within the region has sufficient land area available for renewable electricity facilities to meet its targets through one or more technologies. The only exception is Essex Junction, whose electricity demand is disproportionately higher relative to its land area due to the presence of GlobalFoundries, a major electricity consumer and regionally important manufacturer. Essex Junction would be unable to meet its targets through any mix of technologies. Essex Junction is allocated a higher proportion of the regional target relative to its land area because of the high amount of energy consumption at Global Foundries (which by itself consumes % of the region’s electricity).

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

TABLE 27. MUNICIPAL RENEWABLE ENERGY TARGETS.

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

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

TABLE 28: TOTAL ENERGY POTENTIAL BY TECHNOLOGY AS A PERCENT OF INCREMENTAL GENERATION TARGETS

Target Year: 2050	Incremental Target (MWh)	Total Energy Potential (MWh)	All Resources	Prime Solar	Base Solar	Rooftop Solar	Prime Wind	Base Wind
Bolton	10,679	40,946	383%	32%	37%	10%	8%	296%
Buel's Gore	4,408	20,606	468%	5%	8%	0%	13%	442%
Burlington	-183,236	75,469	N/A	N/A	N/A	N/A	N/A	N/A
Charlotte	49,708	267,598	538%	11%	82%	12%	7%	426%
Colchester	53,459	100,072	187%	30%	30%	41%	13%	73%
Essex Town	84,575	96,081	114%	20%	30%	19%	1%	43%
Essex Junction	52,876	19,389	37%	6%	6%	24%	0%	0%
Hinesburg	41,234	176,271	427%	49%	48%	12%	26%	294%
Huntington	24,706	112,235	454%	37%	29%	8%	79%	301%
Jericho	20,575	93,185	453%	72%	66%	32%	22%	261%
Milton	-15,782	198,025	N/A	N/A	N/A	N/A	N/A	N/A
Richmond	18,076	73,598	407%	65%	38%	21%	98%	185%
Shelburne	43,041	151,748	353%	24%	41%	25%	25%	237%
South Burlington	53,465	86,273	161%	7%	14%	62%	7%	72%
St. George	5,367	21,610	403%	28%	29%	12%	41%	292%
Underhill	33,387	155,796	467%	56%	51%	9%	11%	339%
Westford	17,667	86,107	487%	104%	83%	15%	27%	258%
Williston	28,828	146,049	507%	64%	39%	88%	56%	259%
Winooski	5,243	10,828	207%	58%	15%	95%	13%	26%
Chittenden County	**348,279**	**1,931,886**	555%	59%	69%	57%	37%	333%

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

This table shows the potential energy that could be generated using the full land / rooftop extent of each renewable technology (and all technologies combined) relative to the targets in Table 28. Green cells indicate that there is sufficient area to meet targets with a given technology, while red cells indicate there is not enough. Using the county as an example, 555% for All Resources means that the county 5.55 times more resource area than it needs to meet the 2050 target. However, it could not meet the target through any one technology alone except base wind. N/A indicates that a municipality has met its target but can still contribute to meeting the overall county target.

Constraints and Suitability Methodology

Natural Resource Constraints

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

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

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

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

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

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

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

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

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

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

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

Local/State Known and Possible Constraints*

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

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

Richmond	Shelburne	South Burlington	Underhill
Known Constraints: • Slopes equal to or greater than 35% **Possible Constraints:** • Wetlands and associated buffers • Water Supply Protection Areas • Surface Water Buffers	**Known Constraints:** None identified **Possible Constraints:** • Significant View Areas • Lakeshore Buffer • Archeological ly Sensitive Areas (not mapped)	**Known Constraints:** • Wetlands and buffer • River Corridor • B2 • Very Steep Slopes greater than 25% **Possible Constraints:** • Habitat Block and Corridor Overlay District • Slopes 15% to 25% • SEQ Natural Resource Protection Area • B1 500-year Floodplain	**Known Constraints:** • Above 1,500 ft. Elevation **Possible Constraints:** • Slopes 15% or greater • Mt. Mansfield Scenic Preservation District • Wetlands and associated buffers, • Surface Waters and buffers
Westford	**Williston**	**State**	**State**
Known Constraints: • Slopes 25% or greater • Deer Wintering Areas • Ledge Outcropping • Flood Hazard Overlay • Water Resources Overlay **Possible Constraints:** None identified	**Known Constraints:** • Water Protection Buffers • Primary Viewshed Areas • Slopes 30% or greater **Possible Constraints:** • Slopes 15% - 30% • Conservation Areas/Natural Communities	**Known Constraints** • FEMA Floodways • DEC River Corridors • National Wilderness Areas • State-significant Natural Communities and Rare, Threatened, and Endangered Species • Confirmed Vernal Pools Class 1 and 2 wetlands	**Possible Constraints** • Potential Vernal Pools • Agricultural Soils + Hydric Soils • Act 250 Ag. Soil Mitigation Areas • FEMA Special Flood Hazard Areas • VT Conservation Design Highest Priority o Interior Forest Blocks o Connectivity Blocks o Physical Landscape Blocks o Surface Water and Riparian Area

		(VSWI and advisory layers)	• Protected Lands (State fee lands and private conservation lands) • Deer Wintering Areas

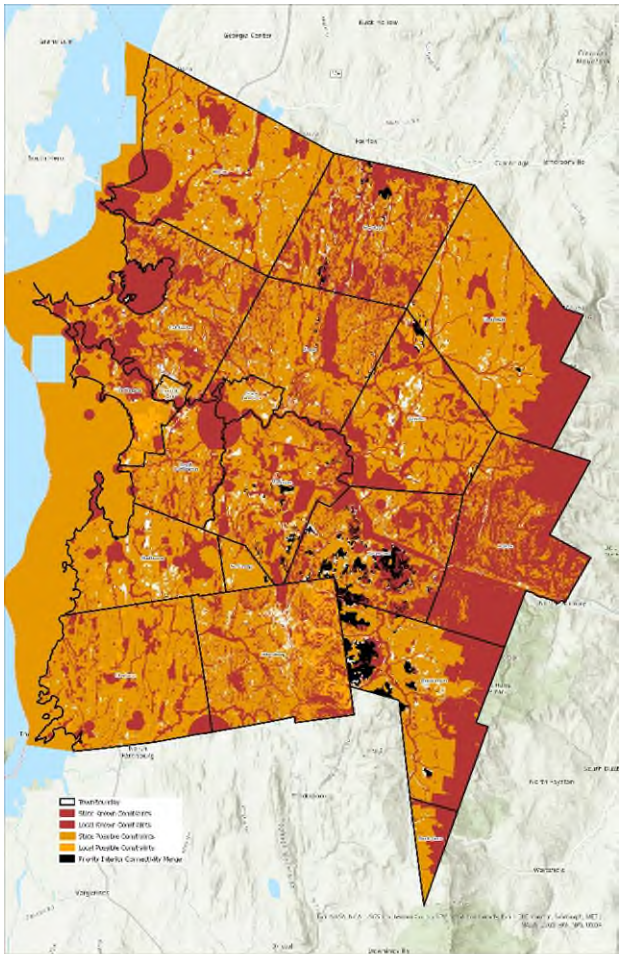
* Not every constraint to development in Chittenden County is reflected in the regional energy planning process. Some municipalities did not request any local constraints. CCRPC did not receive requests from Buel's Gore, Huntington, St. George, or Winooski. In the case of Winooski, it was determined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

Suitability Methodology

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

4. FOREST BLOCK EVALUATION

The energy planning standards require an evaluation of whether forest blocks or habitat connectors should be treated as a possible constraint. CCRPC conducted an overlay analysis of all state/local known and possible constraints included in this plan with priority forest block areas from the Agency of Natural Resources' Vermont Conservation Design. CCRPC determined that a majority of the priority forest block areas are treated as possible constraints due to the inclusion of local constraints with some exceptions in Westford, Jericho, Richmond, and Huntington (see black areas in the image below).

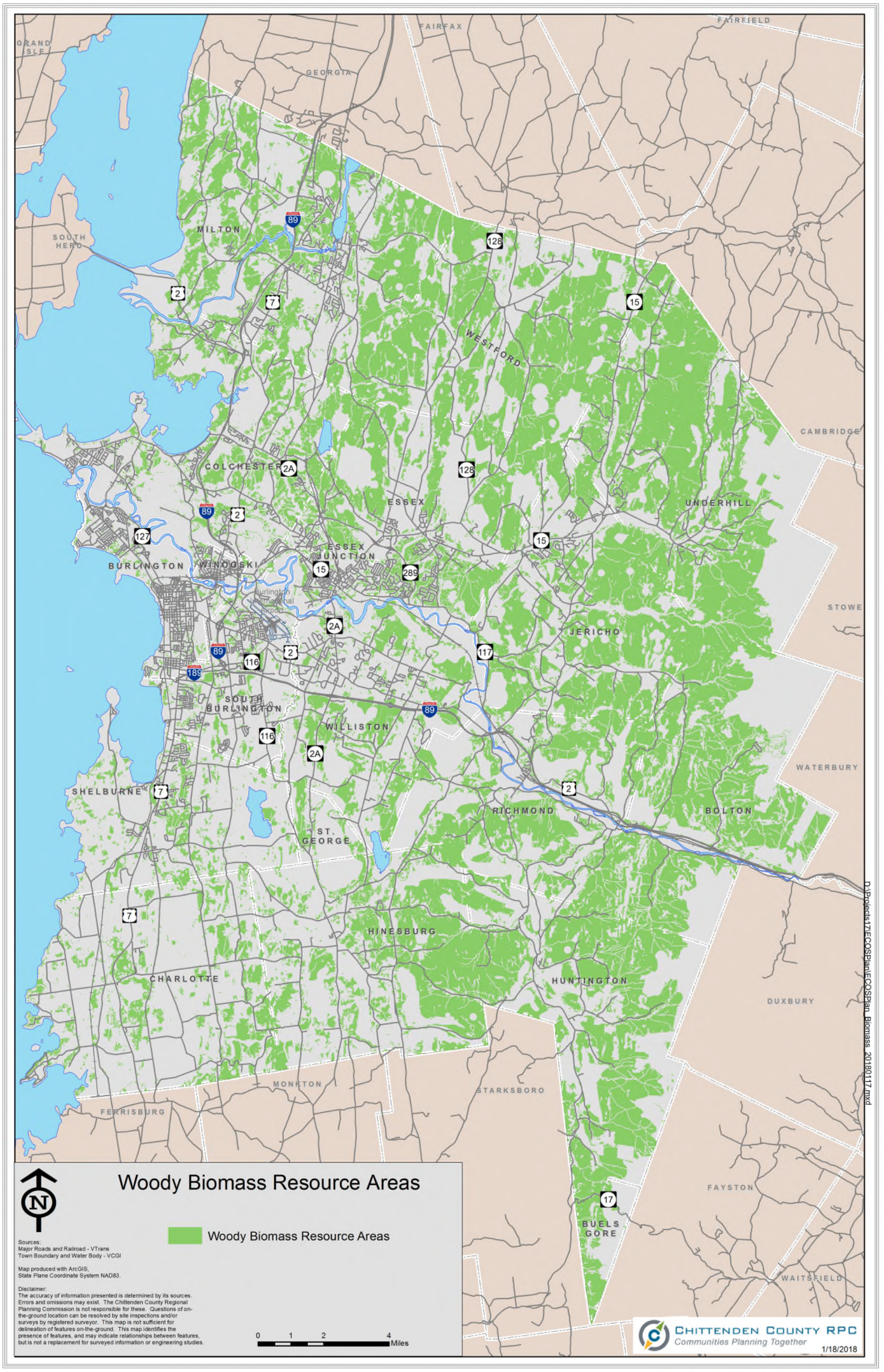


Map 1 shows "woody biomass resource areas" in Chittenden County. The McNeil Generating Station in Burlington is the region's largest user of biomass for energy generation. Most of the wood fueling the McNeil Station in Burlington comes from within 60 miles of the station and is a byproduct of other forestry operations. At full load, approximately 76 tons of wood chips are consumed per hour (about 30 cords). This far exceeds Chittenden County's abilities to produce biomass. A study conducted in 2010 showed that even if Chittenden County's entire annual wood harvest was put towards the McNeil Station, and all non-constrained forest land were harvested at a comparable rate, the McNeil Station could only run for 57 days on wood from Chittenden County. Large amounts of available wood can be found in other parts of Vermont, and neighboring counties in New Hampshire, Massachusetts and New

York.[1] Wood products from both inside and outside Chittenden County will likely continue to provide fuel for the McNeil Station and other biofuel heat and electricity needs. Please keep in mind the woody biomass resource areas do not account for state/local known constraints.

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

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



Draft LEAP Regionalization Results – Answers to RPC Questions

This document provides written answers to each of the questions provided to the Department by the Regional Planning Commissions (RPCs) on the draft outputs of the LEAP regionalization effort. **Questions are listed in black bold** and answers are listed in blue text.

If you asked a question and it is missing from this document, or have a follow up question, please reach out to Claire McIlvennie (claire.mcilvennie@vermont.gov).

This document is structured to address questions in the following manner:

- General Questions (unrelated to specific sectors)
- Residential
- Commercial
- Industrial
- Transportation
- Formatting Issues

General Questions

Are the 2015 numbers actual demand? And the rest are predictions?

In the Vermont Pathways LEAP model, results for 2015-2019 are based on historical data input into the model and 2020 onwards are modeled scenarios (i.e predictions). The results for modeled energy demand in 2015 (and more broadly the 2015-2019 period) are based on calculations within LEAP, which are informed by historical data (ex. the number of heat pumps or other technologies currently in buildings) and then calibrated match information we have on historical demand, vehicle miles traveled, etc.

Given the difficulties (or shall we say impossibility) of getting municipal-specific LEAP-related data, will you and your team have some recommendations/best practices for how the RPCs should disaggregate the RPC data for each of our towns? The last time around several different methods were used. Should we standardize our approach this time?

As discussed during the May Energy Planner Meeting, we will provide guidance on how to disaggregate regional LEAP data for each of your municipalities, based on our review of the existing Municipal Consumption Template, the tool developed by NRPC, and data sources available to support using the same methodology that was used to disaggregate the statewide data to the regional level. This will be included in the final Guidance for Regional Plans that we aim to issue in early July.

Will we talk about how to best use the industrial and heavy-duty vehicle owners' data? Those sectors are not included in most Municipal Plans so it's not part of our typical conversations with our towns. In fact, in the past, many our towns were not sure how to influence commercial energy decisions either. Do you think it wise to have a conversation on how best to address those three sectors?

We can include some additional guidance on that in the Guidance for Regional Plans and am happy to make space to discuss this question during the next meeting with the RPCs on LEAP if desired (i.e the follow-up call we discussed having during the May 26th call). I do think the original Guidance document provides some insight on this which is still relevant and will be carried through to the updated Guidance, for example by suggesting towns and regions identify and reach out to commercial or industrial businesses and encourage them to participate in commercial & industrial energy efficiency programs or encourage energy code compliance in new buildings.

At a high level, I would tailor your discussions based on the towns you are working with – i.e if the town does not include much or any industrial activity or have a large heavy duty vehicle fleet, it wouldn't make sense to have a conversation about this. We are also happy to put energy planners in touch with folks at the state who work on commercial buildings, the industrial sector, or transportation issues who might be able to provide more specific guidance based on the town you are working with.

The table starting on row 67 references statewide. Is this a typo? Also We want to create a total energy demand table that summarizes all the sectors/fuel type for each scenario. Is it correct to add the following tables together:

Residential Sector Final Energy Demand + Residential Thermal Energy Demand + Commercial Sector Final Energy Demand + Industrial Sector final Energy Demand + Passenger Car Final Energy Demand + Non-Road Final Energy Demand + Light Truck Final Energy Demand

Yes this is a typo in row 67 and will be fixed in the final outputs (it should reference "regional" not "statewide" data).

To get total energy demand you would add the following:

- RES Final Energy Demand +
- COM Final Energy Demand +
- IND Final Energy Demand +
- TRANS: Passenger Car + Light Truck + Medium Duty + Heavy Duty + Non-Road Final Energy Demand

The residential thermal energy demand is included within residential final energy demand, so also including that information would double count residential heating, cooling, and water heating energy demand.

Where is geothermal being accounted for? It's our understanding that air source heat pumps typically don't work as well/at all below extreme cold temperatures, so geothermal heat pumps can be a more reliable & sustainable option and have the potential to alleviate issues associated with grid capacity.

In the Vermont Pathways LEAP model, the Residential and Commercial sectors both consider the use of both air source and ground source (geothermal) heat pumps for meeting space heating and cooling needs. For example, the table in rows 2-8, columns AH-AV which describe the number of new residential CCHPs includes data on both air source (ASHP) and ground source (GSHP) units.

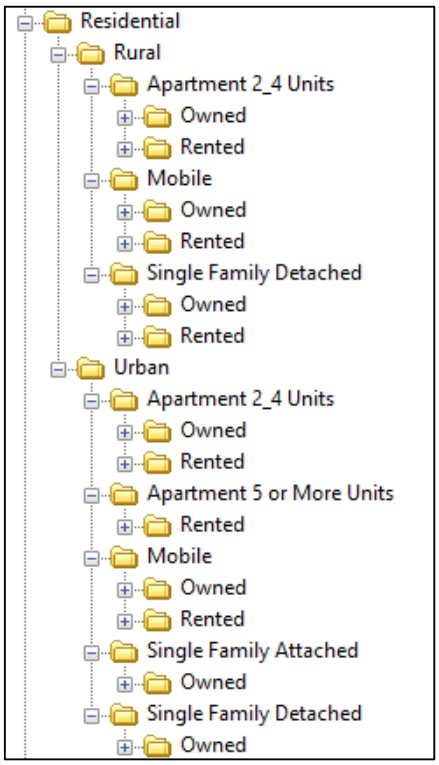
This is the primary way geothermal was considered during this modeling effort.

I am looking for resources on the performance of ASHP and GSHPs in Vermont and will share those.

What is included in final energy demand? Is electricity a combination of thermal and electric appliance use (including EVS)? How does it relate to residential thermal demand? *(responses here modified from those drafted by CCRPC staff)*

What is included in final energy demand varies based on how each of the four sectors was modeled. This is described in some detail in the technical report Stockholm Environment Institute prepared for the Department (LEAP methodology document) but I've included a summary here for easy reference:

Residential Sector – Residential Final Energy Demand includes both thermal and electric appliance energy use. From pages 8 and 9 of the LEAP report "*…energy-consuming technologies are arranged into 16 end-uses: 5 major end-uses including space heating, space cooling, water heating, cooking, refrigeration, and 11 other end-uses including lighting, dishwashing, fans, and others…Final energy demand depends on the total number of households and energy-consuming devices, as well as the annual fuel requirements per household or per device.*" The Vermont Pathways LEAP model simulates these end uses within the following types of buildings (different end uses / fuels are used to varying degrees based on the building type, tenure, urban/rural status):



Picture is a snapshot from the model

In addition, space heating and cooling demand depends on whether a building existed before 2015, is new, or has been retrofitted.

In the outputs provided, I included Residential Thermal Final Energy Demand which is a subset of Residential Total Final Energy Demand and is based on the space heating, space cooling, and water heating end use categories.

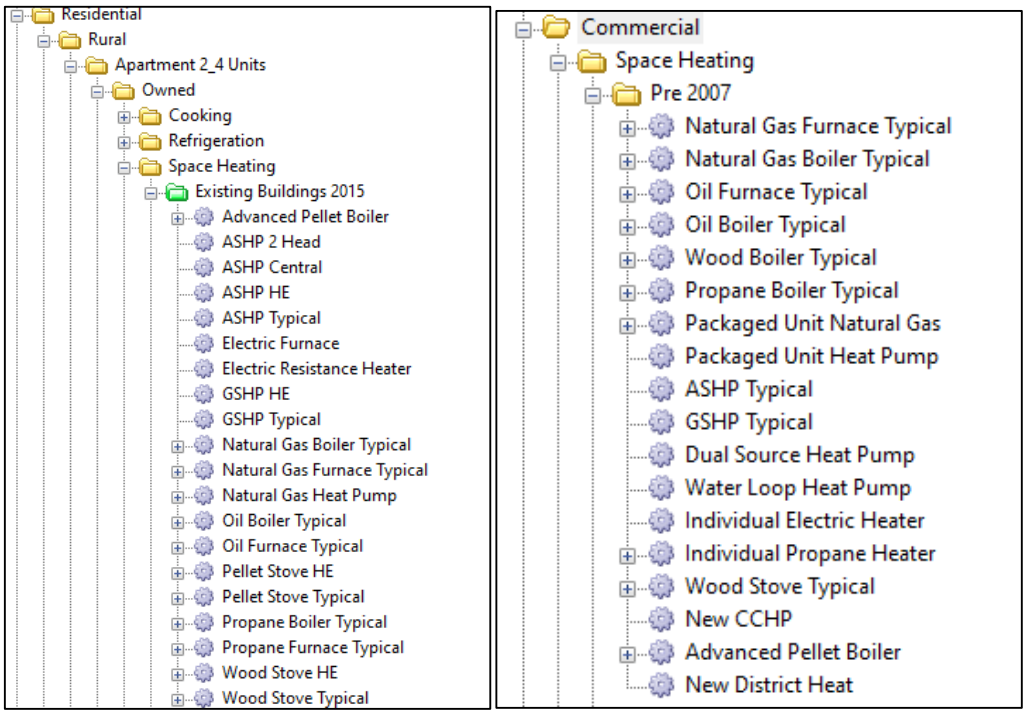
Note: The residential sector DOES NOT include electricity used for EVs or PHEVs being charged at homes, that is included in the transportation sector.

In the commercial sector: Final energy demand is modeled in a similar way to the residential sector (see p.11 of the report):

> *Energy-consuming technologies are arranged into 10 end-uses: space heating, space cooling, water heating, and cooking, with 5 electric end-uses for lighting, ventilation, refrigeration, office equipment, and computing. One miscellaneous end-use is used to represent collective fuel consumption for all other smaller end-uses…Final energy demand depends on the number of commercial square feet occupied by a particular technology, and the energy use (or energy intensity) per square foot for that technology.*

As in the residential sector, commercial space heating and cooling are also modeled based on the age and retrofit status of the building, specifically considering "Pre 2007 with HVAC retrofit", "Pre 2007 with Insulation Retrofit", "Post 2007 or Fully Retrofit".

In both the commercial and residential sector, as noted in the report, "*many fuels are consumed by more than one different technology in a single end-use".* The following screenshots from the model provide examples of this in the space heating end use in both sectors:



Note: The commercial sector DOES NOT include electricity used for EVs or PHEVs being charged at businesses, that is included in the transportation sector.

In the Industrial sector: Final energy demand is modeled in much less detail than the other three sectors given the lack of available data. Historical data is based on fuels represented in EIA SEDs database (2020) and then projections are based on the average growth rates of different fuels from the EIA AEO 2020 Reference case.

In the transportation sector: For on-road transportation, the Vermont Pathways LEAP uses a stock turnover simulation model and final energy demand is based on the number and type of different vehicles in use, annual vehicle miles travel (VMT), and fuel use per mile. As noted in the modeling report (pg 14), "Each of these quantities varies by vehicle type and age". Table 2, also on pg 14 of the report, provides an overview of the types of on-road vehicles represented in the model in each of the four weight classes (passenger cars, light trucks, medium duty, and heavy duty). Non-road transportation includes rail, aviation, navigation, and "other" and is based on fuel use represented in the EIA SEDS database.

Sector Specific Questions

RESIDENTIAL

Why does residential electricity consumption decrease (statewide) between 2015 and 2025?

I believe this is largely due to gains in appliance energy efficiency and building retrofits. Even in the Baseline there are still approximately 2435 retrofits / year by 2040 based on Efficiency Vermont and VGS "low" forecasts. These retrofits save 20% and 38% on average in useful (delivered) energy savings for single- and multi-family households respectively (see slide 46 here). You can see from the tables on Residential Thermal Demand that electricity for space heating, cooling, and water heating does increase during this period (as electrification of the thermal sector increases).

Also it is important to note that residential electricity consumption in the LEAP outputs is GROSS electricity consumption. It **DOES NOT** represent electricity consumption **NET** of behind-the-meter resources like net-metered solar.

Could there also be forecasts for number of new HPWH?

This is definitely possible in the residential sector, I am still looking into the commercial sector. I will include what I can in the finalized outputs.

How come such low HPWH mmbtus expected under Baseline scenario?

In the Baseline scenario, only 0.2%-6.5% of household water needs are met by heat pumps. In the CAP Mitigation scenario, by 2035 HPWH are expected to meet all water heating needs (see page 76 of the technical report).

Why is Baseline 2020 different from CAP? (re residential new CCHP)

2020 is the first modeled year, so while we would expect the 2015-2019 results for the Baseline and CAP scenarios to be the same, 2020 is where they can start to differ based in varying assumptions and/or mitigation measures included in each scenario.

My other question is about the overall trend in energy use across each of the benchmark years, specifically for residential thermal energy demand. The old LEAP data [for BCRC] show a much more significant decline in energy use from 2015 to 2050 (1,912 to 775 Thousand MMBTUs), whereas the new LEAP data [for BCRC] show a much more gradual decline from 2015 to 2050 (1,859 to 1,488 Thousand MMBTUs). My guess is that this is because the new model paints a more accurate picture of the increase in electricity usage that will take place as the thermal residential sector electrifies. The new LEAP data also show a less significant drop-off in use of oil as a heating fuel across the benchmark years. Again, my guess is that the new LEAP model is more sophisticated and paints a more realistic picture of the decline of fossil fuel use over time. The old data show a very sharp decline in use of fossil fuels which seemed more optimistic than realistic. Am I understanding correctly?

There are a couple things going on here I think:

1. There is an error in how the new LEAP data pulled together the "total" residential thermal energy demand (row 15) – the current totals are double counting demand from HP, HPWH, and electric resistance. This will be fixed in the final output spreadsheet.
2. It looks like you're comparing the Baseline Residential Thermal Demand from the new LEAP data and the 90x2050 Residential Thermal Demand from the old LEAP data. Here's what I'm seeing for BCRC specifically:
    a. Baseline Residential Thermal
        i. Old LEAP – declines from 1940 MMBTUs (2015) to 1085 MMBTUs (2050)
        ii. New LEAP – declines from 1832 MMBTUs (2015) to 1359 MMBTUs (2050)
    b. Alternative Scenario:
        i. Old LEAP (90x2050) – declines from 1912 MMBTU (2015) to 776 MMBTU (2050)
        ii. New LEAP (CAP Mitigation): declines from 1832 MMBTU (2015) to 589 MMBTU (2050)
3. As you suggest, I think changes in the model are also influencing this difference, both in terms of the new model being more granular in how it models energy use (the new LEAP model goes down to the technology level for many end uses in the residential sector; the old LEAP model did not consider specific technologies, just fuel use) and also there being more updated forecasts.
4. For the heating oil trends, you're right that Oil demand in the residential thermal sector drops off much more sharply in the 2035-2050 period in the old LEAP reference case as compared to the same period in the baseline scenario for the new LEAP modeling (the remainder of the periods seem to actually track pretty similarly with Oil / Heating Oil demand). In the old LEAP model, this seems to be driven by how heat pump adoption was modeled for Single Family homes – the documentation from VEIC notes the assumptions for the old reference scenario were in line with the Total Energy Study (TES) done by the Department : *"The reference scenario heating demand projections were developed in line with the TES reference scenario. This included the following: assumed an increase in the number of homes using natural gas, increase in the number of homes using heat pumps as a primary heating source (up to 37% in some home types), an increase in home heated with wood pellets, and drastic decline in homes heating with heating oil."*

COMMERCIAL

Why is gasoline included as fuel type in the commercial and industrial sectors?

In the Commercial Sector: The Vermont Pathways LEAP models final energy demand for the following end uses: Space Heating & Cooling, Water Heating, Cooking, Lighting, Ventilation, Refrigeration, Office Equipment, Computing, and "Miscellaneous". Gasoline is included as a fuel used only in the Miscellaneous end use category, which estimates the collective fuel use of smaller end-uses. Much of the commercial buildings sector is constructed using microdata from the US EIA "Commercial Building Energy Consumption Survey (CBECS)", 2012, however you are correct that there is no gasoline in CBECs. It appears the gasoline comes from the calibration SEI performed for the commercial sector to align with the SEDS (state energy data system) database for 2020 – in the technical report SEI notes "all energy intensities are adjusted so that the model-estimated consumption of each commercial fuel (except wood) in years 2015-2019 matches the consumption recorded in SEDS for Vermont."

In the Industrial Sector: There was little data to inform the industrial sector modeling so the modeling of this sector is much simpler than the other three core sectors (residential, commercial, and transportation). Historical fuel consumption (2015-2019) is taken directly from SEDS which includes gasoline.

Why is there solar in the commercial sector and not the residential sector. When residential uses are a sector that we would expect solar to be in? Is solar in Commercial for solar hot water?

This is largely because the Vermont Pathways LEAP model treats behind-the-meter and larger scale solar as a primary supply-side resource (part of the "transformation" branch of the model) used to produce electricity (a secondary energy source) and not a demand-side load reducer.

In the residential sector, many end-uses use electricity, a portion of which is supplied by solar. However, the outputs provided to the regions come from the "Demand" branch of LEAP, so do not differentiate between the different fuels used to supply electric demand.

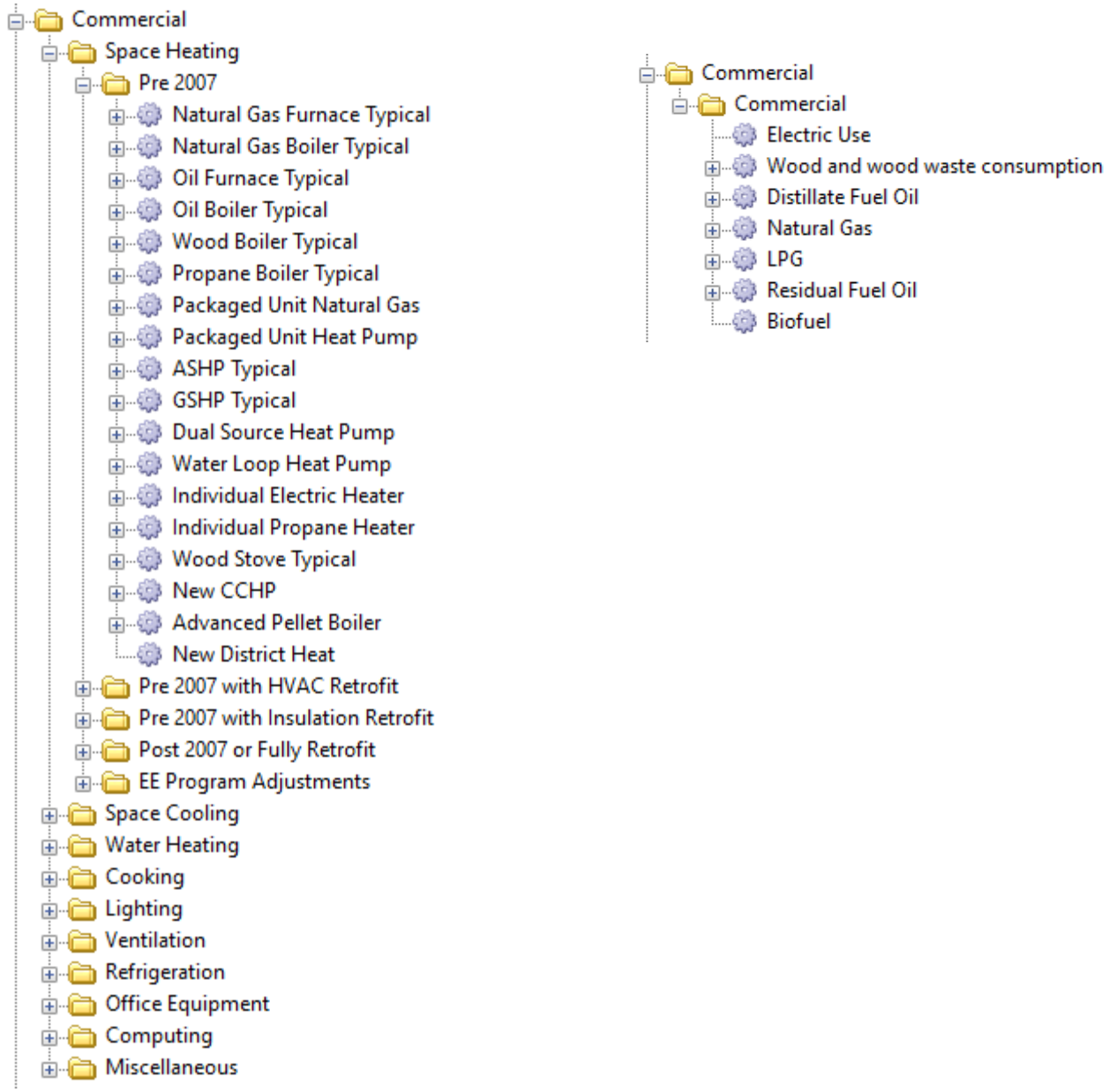
In the commercial sector, as you suggest, the Vermont Pathways LEAP models solar water heating. As in the residential sector, many end uses also use electricity, a portion of which would also be supplied by solar.

Wow baseline is VERY different than where we need to be…20K CCHP vs. 190K by 2050?

Yes! Here are the Baseline v CAP scenario assumptions (for the statewide model) about commercial heat pumps (see page 76 of the technical report):

- **Baseline**: Approximately 240,000 heat pumps deployed by 2050, 90% of which are in households
- **CAP Mitigation:** By 2040 air-source heat pumps heat 80% of commercial floorspace

For commercial sector energy demand, the total energy use in each benchmark year is much higher than previous LEAP data. This is not the case for industrial or residential sector energy use, where total energy use in each benchmark year is roughly similar between both the old and new LEAP data. Do you know why the commercial sector energy use is so much higher in the new LEAP data? Is it because there are more fuel types being factored into the analysis or is it something to do with the new model?



Snapshots from new model (left) and old model (right)

My guess is that this is primarily driven base changes in how the LEAP models were constructed to represent the commercial sector.

As seen in the snapshots above, the old LEAP had a considerably simpler representation of the commercial sector and, as noted in the VEIC documentation: *"Commercial energy use estimates are*

entered in to the model as energy consumed per square foot of commercial space, on average. This was calculated using data from the [total energy study].” This modeling was done using a different, non-LEAP based model.

In the new LEAP, commercial floorspace is still one of the primary drivers of energy demand, but the model is considerably more granular, so comparing the outputs of these two models might be a particularly “apples to oranges” comparison.

Heat is listed as a fuel type for the commercial sector, and it is distinct from heating oil. Does heat represent waste heat generated through commercial processes which is then captured and used as energy? If so, why is heat not a distinct fuel type in the industrial sector as well?

The “heat” fuel type in the commercial sector is associated with New District Heating systems in the space heating end use category. LEAP notes that “heat” can be in the form of “steam, hot water, or hot air”. See slide 53 of this summary presentation for the assumptions made around Commercial District heating in the model.

INDUSTRIAL

Should both tables (Baseline & CAP) Industrial sector TOTALS be identical?

We noted in Row 53 that there is no net change between the total baseline and CAP demand for industrial energy demand, in LCPC and statewide. Just curious why that is.

(answer to both questions above)

I also balked at this result, but it is accurate! However, what you do see in the CAP Mitigation Scenario (compared to the Baseline) is a shift in energy demand from diesel to biodiesel and from natural gas to biogas, which results in a reduction in greenhouse gas emissions from the industrial sector in the CAP v Baseline.

As noted above, the industrial sector was modeled in considerably less detail than other sectors due to the lack of available information.

TRANSPORTATION

CAP total by 2050 is higher than baseline for heavy duty?

This appears to be accurate, although I will note that a large majority of the energy demand in the CAP 2050 total is from electricity, while in the Baseline 2050 total it is from diesel, so the CAP scenario will still be associated with reduced emissions compared to the Baseline.

Wasn't expecting such a big difference between plug in hybrids in baseline vs CAP for 2050 (baseline 11,032 v CAP 362)

I think this is a result of the fact that, generally speaking, battery electric vehicles (BEVs) are the dominant type of EV considered in LEAP. The assumptions around BEV adoption are much more aggressive in the CAP mitigation scenario, so I imagine more aggressive BEV adoption displaces some of the adoption of PHEVs that happens in the Baseline scenario under less aggressive BEV adoption. For reference, here are the assumptions in LEAP (see page 57 and of the technical report):

- Pg 57: *"BEVs are singled out for comparison because they (as opposed to PHEVs) are the dominant EV technology in the model… In the Central [CAP] … Mitigation Scenarios, BEVs make up greater than 91% of all LDVs in 2050, compared to 30% in the BAU scenario (or, 35% when including PHEVs, to align with the VELCO low electrification forecast for LDVs)."*
- Pg 78 re BEV adoption:
    - Baseline: By 2050, only 41% of Light Duty Vehicle (Passenger Cars + Light Trucks) sales and 7.5% of Medium + Heavy Duty vehicle sales are BEVs
    - CAP: By 2033, all sales of new on-road vehicles are BEVs

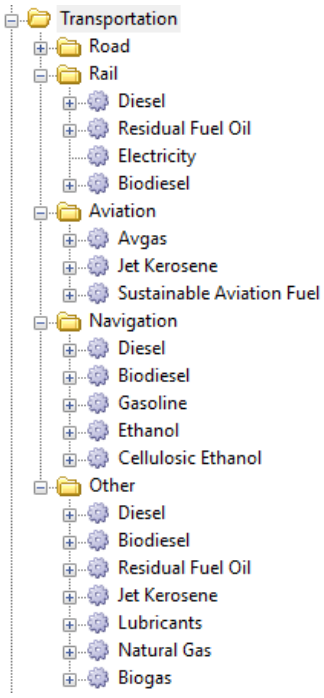
Can you please explain the non-road sector?

Non-road transportation includes rail, aviation, navigation, and "other" and is based on the EIA SEDS database. These are SEI's notes on non-road included in the LEAP model itself:

Historical total energy demand for each fuel is constructed from U.S. Energy Information Administration (2018). State Energy Data System. https://www.eia.gov/state/seds/. Total fuel consumption is disaggregated into subsectors according to the share of each fuel consumed for that mode in US EIA's AEO2020 Reference Case (shares calculated for year 2020, and the same shares are applied for all historical years). Though the AEO shows only national-level consumption of fuels within each transport mode. Fuels that are not consumed historically in Vermont but appear in AEO, and sectors that are not present in Vermont by appear in AEO (i.e. maritime shipping), are ignored.

Emission factors from Stockholm Environment Institute (2019). Energy Sector Emissions Factors for Use in LEAP-IBC. https://www.energycommunity.org/documents/Combustion_EFs_LEAP_IBC.xlsx.

These are the fuels modeled in each non-road sector:



Non-road transportation: Why are diesel, avgas, gasoline, lubricants, and natural gas totals not expected to change from baseline to CAP?

The only mitigation measures related to the non-road sector included in the CAP Mitigation scenario influenced 1) a shift from jet kerosene towards sustainable aviation fuel and 2) increased use of biodiesel in transportation generally.

Formatting

Each of the following formatting issues will be addressed in the final LEAP outputs. Thanks for flagging them!

Formatting Commercial Sector CAP Mitigation Statewide Table

Baseline Commercial Statewide CCHP – remove decimals

In the Assumptions tab, it would be best to cite where the RPCs got their information, rather than citing the RPC template. (US Census, ACS survey, various sources, etc.)

Is it necessary to have extra years listed throughout the model? If this is useful for the State, that is fine – it would just be helpful for the RPCs to have the target years highlighted (2015, 2025, 2035, 2050).

Information tab – second paragraph, first sentence – "municipal" spelling

Statewide tab & LCPC tab – commas in row 19 of baseline commercial grid

X. ENERGY AND GREENHOUSE GAS EMISSIONS REDUCTION

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

Key Issues/Trends/Insights

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

Energy Overview

- As noted in the Climate section, fossil fuel combustion is a major cause for increases in the atmospheric concentration of carbon dioxide and other greenhouse gases, which are the causes of global climate ~~change.~~change. Because fossil fuels drive our present-day economy, countries with higher gross domestic products and people with wealth have higher carbon footprints than poorer countries or individuals. ~~-~~Climate change will have profound impacts on the environment, public health, infrastructure, and economy of Chittenden County. Although just as the contribution to climate change is not distributed evenly nor are the impacts of climate change.
- According to the State of Vermont's Climate Council's Guiding Principles for a Just Transition, "studies continue to show that low-income communities, indigenous people, and Black and communities of color are among those who are particularly vulnerable to the impacts of climate change." Impacted populations also include older and chronically ill Vermonters, as well as people with disabilities. Additionally, the initial up-front cost of transitioning to electrification in the renewable energy generation, heating, and transportation sectors may be burdensome to these impacted communities. Therefore, investments, policies, administration, and oversight should tackle the needs of impacted people first by including targeted strategies for different groups that take into account their specific histories, sociocultural, and economic realities.
- A transition to renewable energy will drive down carbon emissions and avoid more severe impacts of climate change. ~~As noted in the Climate section, a transition to renewable energy will drive down carbon emissions and avoid more severe impacts of climate change.~~ To meet the goals in the ~~The~~ State of Vermont Comprehensive Energy Plan (CEP) ~~calls for electrifying the heating and transportation sectors and generating more electricity from renewable sources to power these sectors.~~
- ~~To meet state energy goals~~, the region is planning for a major shift away from fossil fuels in the transportation and heating sectors to renewable sources of energy, efficiency in all sectors, and an increase in ~~state~~ renewable energy generation within the state and from outside the state. ~~ors.~~
- Vermont citizens, businesses, and industries spend about $1.~~95~~ billion a year to pay for imported fossil fuels (~~2024~~2 Energy Action Network (EAN) Annual Report). ~~Much~~ About 75% of this money leaves the County and state immediately. This outflow of energy dollars acts as a drain on the local economy. The inverse is true for electricity: about 70% of spending on

Commented [RM77]: From Anne Margolis conversation on 6/23 - really thinks the map layer changes in the requirements is the most important; and the policy changes with equity/forest protection stuff. Doing this work is more important than the LEAP data. And then maybe you do the LEAP modeling afterward because the standards don't really say that you have to use the most recent LEAP model. There is also the renewable generation targets, and their tool will consider the grid/transmission constraints. In accordance with the guidance we can keep our current generation targets (but the constraints will change that).

Commented [MN78]: Maybe we end the goal after sectors because the second of half of the goal is implied in the first part by "not burdening any groups.."

Commented [AS79R78]: We could combine it into "Move Chittenden County's energy system toward cleaner, more efficient, and renewable sources in a manner than is accessible to all, does not unfairly burden any communities, and benefits public health, the natural environment, economic development, and the local and global climate." ?

Commented [DS80R78]: I used Anne Nelson's language with some modifications. Thanks!

Commented [RM81]: We should include the state Comprehensive Energy Plan here.

Commented [AS82]: Maybe we open this section up with this bullet, followed by the bullet that is currently the first one. In my opinion, it's also important to name who/what is contributing the most to CO2 emissions/using the most energy. It's not our low income communities. Globally, at least, the top 1% contributes over double the emission of the poorest half of society. We need to hold the right people accountable.

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

Commented [DS83R82]: Moved as suggested, will try to add language that addresses source of impacts and growth vs. GHG reductions.

Commented [MN84R82]: Thanks! I took a stab at it too. Feel free to revise.

Commented [AS85]: This is great!

Commented [AS86]: Could this be combined with the bullet point above?

Commented [DS87R86]: Combined these bullets

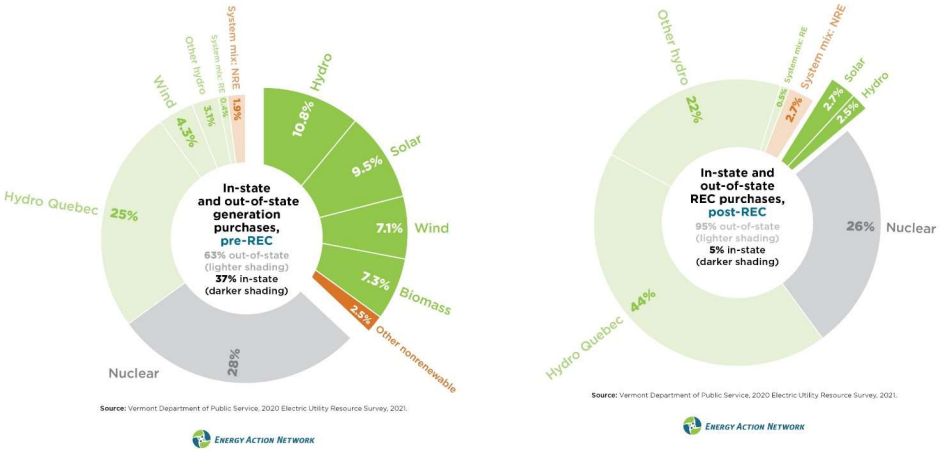
Commented [MN88]: 75%, EAN graphic, hydro quebec imports, staying in the US?

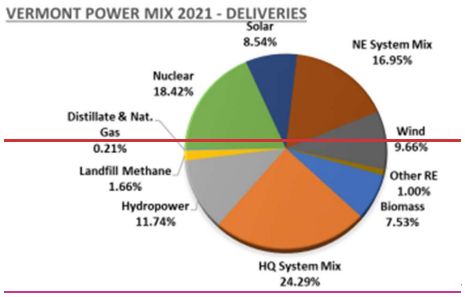
Commented [RM89R88]: Could we include a pie chart of where our energy comes from?

Commented [DS90R88]: I'm resolving this because we now reference the 2022 EAN report and include the energy mix graphics below.

electricity recirculates within the state economy (regardless of how renewable energy credits are traded). Developing local renewable energy generation systems will provide more jobs and economic stimulation within the state in addition to advancing other energy-related goals.~~Bring in dollars related to electricity and renewable energy~~

- ~~According to t~~The 2022 Vermont Energy Action Network's Annual Progress Report ~~published by the Public Service Department,~~ documents the ~~Vermont~~ power mix physically delivered to the state (based on contractual, or ownership entitlements) ~~is~~ as shown in the pie chart below. The power mix looks different after renewable energy credits are ~~sold~~traded, but either approach shows that Vermont's electricity consumption is 96-97% carbon-free and less than 5% fossil fuel based. See the annual report for further information.





- The price of energy is forecasted to continue increasing in the future, which will result in an additional burden on the County's residents and businesses, especially for low or fixed income households,. Reducing energy consumption and generating on-site renewable energy are ways to mitigate the increasing costs of energy. ~~unless energy consumption can be reduced.~~
- ~~Fossil fuel combustion increases the atmospheric concentration of carbon dioxide and other greenhouse gases, which are the causes of global climate change. Climate change will have~~

Commented [DS91]: Change to reference EAN annual report since it breaks out system mixes. Remove PSD pie charts and report references.

Commented [DS92]: I think this figure from page 31 of the 2022 EAN Progress Report does a better job explaining the mix of electricity, including in-state vs. out-of-state. Not sure if we want to get a cleaner version or try to reproduce it.

Commented [DS93R92]: Crop better or download graphics from EAN website

profound impacts on the environment, public health, infrastructure, and economy of Chittenden County.

- Vermont, and the County, relies heavily on gasoline and diesel for transportation. However, gasoline usage for transportation has decreased due to improved fuel economy standards and the inclusion of electric vehicles in the light duty sector. According to the Energy Information Administration, between 2010 2012 and 20192021, motor gasoline consumption decreased by almost 8.9%11% or from 7,7107,409 to 7,022 6,606[45] thousand barrels.
- Chittenden County is home to an international airport and a National Guard base. Transportation fuel consumption in the County not only includes gasoline, diesel, and compressed natural gas, but also aviation gasoline and jet fuel.

Weatherization and Energy Efficiency

- Weatherizing homes has an immediate impact on people's lives and promotes energy efficiency and a cleaner environment. Once a home is weatherized, there is an average annual energy savings of 31%, which puts much-needed money back into the pockets of people who need it the most. Weatherization is a critical anti-poverty program for low-income households that also promotes environmental justice and health equity. For example, weatherization programs reduce carbon emissions and assist in the removal of environmental hazards such as lead, asbestos, and vermiculite. These environmental hazards are typically found in buildings located within Chittenden County's disadvantaged neighborhoods, as defined by the Federal Justice40 Initiative.
- The 2022 CEP and the State Climate Action Plan calls for an ambitious target to weatherize 120,000 homes by 2030 statewide to meet carbon reduction goals and to protect the health and financial security of Vermont's most impacted communities. According to the LEAP analysis, Chittenden County would need to weatherize XX% of homes by 2025 and XX% of homes by 2050. According to the 2022 Vermont Energy Action Report, 31,338 homes have been weatherized statewide as of 2020. To meet the state's weatherization goal, the Energy Action Network estimates that Vermont's qualified weatherization workforce needs to grow from 770 people working in weatherization as field workers, office staff, and energy auditors to 6,200 people by 2030[46]. To meet the weatherization goal, the State needs to address all the challenges affecting the weatherization workforce. These challenges include shortages of skilled workers willing to work in uncomfortable conditions, wage competition with less-strenuous working conditions, fluctuations in funding/incentives for weatherization projects, and affordable housing. As noted in the Comprehensive Economic Development Strategy (CEDS), a current workforce shortage in the weatherization industry represents a challenge to meeting these goals, but there is also an opportunity to address this by supporting reskilling and transition from the fossil fuel industry.
-
- Chittenden County has a long history of electrical and natural gas energy efficiency programs, dating back to 1990, ~~which~~ these programs have provided significant energy savings and economic benefits to the state and County. These programs along with improvements in federal standards have led to a reduction in per household and per employee energy consumption of electricity and natural gas. Reduction in energy consumption directly results in a reduction in energy bills. ~~Following the~~ The Home Performance with ENERGY STAR® guidelines~~,~~ and building/renovating to the State's Building Energy Code~~,~~ are two programs which assist Vermonters with reducing energy consumption from heating and electricity in homes and businesses. ~~See Indicators for data on efficiency gains.~~
- ~~The 2016 Comprehensive Energy Plan (CEP) included a goal to weatherize 80,000 homes by 2020.; according to the 2021 Vermont Energy Action Report, only 10% or 29,289 homes have been weatherized. The 2022 CEP calls for an even more ambitious target to weatherize 120,000 homes by 2030, therefore approximately 90,000 homes need to be weatherized by~~

Commented [AS94]: Maybe we open this section up with this bullet, followed by the bullet that is currently the first one. In my opinion, it's also important to name who/what is contributing the most to CO2 emissions/using the most energy. It's not our low income communities. Globally, at least, the top 1% contributes over double the emission of the poorest half of society. We need to hold the right people accountable.

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

Commented [AS95]: I wonder how much aviation gasoline and jet fuel? Who is using it/who is it for? No need to include this, just curious.

Commented [AS96]: These additions are great, Melanie!

Commented [MN97]: Consider all towns to adopt stretch

Commented [DS98R97]: Updated in Strategy 4 actions

Commented [MN99]: wait for 2021 Efficiency VT Report to display progress on efficiency with the most current data

Commented [MN100]: Darren: Are we documenting GHG emissions reductions from weatherization? Would be curious to see the #s for that.

Commented [DS101R100]: Waiting on LEAP GHG emissions data from PSD

~~2030. To meet this target, the Energy Action Network estimates that Vermont's qualified weatherization workforce needs to grow five-fold in fewer than five years (EAN 2021 Annual Report). To meet the weatherization goal, the State needs to address all the challenges affecting weatherization workforce. These challenges include shortages of skilled workers willing to work in uncomfortable conditions, wage competition with less-strenuous working conditions, fluctuations in funding/incentives for weatherization projects, and affordable housing (Weatherization Workforce Plan, Efficiency Vermont 2021).~~

- ~~There is a need for focused study to determine solutions for vermiculite removal as it relates to weatherization, in particular low-income weatherization. Vermiculite was used as an insulator for decades (1960-1990) and was mined with asbestos. Thus, any home with vermiculite is assumed to be contaminated.~~
- ~~While efficiency programs targeting electricity and natural gas have been largely successful in the commercial and residential sectors~~The Affordable Heat Act of 2023 will create a market mechanism to be implemented in 2026 that will incentivize the delivery of cleaner energy options so these options can become increasingly available and affordable for Vermonters. This is intended to ~~and~~ accelerate weatherization and switching to clean fuels in the thermal sector. ~~However, the program will not be implemented until 2026. , there is an~~ ~~is intended~~ ~~urgent need to fund and develop similar programs and policies for non-regulated thermal fuels to accelerate switching to fuels with less greenhouse gas emissions.~~
- ~~According to the LEAP analysis, Chittenden County would need to weatherize 14% of homes by 2025 and 70% of homes by 2050.~~ ~~Provide a connection to CEDS and workforce issue~~As noted in the Comprehensive Economic Development Strategy (CEDS), a current workforce shortage in the weatherization industry represents a challenge to meeting these goals, but there is also an opportunity to address this by supporting reskilling and transition from the fossil fuel industry.

Fuel Switching and Electrification

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

Commented [RM102]: Clarify what this means.

Commented [AS103]: Yes! It's a funny thing: the wealthy communities contribute more to the problem and then are also the ones that can afford the "solutions"

structures to encourage off peak charging need to be considered to mitigate grid constraints associated with electric vehicle charging. Refer to the EV Charging Equipment Location Prioritization Technical Report for specific priority locations for EVSE.

- The Metropolitan Transportation Plan (MTP) anticipates a significant mode shift from driving to biking or walking, including the use of electric bikes (e-bikes). Improving the region's active transportation infrastructure will be necessary to support this transition.

- **Heating.** It is necessary to shift the heating sector away from fossil fuel use. Promoting ~~cold~~ air source and geothermal ~~climate~~ heat pumps (powered by a renewable electric grid), in addition to sustainably harvested wood/biomass systems, biogas and geothermal heating systems, is key to meeting the Global Warning Solutions Act requirements and the 2022 CEP goals. However, low income, BIPOC, and renter households are likely to experience barriers and be burdened by the cost of transitioning to heat pump technology or any technology because of the cost of upfront investments to retrofit buildings. ~~Currently As~~ Additionally as noted in the 2022 Vermont Energy Action Network Annual Report, natural gas ~~prices are not cost competitive with~~ costs less than electricity[1] so customers are not likely to save money by replacing existing natural gas heating systems with ~~cold climate~~ heat pumps~~. However, Vermont Gas is currently piloting the use of ground source heat pumps as a cheaper alternative to natural gas, except in the summer for cooling. According to the Energy Information Administration, The 2023 Vermont Annual Energy Report notes that as of November 2022, effective cost of $15.67 per Metric Million British thermal units (MMBTU) $22.44 / MMBTU for air source heat pumps~~. Buildings s~~S~~witching from fuel oil or propane to a heat pump system will save customers money and protect customers from price volatility as the cost of electricity is less than fuel oil or propane and is less susceptible to price ~~.~~fluctuations. Net-zero buildings and ~~cold climate~~ heat pumps as the primary fuel source in new buildings will help the region meet its goal of shifting the heating sector away from fossil fuels.

Commented [MN104]: needs to be linked

Commented [MN105]: need data on rates

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

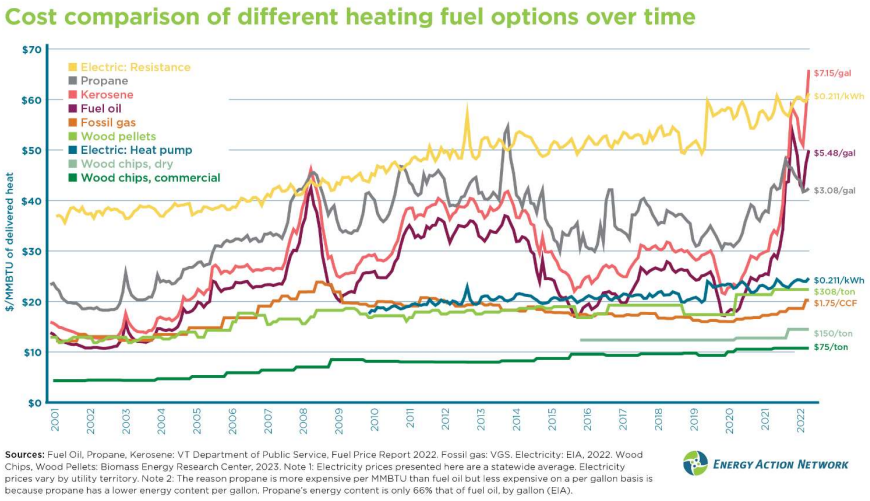


Figure sourced from 2022 Vermont Energy Action Network Annual Progress Report, page 27.

- VGS's comprehensive strategy for NetZero by 2050, with an immediate goal of reducing GHG emissions for customers by 30% by 2030, is critical to achieving the State's energy and climate goals. Expanding renewable natural gas to make up 20% of the supply mix by 2030 is also part of VGS's strategy.

Commented [MN106]: Adding discussion about Ebikes, infrastructure and safety

Commented [DS107R106]: Added above

Transition to Renewable Energy

- **Renewable Energy Goals.** In analyzing Chittenden County's ability to meet the 90% renewable energy by 2050 goal the Long-Range Energy Alternatives (LEAP) model was utilized to understand the type and amount of fuel needed to meet the State's energy goals. It is important to note that Chittenden County's LEAP scenario reflects 87% renewable by 2050. Although the level of renewability is not 90%, the ECOS Plan is deemed to be consistent with the State energy goals because the policy statements within this plan are aligned with the framework for advancing state energy goals and Chittenden County is well suited to move in the right direction. See Supplement 6 for more information on LEAP.
- **Heating.** The LEAP model shows a significant reduction in natural gas as one scenario to achieve the ambitious 90% renewable energy by 2050 goal in Chittenden County. This scenario will be challenging because of the region's current reliance on natural gas for heating in significant portions of Chittenden County, recent and planned service area expansions, and the relatively low cost of the fuel source. The natural gas infrastructure in Chittenden County also represents a significant investment on the part of utility companies, and much of the County's dense residential and commercial growth is dependent on this fuel. Therefore, fulfillment of this scenario requires aggressive weatherization of the region's building stock, switching to heat pumps and other renewable heating technologies. The shift to renewable energy sources for heating will also require the involvement of private-sector energy developers, regional and state-wide utilities, and individual energy users; as well as changes to state energy policy implementation. Despite challenges related to natural gas, CCRPC will work to the best of our ability to meet the 90x2050 goal via the actions discussed in Strategy 2. It is important to note fuel use in the aviation sector was removed from CCRPC's LEAP analysis and modeling of future energy use, as this is a sector the region will have little influence over.
- A transition to renewable energy will drive down carbon emissions. This will require electrifying the heating and transportation sectors and generating more electricity from renewable sources to power these sectors.
- **Grid Resilience.** As we transition to more renewables, grid resilience is valued by both residents and business, especially because Vermont's climate makes us vulnerable to grid outages. When storage is coupled with distributed energy generation it can provide a source of backup power and also offer the potential to minimize loads at peak times, thereby reducing energy costs.
- **Renewable Electricity.** A Vermont statute law passed in 2015, Act 56, established a renewable energy standard (RES) which requires Vermont's Eelectric Uutilities to be source 55% of their retail electricity from renewable sources by 2017, 75% by 2032, and 90% by 2050.
    - Also as part of Act 56, electric utilities need to work with customers to reduce fossil fuel and decrease carbon emissions from transportation and thermal heating by offering new innovative programs and services to their customers. The electric utilities subject to Act 56 are offering innovative products for electrification and incentives to meet the statute and deliver innovation. Among the three electric utilities that operate within Chittenden County, Green Mountain Power's supply is now 100% carbon free and 68% renewable now and will be 100% renewable by 2030. Burlington Electric Department's portfolio is also 100% renewable. Vermont Electric Co-op plans to meet or exceed its RES obligations by 2030.
    - While the region's baseline electricity consumption overwhelmingly comes from carbon-free and even renewable sources, during peak demand times that exceed renewables' capacity the demand must be met with imports from the New England (NE) System Mix. In order to meet the demand, peak electricity is mostly provided by natural gas generation, which is a source of greenhouse gas emissions.
- As part of Act 56, electric utilities also need to work with customers to reduce fossil fuel and decrease carbon emissions from transportation and thermal heating by offering new innovative

Commented [MN108]: consider taking out this section and moving bullets to the Renewable Energy Generation Section

Commented [MN109]: will update this section after PSD LEAP data and guidance becomes available.

Commented [MN110]: Darren:2 things: 1. Is it true that the RPC can't influence aviation? What about supporting rail? 2. How does removing this from LEAP affect the ability to achieve the CEP goals (i.e., do we have to raise other targets to account for not having control over this one)?

Commented [MN111]: link to franchise areas

Commented [DS112R111]: Linked to here: https://publicservice.vermont.gov/electric-utility-service-territory-map

Commented [MN113]: Recgnize difference btwn total demand vs peak demand

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programs and services to their customers. The electric utilities subject to Act 56 are offering innovative products for electrification and incentives to meet the statute and deliver innovation.

Commented [DS116]: Consider consolidating with Heating above

Renewable Energy Generation

- As of 2022, Chittenden County generates 606,554 MWh of renewable energy from Chittenden County has manya range of non-fossil fuel based, renewable energy production sites owned by utilities, private parties, and municipalities. Reliable, cost effective, and environmentally sustainable energy availability is critical to support the economy and natural resources of Chittenden County.
- **Equitable Access to Renewables.** However, the environmental and cost saving benefits of renewable energy generation are not always equally accessible. Impacted communities may be left out or burdened by renewable energy generation programs because of not owning homes or living in multi-unit buildings. Community solar is one way to increase access to renewable energy generation because zero upfront investment is needed and participating in community solar programs does not require solar panel installations.
- **Electricity Generation Targets.** CCRPC supports the generation of new renewable energy in the County to meet Vermont's Global Warming Solutions Act and Comprehensive Energy Plan's goal of using 90% renewable energy by 2050, in a manner that is equitable, cost effective and respects the natural environment.
  - Specifically, Chittenden County needs to generate a total of 954,833 MWh (Megawatt hours) of energy annually (a 63%% 57% increase over 2022). Table XX sets progressive milestones to reach this goal, including the amount of additional generation that must be brought into production after accounting for existing renewables. As 2022,Chittenden County generates 598,409 MWh of renewable energy. These targets are based on the average of the county's share of statewide population and land area.
  - The targets are technology neutral, meaning that they can be met with any mix of technologiessolar, wind, hydroelectric, biomass, or other sources of renewable electricity. CCRPC has completed an analysis of areas suitable for solar and wind energy generation to determine our ability to meet the 90% renewable by 2050 goal. See the key indicators and Supplement 6 for an analysis of existing generation and future generation possibilities and documentation that the region has sufficient land available to meet its targets using solar or wind.
  - The following statements are CCRPC's renewable energy generation facility siting policies are detailed in Strategy 4, Action 2 and will inform CCRPC's preferred sites policy.

Commented [DS117]: Are we keeping Key Indicators for this? Would it be better to reference Supplement 6?

Commented [DS118]: Check this reference in the final document

Commented [MN119]: will be updated once PSD guidance and LEAP data is available. July/August timeframe

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

Target Year	2032	2040	2050
Total Renewables Target	648,475	857,945	954,833
Existing Renewables (2022)	606,554	606,554	606,554
New Renewables Target	41,922	251,391	348,279

- **Grid Resilience.** As we transition to more renewables, grid resilience is valued by both residents and business, especially because Vermont's climateweather and landscape patterns makes us vulnerable to grid outages. When storage is coupled with distributed energy generation it can provide a source of backup power and also offer the potential to minimize loads at peak times, thereby reducing energy costs compared to the use of centralized power plants.
- **Renewable Electricity Standard.** A Vermont law passed in 2015, Act 56, established a renewable energy standard (RES) which requires Vermont's electric utilities to source 55% of their retail electricity from renewable sources by 2017, 75% by 2032, and 90% by 2050.

- Among the three electric utilities that operate within Chittenden County, Green Mountain Power's supply is now 100% carbon free and 68% renewable now and will be 100% renewable by 2030. Burlington Electric Department's portfolio is also 100% renewable. Vermont Electric Co-op plans to meet or exceed its RES obligations by 2030.
- While the region's baseline electricity consumption overwhelmingly comes from carbon-free and even renewable sources, during peak demand times that exceed renewables' capacity the demand must be met with imports from the New England (NE) System Mix. To meet the demand, peak electricity is mostly provided by natural gas generation, which is a source of greenhouse gas emissions.

As part of Act 56, electric utilities also need to work with customers to reduce fossil fuel and decrease carbon emissions from transportation and thermal heating by offering new innovative programs and services to their customers. The electric utilities subject to Act 56 are offering innovative products for electrification and incentives to meet the statute and deliver innovation.

- Vermont's rural nature offers challenges for the transmission and distribution of energy. It is important to maintain and develop an energy production, transmission, and distribution infrastructure in Chittenden County that is efficient, reliable, cost-effective, and environmentally responsible. Current energy distribution projects include: Extension of 3-phase power in south Hinesburg along VT116 by Green Mountain Power; and the City of Burlington and partners are planning to advance a district heating system using McNeil's waste heat for distribution to the University of Vermont Medical Center. See the CEDS Project list in Supplement 4 for cost estimates, funding sources and proposed timelines for these projects.
- The cost of electricity is impacted by the distance it travels. When electricity is transmitted over long distances a significant amount of electricity is lost. Locating distributed generation near electric loads reduces transmission losses and could result in more cost-effective retail electricity rates.
- Every three years, Vermont Electric Power Company (VELCO), the State's transmission utility, completes a Long-range Transmission Plan. This plan identifies transmission-constrained areas and reliability concerns. The plan also identifies potential infrastructure projects that may be needed to address identified concerns. The 2021 Long-range Transmission Plan identifies several projects within Chittenden County, and in areas immediately adjacent to the County, that will likely need to be installed over the next decade due to anticipated growth in electric demand due to mass electrification and due to the State's increasing reliance on distributed generation (~~S~~see page~~s~~ 38-39~~:~~ ~~https://www.velco.com/assets/documents/2021%20VLRTP%20to%20PUC_FINAL.pdf~~). Adequate transmission and distribution grids that are able to accommodate the planned increase in electricity use, and reduces energy loss, are necessary to meet the goals of this section.
- ~~CCRPC has undergone a process to look at areas suitable for solar and wind energy generation to determine our ability to meet the 90% renewable by 2050 goal. See the key indicators below for an analysis of existing generation and future generation possibilities.~~

Energy and Land-Use Planning

- **Compact Development Patterns.** One of the most impactful ways to reduce greenhouse gas emissions is to enable more compact walkable neighborhoods in the region's areas planned for growth. Chittenden County, perhaps more so than other regions of the State, can achieve great energy efficiency and GHG benefits because of development density and infill development goals.

Commented [MN120]: link to franchise areas

Commented [DS121R120]: Linked to here: https://publicservice.vermont.gov/electric-utility-service-territory-map

Commented [MN122]: Recgnize difference btwn total demand vs peak demand

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Commented [DS125]: Consider consolidating with Heating above

Commented [DS126]: Are we keeping Key Indicators for this? Would it be better to reference Supplement 6?

Commented [MN127]: Darren:Should this section be moved to the start to greater emphasize its importance?

Commented [DS128R127]: Fine for now since this will become web based

- Energy Efficiency. Compact walkable neighborhoods encourage smaller building footprints with lower heating and cooling needs, promotes efficient travel that is less dependent on cars and provides more opportunity for walking, biking, and transit.
- Conservation for Carbon. Compact development also decreases development pressure on Vermont's working and natural landscapes, preserving land for existing and future carbon sequestration and storage. Maximizing use of rooftops and other previously developed sites for renewable energy generation also achieves this goal.
- Electric Load Efficiency. Dense population centers make distributed generation easier~~,~~ because energy can be produced near significant numbers of customers. Additionally, portions of the county's dense land use pattern may allow for innovative energy solutions, such as district heating and microgrids.

- **Enhanced Energy Planning.** In 2016, the Vermont Legislature Enacted Act 174 to improve energy planning and give town and regional plans greater weight or "substantial deference" in Public Utility Commission (PUC) proceedings. As of 2022, Bolton, Burlington, Charlotte, Colchester, Essex Junction, Huntington, Jericho, Richmond, Shelburne, Williston, Winooski, Hinesburg, Underhill, and Westford have adopted enhanced energy plans.
  - Development Constraints. One element of enhanced energy planning involves identifying and mapping restrictions on development, which under Act 174 must be applied equally to renewable electricity generation projects as well as other forms of development. While this is generally good policy, there may be circumstances where ground-mounted solar panels or wind turbines could be developed without creating negative impacts. Further study and consideration of these policies is warranted to find workable solutions for responsibly siting renewables amidst these constraints. This will reduce competition between renewables and other forms of development which have greater impacts on protected resources.
  - Furthermore, the current PUC Rule 5.700 imposes standards and requirements on wind energy that have the effect of prohibiting its development. CCRPC supports regulatory changes to make wind power more viable for several reasons. First, it is complementary to solar in terms of its generation profile. Second, it can provide local low-cost electricity for Vermont rate payers. Host ~~communities~~communities' benefit from increased property taxes and jobs. Wind generation in Vermont can also reduce Vermont's strong dependence on external electricity providers, such as Hydro Quebec, to supply our electric needs in an increasingly electrified world.

Commented [DS129]: Also talk about why EEPs are important to accessing CPRG implementation funds

Commented [DS130R129]: Also tie to an action of supporting development of renewable resources (public and private) through technical assistance, funneling grant $

Commented [MN131]: Wetlands to become a possible constraint add to actions. ANR wetland rules

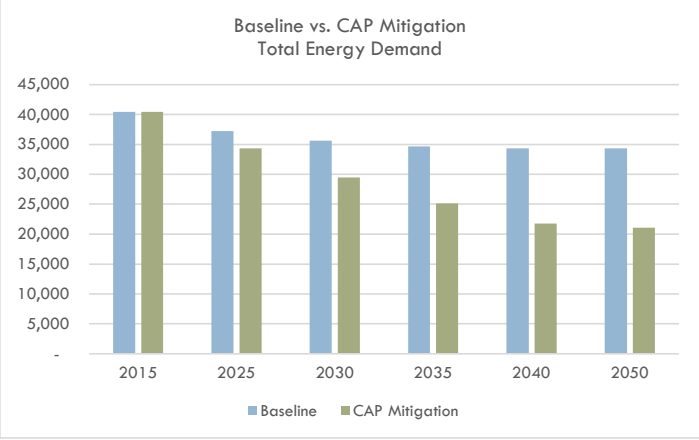
Commented [DS132R131]: Took a stab at this but I'm not sure it captures the nuance sufficiently.

Commented [DS133R131]: Work with PSD and ANR to clarify process for listing constraints

Commented [DS134]: Distill to one sentence about balancing climate goals with negative impacts of renewables development

Energy Analysis ~~+~~and Targets

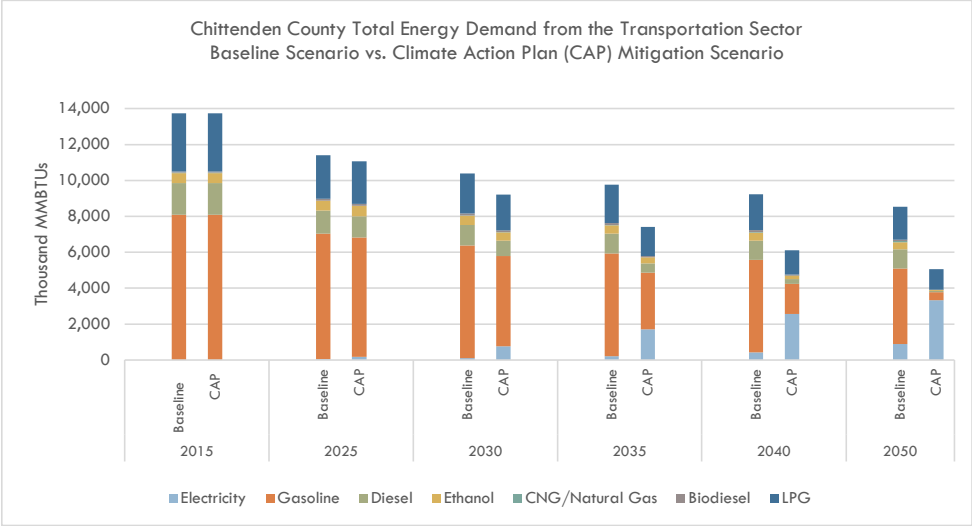
- As part of the development of Vermont's Comprehensive Energy Plan (CEP) and Climate Action Plan (CAP), the Stockholm Environment Institute (SEI) and Northeast States for Coordinated Air Use Management (NESCAUM) developed a scenario model of Vermont's energy consumption to construct pathways to meet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



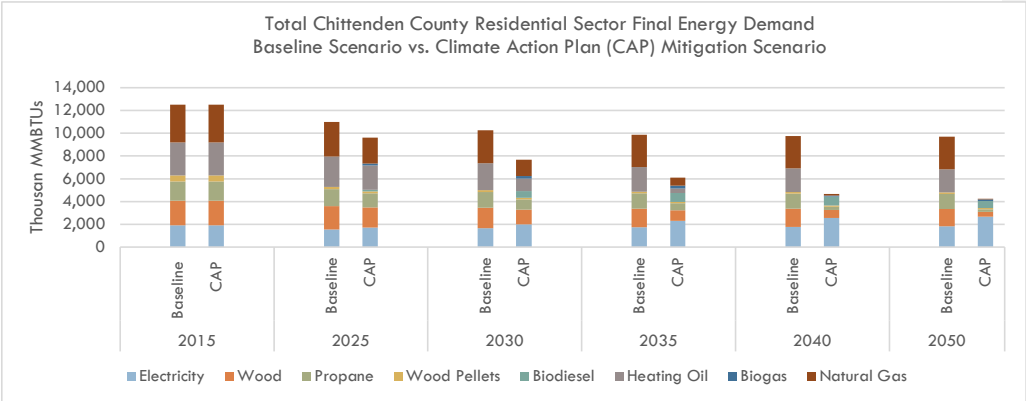
- The CEP includes a goal of having zero-emission vehicles account for 100% of light duty vehicle sales in Vermont by 2035 and calls for the transportation sector to meet 10% of energy needs from renewable energy by 2025, and 45% by 2040. As the county transforms the transportation sector to meet these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

Commented [DS135]: Should this move to follow the "Energy Overview" so that other key issues flow from this? Would definitely flow better for the renewable electricity generation targets discussion.

Commented [DS136R135]: Melanie and I agreed that it's better to keep the key issues focused up-front on context rather than analysis and targets.



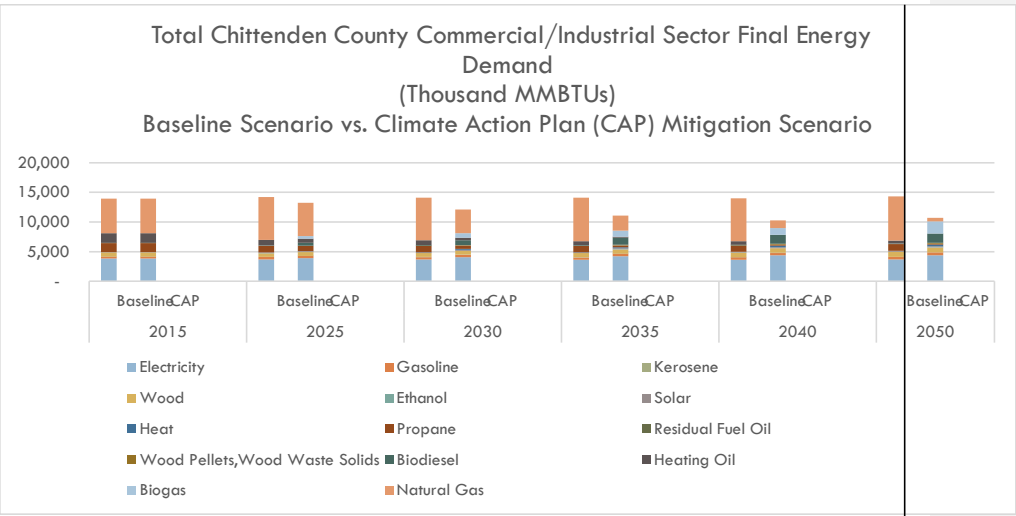
- Based on the LEAP Climate Action Plan Mitigation Scenario,thermal energy use in Chittenden County homes is projected to decrease by 64% from 2025 to 2050.Electricity demand will increase by 140% between 2025 and 2050. Natural gas, fuel oil, and propane will virtually be eliminated. Residential buildings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



- The LEAP Climate Action Plan mitigation scenario estimates that for Chittenden County total energy demand in the thermal commercial/industrial sector needs a 19% reduction from 2025 levels to meet future energy, carbon reduction and renewable energy source goals. This will primarily be achieved through weatherization of commercial buildings and the use of more

Commented [MN137]: Waiting on weatherization targets from PSD

efficient heating technologies, like cold climate heat pumps powered by renewable electrification. By 2050, the LEAP model estimates that 64,790 new heat pumps will be installed in commercial buildings. As a result of this transformation in how commercial buildings are heated, natural gas demand is estimated to decrease by 63% from 2025 to 2050. Additionally, demand for heating oil and propane will be eliminated.



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

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New Renewables Target	41,922	251,391	348,279

Commented [DS138]: Check this reference in the final document

Commented [MN139]: will be updated once PSD guidance and LEAP data is available. July/August timeframe

Key Indicators

Additional indicators can be found on the ECOS Scorecard.

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

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

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

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

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

Actions

1. **Invest in Areas Planned for Growth** -
    a. Invest in wastewater, water and stormwater infrastructure, energy systems (e.g. distribution, storage, and generation) and transportation infrastructure (~~including~~ prioritizing ~~bike~~bicycles, pedestrians and public transit) in areas currently developed and/or planned for growth.
    b. Target reuse, rehabilitation, redevelopment, infill, and brownfield investments to ~~the non-rural Planning Areas to minimize greenfield development~~ areas planned for growth.
    c. Retrofit existing buildings to reduce energy use and greenhouse gas emissions.
    d. Improve the walkability and streetscapes ~~design quality~~ of high density areas, and allow flexibility for creative solutions~~.~~ to improve vibrancy and livability.
2. **Municipal Planning and Zoning** - Strengthen and direct development toward areas planned for growth through infill development and adaptive reuse of existing buildings through municipal plan and bylaw revisions and state designation programs.
    a. Municipal Development Review Regulations should be revised to improve the mix of uses, shared parking, support for transit, access to a variety of services (for example restaurants, grocery stores, parks, entertainment) via active transportation, energy efficiency, renewable energy and the affordability of housing. A particular emphasis is needed on providing for affordable rental housing.
    b. Integrate capital planning and budgeting in planning efforts to provide the right mix of infrastructure over time. Official maps can also be a useful tool to drive infrastructure improvements in the areas planned for growth.
    c. Health Impact Assessments (HIA) provide a tool to use at the regional, municipal, agency, and organizational level to assure that planning decisions maintain or improve the public health. Access can be improved by co-locating public facilities, in particular, medical and mental health facilities in areas with easy access via active transportation and public transit. Town health officers should be encouraged to participate in community planning efforts.

Commented [DS337]: Keith Epstein (Energy Subcommittee): can this section mention the % of land area included in the TOD overlay so we can track it over time like the areas planned for growth?

Commented [DS338]: Suggested by Keith Epstein, though there is some concern this will read as discouraging growth in Village areas.

Commented [DS339]: Keith Epstein: this is vague and should be elaborated.

Commented [DS340R339]: Streetscape, complete streets, building design - look to Enabling Better Places for language (also FBC)

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

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

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

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

Commented [RM341]: Look at Strategy 4: Beef up or make connections on forest connectivity strategies (like Williston). And other strategies for protecting forest areas (Current Use, Carbon Sequestration programs, and others).

Commented [RM342R341]: From Bob H: Here's the carbon credit program: https://familyforestcarbon.org/

Commented [RM343]: Include language to identify off ramps for municipalities or specific geographic areas.

Commented [RM344]: Update.

Commented [RM345]: Congestion policy with MTP language and Vtrans work.

3. HOUSING ~~STRATEGY~~: BUILD NEW HOMES (1,000 HOMES PER YEAR), WITH 25% OF THEM AFFORDABLE, AND 90% OF THEM BUILT IN AREAS PLANNED FOR GROWTH WITH THE AFFORDABLE HOMES BUILT IN OPPORTUNITY NEIGHBORHOODS OUTSIDE OF AREAS THAT ALREADY HAVE A SIGNIFICANT AMOUNT OF AFFORDABLE HOUSING.

Commented [RB346]: This is how you slow/stop segregation and build inclusive communities.

1. **Policy Changes** - Businesses, hospitals, governments and nonprofits are connecting the dots between housing access and their own goals; and many are experiencing an inability to fill jobs due to a lack of housing. Municipalities and the State are promoting smart growth and density for healthy communities by updating zoning, reforming Act 250, and providing tax incentives. However, much more work is needed in the following areas:

Commented [RM347]: Comment from the PAC: actions seem weak on affordable housing. But I wonder if that is just because it isn't called out as a sub-bullet, because all of these actions are for affordable housing really.

   a. **Regulatory reform -** Improve the process to increase certainty for good projects in areas planned for growth. Increase housing choice and density in areas planned for growth considering community character and design. Encourage rehabilitation and maintenance of existing housing stock.
   b. **Reduce regulatory redundancies –** End duplication of review between Act 250, State agencies, and municipalities especially in areas planned for growth, or at least in state designated areas.
   c. **Reduce permit fees** – At the state and municipal levels consider fee waivers or other development review process incentives for projects that include affordable housing.
   d. **Infrastructure investment -** Target government funding to infrastructure that will support housing development in areas planned for growth. Revise infrastructure requirements with a goal of reducing costs for developers.
   e. **Inclusive communities** – Integrate a variety of housing types for all income levels for all new/infill housing projects throughout the County to provide for different incomes and access to jobs and services. Adopt inclusionary zoning requirements, or other incentive programs, to serve all needs.
   f. Target policies to lower income households, including rentals, for weatherization and installation of cold climate heat pumps. Also, work towards electric vehicle charging station equipment especially for multi-family housing.
   g. Support a statewide rental housing safety inspection process and rental registry; while retaining existing municipal rental registry programs as is.
   h. Continue to work with the University of Vermont and Champlain College and to develop specific plans to increase the percentage of students who reside in dedicated student housing.

Commented [RB348]: This is good policy. But. Not fitting the "character of the neighborhood" is one of the main sticks that NIMBYists deploying Act 250 use to keep multifamily housing—especially MF housing where children could live—out of their town.

Commented [RM349]: From Rachel Batterson: "What about amending Act 250, or regulations under it to require objective criteria for the "character of the neighborhood" prong. Right now, "I don't like it" seems to be sufficient.

Commented [RM350]: Suggested edit from Rachel Batterson: "Target government funding to infrastructure that will support affordable housing development in areas planned for growth. Revise infrastructure requirements with a goal of reducing costs for developers in exchange for developers including below-market housing in developments"

Commented [RB351]: Why not "on-campus" housing?

2. **More Capital for Affordable Housing** - Maintain or increase local and state resources that fund additional affordable housing, maintain existing affordable housing, and make housing more affordable. These actions include:
   a. By 2026 utilize current State and local American Rescue Plan Act (ARPA) funds for housing. Also, secure new federal financial resources such as the Infrastructure Investment and Jobs Act, and the proposed Build Back Better Bill to support, convert, and construct new housing.
   b. The state should fully fund the Vermont Housing and Conservation Board. This funding should be used to increase the stock of permanently affordable housing in Chittenden County. Also, sustain State bonding investment for capital and infrastructure investments

Commented [TN352]: Deleted this language from Strategy 9: Affordable housing financing and Implementation – Increase resources for housing, which includes but is not limited to: local housing trust funds, state housing trust fund, state housing tax credits, and strongly advocating for increased federal resources.

Commented [RM353]: Recommended addition from Rachel Batterson: "permanently affordable to the lowest income people (30% AMI)"

in service of more housing; work with institutions, businesses and philanthropy to invest in housing for working families; and create avenues for social investment financing.

c. The state should fully fund the Regional Planning Commissions, Municipal Planning Grants and the Vermont Center for Geographic Information with property transfer tax revenue to the levels outlined in existing state statute 24 V.S.A. § 4306(2) to assist in reaching housing goals (as well as other state planning goals).
d. Advocate for BIPOC specific financing for homeownership. OR The state should create targeted financing for BIPOC Vermonters.
e. ~~The state should allow for more Tax Increment Financing (TIF) districts to help fund infrastructure improvements.~~ Encourage the use of municipal housing trust funds to assist in the financing of affordable housing.
f. Encourage and support first time homebuyer financial support programs.
g. Take steps to preserve existing affordable housing from being converted to market rate housing; and continue to encourage shared equity for new owner homes.

3. **Education and Advocacy** – Work together to move toward a regional housing market that serves people of all backgrounds and incomes, increases the persistent low rate of homeownership among Black Vermonters, supports business needs and economic growth, helps people to retain their homes, and reduces homelessness. These actions include:
   a. Build cross-sector and public support for good housing projects. Provide the public with the most accurate and up-to-date data to explain the region's critical needs and the measurable benefits behind new sustainable development.
   b. Provide educational resources for municipalities, employers, and other stakeholders to assist with increasing housing access to the BIPOC community.
   c. Train municipal officials and staff, the public, developers, banks, and real estate agents to promote better development practices that achieve a higher level of density with quality design.
   d. Increase capacity for essential tenant supports, such as the CVOEO Vermont Tenants hotline and educational programs for renters.
   e. Support the media on continued coverage of the housing crisis.

4. **Fair Housing** - Increase compliance with fair housing requirements to better address housing equity in the County, as described in the Vermont Fair Housing Action Plan from 2017 (or as amended) and the Burlington Assessment of Fair Housing.
   a. Increase fair housing education and outreach for landlords, property managers, real estate professionals, and anyone involved in the sale, rental or finance of housing. Work with the Vermont Refugee Resettlement Program, the Association of Africans Living in Vermont, Opportunities Credit Union, and other organizations to develop strategies for new Americans to quickly develop credit history. Create educational materials that encourage landlords to use alternative criteria for new Americans and other groups traditionally excluded from housing opportunity that don't penalize them for a lack of credit or rental history.
   b. Provide fair housing and land use planning training for land use professionals and municipal officials throughout the County.
   c. Identify gaps in municipal implementation of State Fair Housing laws and ADA compliance (including but not limited to municipal bylaws should include language that explicitly permits officials to make reasonable accommodations for people with disabilities without delay or public input).
   d. Increase enforcement and testing capacity of fair housing organizations such as Vermont Legal Aid, particularly for classes protected only under Vermont law: marital

Commented [RM354]: Add Regional Development Corporations? Or are they funded through a different source?

Commented [RM355R354]: And/or it might make more sense to mention this under the economic development section?

Commented [RM356]: Eric V. - expand to other groups? AAPI, LGBTQ, etc?

Commented [RM357]: From Rachel Batterson

Commented [RB358]: Thank you! '-) One thing we could really use is funding to test and enforce Vermont only bases, such as receipt of public assistance. We know that there is widespread discrimination against people with housing vouchers, but we cannot test this b/c public assistance is a Vermont only prohibited basis and all of our funding for this work comes from HUD which only allows us to test for federal bases.

Commented [DS359R358]: Added language about VT-protected classes

status, age, sexual orientation, gender identity, receipt of public assistance, and victims of abuse.

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

4. CLIMATE/ENERGY ~~STRATEGY~~: TRANSFORM THE REGION'S ENERGY SYSTEM TO MEET ~~THE GOALS OF~~ VERMONT'S ENERGY AND GREENHOUSE GAS REDUCTION GOALS WHILE AVOIDING UNFAIR IMPACTS ON ~~COMMUNITIES~~MARGINALIZED GROUPS AND ~~BALANCING~~ MAINTAINING ECOLOGICAL HEALTH, ECONOMIC VITALITY, AND EQUITABLE ACCESS TO AFFORDABLE ENERGY~~AND AFFORDABILITY, AND DOES NOT UNFAIRLY BURDEN ANY GROUPS, COMMUNITIES, LOCATIONS, OR ECONOMIC SECTORS~~.

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

- Meet the Global Warming Solutions Act greenhouse gas emissions (GHG) requirements:
  - 26% reduction from 2005 levels by 2025
  - 40% reduction from 1990 levels by 2030
  - 80% reduction from 1990 levels by 2050
- Weatherize 120,000 Vermont homes by 2030 (relative to the 2008 baseline)
- Meet 90% of Vermont's energy from renewable sources by 2050
  - Intermediate goals of 25% of energy from renewable sources by 2025 and 45% by 2035.
  - In the transportation sector, 10% of energy needs will be from renewable energy by 2025, and 45% by 2040. Zero-emission vehicles account for 100% of light-duty vehicle sales by 2035.
  - In the thermal sector, 30% of energy needs will be from renewable energy by 2025, and 70% by 2042. Weatherizing 120,000 households by 2030. Achieve net-zero ready construction for newly constructed buildings by 2030.
  - ~~o~~ In the electric sector, be 100% decarbonized and at least 75% renewable by 2032.
  - ○

b. Municipal Assistance

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

ii. Provide assistance to municipalities ~~,~~to implement their energy plans ~~and~~ encourage municipalities to lead by example with respect to energy efficiency for buildings and

Commented [AS360]: I wonder if this could read: "Transform the region's energy system to meet Vermont's energy and greenhouse gas reduction goals, while balancing and managing ecological health, access, economic vitality, and unfair burden on communities."

Commented [DS361R360]: I rephrased with your suggestions Anne Nelson - wasn't sure if "balancing and managing unfair burden on communities" was clear enough. But feel free to keep wordsmithing!

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

transportation and the deployment of renewable energy. ~~Also assist municipalities in implementing enhanced energy plans.~~

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

~~a. **Assist municipalities with revising zoning regulations to enable more compact walkable neighborhoods in areas planned for growth.**~~

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

~~ii. Decrease fossil fuel consumption in the thermal sector by working with partners such as Green Mountain Power, VGS, Efficiency Vermont, Burlington Electric Department, and other energy service providers to educate developers, businesses, and homeowners about cold climate heat pumps, heat pump hot water heaters, wood heating, biofuels, and geothermal systems.~~
~~Advocate for the State, utilities, and workforce/business development organizations to address weatherization workforce challenges identified in the 2021 Weatherization Workforce Report.~~
~~Promote the expansion of current workforce training programs that are effective, such as ReSOURCE's weatherization and HVAC 101 training programs.~~

c. Transportation

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

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

d. Thermal Sector Partnerships

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

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

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

iv. Encourage the State of Vermont to implement a single building energy code standard at least as high as the current stretch code for all new development and retrofits that

Commented [DS362]: Keith Epstein: consolidate this with item xi

Commented [DS363]: Jeff Forward specifically asked to include a policy about transitioning off-road equipment to electric, is this an appropriate place to include or is that too detailed for the ECOS Plan?

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

Commented [DS364]: Moved and modified from CEDS

Commented [DS365]: Based on a comment from Keith Epstein, Energy Subcommittee that we encourage all towns to adopt stretch code.

Commented [DS366R365]: Jeff Forward noted that it is difficult to get municipalities to adopt and enforce stretch codes. Also, PSD should be consulted on this policy since their approach has relied on having 2 levels of code to test new technologies / techniques.

Commented [DS367R365]: Taylor determined this is a non-issue

accelerates net zero building practices and electric vehicle charging infrastructure. The code should be enforced at the state level and should ensure that energy efficient construction is accessible to and does not unfairly burden communities of color and those with lower incomes, installations. This will ensure progress is made on the State energy goals and Global Warming Solutions Act.

c. Collaborate with the State of Vermont and utilities to ensure that state energy policy implementation (i.e. permits for non-renewable fuels) reflect state energy goals and our policies in Section b.ECOS Plan policies in section 4.b below.

d. Encourage the State of Vermont to implement a single building energy code standard at least as high as the current stretch code for all new development and retrofits that requires enforcement at the state level, accelerates net zero building practices and electric vehicle charging infrastructure installations in a manner that ensures progress is made on the State energy goals, Global Warming Solutions Act requirements, and includes consideration of low income communities, BIPOC, and other impact communities.

e. Renewable and Resilient Electricity

S Provide assistance to municipalities when requested to enhance town plans to be consistent with Act 174 standards for the purpose of enabling municipalities the ability to gain substantial deference in the Certificate of Public Good Section 248 process. This assistance will include working with municipalities to identify natural, cultural, historic, or scenic resources to be protected from all development types, identify preferred locations for renewable energy generation facilities, and encourage municipalities to lead by example with respect to energy efficiency for buildings and transportation and the deployment of renewable energy. Also assist municipalities in implementing enhanced energy plans.

e. Review municipal plans, ordinances, bylaws, and policies to identify best practices for meeting energy goals and share these with other municipalities and partners.

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

g.ii. Work Coordinate with the transmission and distribution utilities to resolve electric grid constraints to enable the region to achieve Chittenden County's renewable energy generation target needed for the electrification of the heating and transportation sector. on long-range infrastructure capacity planning.

h.iii. Support in-place upgrades of existing facilities, including existing renewable energy generation, storage, transmission lines, distribution lines, and substations, and energy storage as needed to reliably serve municipalities and the region with a resilient and low-carbon electric grid that supports a growing renewable electricity economy and low electricity costs.

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

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

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

Commented [AS368]: It reads a little bit too much like it was an afterthought. Maybe we could say, "...in a manner that ensures the considerations of low income and communities of color are taking into account, while progress is made on the State energy goals and Global Warming Solutions Act requirements."

Commented [DS369R368]: I rephrased to bring the equity considerations forward and make them a little more specific. But I'm not really sure what this would look like, and how CCRPC will truly make an impact on this outside of improving existing weatherization assistance and affordable housing programs.

Commented [DS370]: Deleted since this is redundant with Renewable Energy Generation Regulation

Commented [DS371]: Based on a comment from Keith Epstein, Energy Subcommittee that we encourage all towns to adopt stretch code.

Commented [DS372R371]: Jeff Forward noted that it is difficult to get municipalities to adopt and enforce stretch codes. Also, PSD should be consulted on this policy since their approach has relied on having 2 levels of code to test new technologies / techniques.

Commented [DS373R371]: Taylor determined this is a non-issue

Commented [AS374]: It reads a little bit too much like it was an afterthought. Maybe we could say, "...in a manner that ensures the considerations of low income and communities of color are taking into account, while progress is made on the State energy goals and Global Warming Solutions Act requirements."

Commented [DS375R374]: I rephrased to bring the equity considerations forward and make them a little more specific. But I'm not really sure what this would look like, and how CCRPC will truly make an impact on this outside of improving existing weatherization assistance and affordable housing programs.

Commented [DS376]: Keith Epstein: consolidate this with item xi

Commented [DS377]: Jeff Forward specifically asked to include a policy about transitioning off-road equipment to electric, is this an appropriate place to include or is that too detailed for the ECOS Plan?

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

Commented [DS378]: Keith Epstein: this is very broad, but other actions could be organized under this.

Commented [DS379R378]: Specific sub-actions added based on Energy Subcommittee meeting 5/25/23, but not sure all of these should stay.

iii. Establish a tiered system for net-metering rates in which utilities pay a lower premium rate to facilities over a certain size (such as 500kW) to encourage larger projects to use this program.

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

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

~~j. Provide assistance to municipalities on implementing enhanced energy plans.~~

~~k. Support investments in distribution and transmission infrastructure upgrades necessary for handling increased electricity loads and renewable energy generation.~~

Commented [DS380]: Consolidated with xii above

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

~~Address barriers and empower multi-unit housing owners to retrofit parking to include electric vehicle charging equipment that is adequate to advance widespread electric vehicle adoption.~~

Commented [DS381]: Deleted to consolidate with Transportation subsection above

~~m. FOR DISCUSSION WIND POLICY STATEMENT GIVEN SOUND RULES~~~~Advocate for the Public Utility Commission to open the rule making process on Rule 5.700, Sound Levels From Wind Generation Facilities, to reassess existing sound standards with the intent of allowing all sizes and scales of wind energy generation possible in Chittenden County.~~

~~b.~~g. **Renewable Energy Generation Siting Policies.** CCRPC supports the generation of new renewable energy in the County to meet ~~the~~Vermont's Global Warming Solutions Act and ~~Vermont~~ Comprehensive Energy Plan's goal of using 90% renewable energy by 2050, in a manner that is cost effective, ~~and~~ respects the natural environment, and does not unfairly burden low-income communities with the impacts of development. Specifically, Chittenden County needs to generate a total of ~~756,250~~954,833 MWh (Megawatt hours) of energy annually ~~to meet the low target (a 51% increase), or 1,265,134 MWh to meet the high target~~ (a 63%~~152~~% increase). As 2022,~~Currently,~~ Chittenden County generates ~~501,661~~598,409 MWh of renewable energy. The targets are technology neutral, meaning that they can be met with any mix of technologies. The following statements are CCRPC's renewable energy generation facility siting policies and will inform CCRPC's preferred sites policy.

Commented [MN382]: will be updated once PSD guidance and LEAP data is available. July/August timeframe

Constraint Policies: Ground mounted renewable energy generation is constrained in certain areas due to state and local restrictions on development.

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

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

Commented [DS383]: Daniel Parkins asks if the areas outside of constraints can be more clearly identified on the maps (right now it's negative space).

Suitability Policies: After considering the constraints referenced above and found in Supplement 3, different levels of suitability exist for different scales and types of renewable energy generation depending on location within the County. To determine an appropriate location for a facility, first review the constraints above and then look at the polices below to determine how and where CCRPC encourages renewable energy generation facilities. CCRPC recommends the location of renewable energy generation facilities in accordance with the relevant guidelines below. Inability to meet these guidelines does not necessarily preclude the ability to develop renewable energy generation development.

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

~~ii.~~iv. Locate renewable energy generation in areas designated by a municipality in an adopted plan for such use, including specific preferred sites for solar (state preferred sites are mapped on Map 5).

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

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

~~v.~~vii. ~~Locate ground-mounted solar generation, and small-scale wind (1 or 2 turbines, up to 50 meters (164 ft.) in Chittenden County's areas planned for growth, while allowing infill development wherever reasonably practical. In~~To mitigate load growth, integrate renewable energy generation facilities in a manner that allows infill to be the priority within areas planned for growth but outside designated areas mentioned above ~~to mitigate load growth~~.

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

Commented [MN384]: wind rules?

Commented [AS385]: Maybe somewhere, we could add language about being mindful about where we site energy generation projects. Land is the most affordable near low-income communities, which means they bear more of the impact.

Commented [DS386R385]: This is absolutely important!

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

Commented [DS387R385]: I did add a sentence to #2 above that tries to address this.

Commented [DS388]: Jeff Forward asked whether this can be modified to apply only to buildings listed on the state or national register, rather than historic districts to allow more flexibility for renewables.

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

Commented [DS389]: Jeff Forward suggests re-evaluating restrictions re: solar on historic districts and buildings, especially if it would not detract from the historically important elements.

Commented [MN390]: clarify that these generation faciliteis are to be integrated to keep load and generation. clarify that areas planned for growth is minus designated areas

Commented [MN391R390]: This modification also addresses the removal of Burlington's Mixed Use Institutional Core Campus and Enterprise Zoning from list of possible constraints. The PAC had a conversation about these districts not fitting as a possible constraint because possible constraints need to be equally restrictive across all types of development.