Energy

Appendix A – Regional Energy Targets

In **Chapter 2**, pages 7-19, the Plan catalogs the Region's current energy demand and generation capacity. Appendix A creates targets for regional energy conservation, use, and generation to guide the Region toward achieving state and regional energy goals. Achieving these goals will be challenging, requiring intensive conservation across all sectors, increased electrification of transportation and space heating (with subsequent decreases in fossil fuel use), and decreased total energy demand despite population growth. **Appendix D** contains a comprehensive list of regional energy targets. Appendix F provides the methodology for how regional and municipal targets were developed. Total regional energy demand targets can be viewed in **Table 9** below.

Table 9: ACRPC total energy demand reduction targets, MMBtu

	Current	2025	2035	2050	Change
Residential	1,713	1,332	946	731	(982)
Commercial	990	832	735	727	(263)
Total	3,760	3,232	2,782	2,675	(1,085)

BUILDING TARGETS

Building targets for the Region include reducing total energy demand across residential, commercial, and industrial sectors. PSD's modeling estimates the Region's overall energy demand must decrease to meet state goals by 2050. The largest contributors to this reduction will be conservation and efficiency improvements. Thermal conservation and more efficient equipment are projected to shrink the Region's energy use by about one third. This change is represented by white space in **Figure 3**. VEIC's model projects that fossil fuel use in the Region will significantly decrease by 2050 (orange, green, and beige bars). Fossil fuels will be replaced by increases in biomass, wood chips and pellets (purple and pink bars) for heating commercial and industrial spaces, biodiesel (blue bar) for heavy equipment, and electricity (yellow bar) in residential space heating and light vehicles.

Table 10: Regional Thermal Energy Project Targets

Building Type	Target	2025	2035	2050
Commercial	New Cold Climate Heat Pumps	2,336	7,064	9,034
Residential	New Cold Climate Heat Pump	4,637	12,468	18,374
	New Heat Pump Water Heaters	3,048	10,151	13,928
	New Weatherization Retrofits	3,356	7,253	11,734

THERMAL TARGETS

To achieve energy goals, according to the LEAP model, space heating demand is expected to fall regionally between the present and 2050 due to electrification with the rise of heat pumps and increasing energy savings from weatherization retrofits of existing structures and construction of new buildings compliant with the state's building energy standards.

The model results also show significant reductions in fossil fuel use (or in some cases, complete elimination) as a residential home heating source. The regional model shows elimination of coal and fuel oil as heating sources by 2050. Liquid propane and natural gas use are projected to drop substantially during the model time frame. In contrast, electricity demand will increase as heat pumps replace other systems. Heat pumps are most effective when residential properties are fully weatherized; therefore, weatherization rates should dramatically increase, although this version of the model does not provide a specific target. Industrial and commercial space heating demand is also estimated in the LEAP modeling.

Due to the lack of existing data on commercial energy heating, it is difficult to accurately determine the

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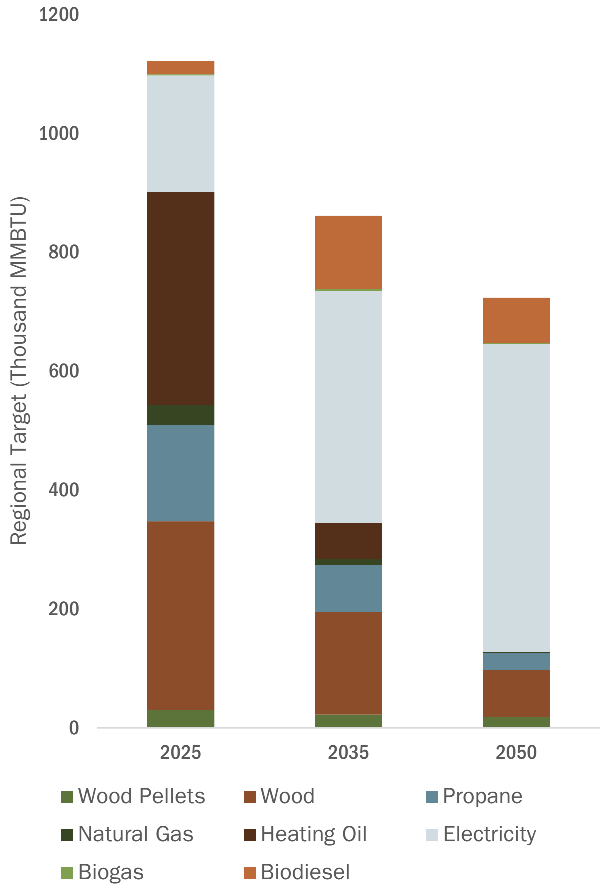
Figure 10: Residential Fuel Demand Change Targets



scale of change necessary. However, industrial and commercial uses will need to transition from fossil fuels to electricity to meet energy goals, including nearly eliminating natural gas usage. This will require a large increase in the number of commercial cold climate heat pumps.

ELECTRICITY TARGETS

The Region will need to focus on efficiency and conservation to minimize electricity use. Since electrical consumption in the Region is split almost evenly between residents (48%) and commercial and industrial entities (52%), targets will require participation from both individual homeowners and commercial and industrial users.

However, even with significant efficiency steps taken by businesses and residents, the Region's electrical usage will likely increase. This is because many new technologies needed to reduce fossil fuel consumption, like heat pumps and electric cars, replace fossil fuels with electricity. Importantly, this strategy only reduces greenhouse gases if electricity is generated renewably. **Table 11** shows the Region must increase efficiency and conservation by about 52,000 MWh by 2050 to meet proposed targets. This target is based on efficiencies available today. Future technological advances, such as better fuels or motor efficiencies, may help drive this change. However, the Region and its residents will also need significant capital invest-

Table 11: Residential Fuel Demand Change Targets

Energy Efficiency Source and Type		2025	2030	2035	2040	2050
Residential	Incremental Annual	1,428	1,500	1,627	1,572	1,748
Residential	Cumulative Annual	2,823	9,620	16,197	20,410	29,880
Non-Residential	Incremental Annual	2,532	2,300	2,303	2,270	2,640
Non-Residential	Cumulative Annual	5,075	16,614	25,489	24,914	22,984
Total	**Incremental Annual**	**3,961**	**3,800**	**3,929**	**3,842**	**4,388**
Total	**Cumulative Annual**	**7,898**	**26,234**	**41,686**	**45,324**	**52,865**

ments in new technologies and efficiencies to meet targets.

Efficiency Vermont is a statewide energy efficiency utility, the first of its kind in the nation. Efficiency Vermont helps consumers reduce energy costs by making homes and businesses more energy efficient. It provides technical assistance and financial incentives to help Vermonters identify and pay for cost-effective approaches to energy-efficient building design, construction, renovation, equipment, lighting and appliances. Efficiency Vermont is funded by an energy efficiency surcharge on electric bills.

TRANSPORTATION TARGETS

Transportation energy demand is a major contributor to regional energy and greenhouse gas emissions. Therefore, ACRPC proposes that regional targets for overall reductions in fossil fuel usage across all vehicle classes must be met to achieve climate change resilience. Further, reducing demand for these non-domestically produced transportation fuels will also enhance energy security by making the Region less dependent on fuel imports. Projections of necessary reductions in demand by fuel type and vehicle type can be seen in **Table 12**.

Much of this transition involves shifting from fossil fuel powered vehicles to electric vehicles. As EV use grows, this should lead to declining demand for gasoline, diesel and ethanol. Targets for EV adoption can be viewed in **Table 13**. Meeting these EV and PHEV targets, plus shifting single-traveler, single-destination travel to public options, should help substantially reduce demand for fossil fuels and their additives for road transportation.

Currently the national political climate has moved away from electric vehicle adoption. However, the car manufacturers have made great strides in producing great electric vehicles at prices comparable to traditional internal combustion engines. Fast, convenient public charging infrastructure range anxiety and resistance to change remain the biggest hurdles to electric vehicle adoption. Even in the current climate, this plan supports the long-term investment in electric charging infrastructure to support EV adoption.

Public transit, compact land uses and active transportation constitute the other strategies the Region supports to improve transportation and reduce costs and consumption. See the transportation section of this plan for a discussion of those resources.

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Table 12: Transportation Fuel Demand Targets, thousand MMBtu

	Passenger Car			Light Truck			Medium Duty			Heavy Duty		
Fuel	2025	2035	2050	2025	2035	2050	2025	2035	2050	2025	2035	2050
Electricity	11	93	192	14	167	295	20	165	352	10	81	147
Natural Gas	-	-	-	-	-	-	-	-	-	-	-	-
Gasoline	416	202	26	1,050	477	64	147	98	26	0	0	0
Diesel	2	1	0	20	12	1	190	108	22	283	91	9
LPG				-	-	-	2	1	0	-	-	-
Ethanol	35	21	3	90	50	7	13	10	3	0	0	0
CNG	-	-	-	-	-	-	-	-	-	-	-	-
Biodiesel	0	0	0	1	1	0	13	14	5	20	12	2
Total	**465**	**317**	**222**	**1,176**	**707**	**368**	**384**	**396**	**408**	**312**	**183**	**159**

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Table 13: CAP Regional EV and PHEV Targets (Number of Vehicles)

Vehicle Type		2025	2035	2050
Passenger Vehicle EV and PHEV Stock	Battery Electric	606	6,250	14,719
	Plug In Hybrid	115	88	20
	Total	721	6,338	14,739
Light Duty Truck EV and PHEV Stock	Battery Electric	622	8,705	17,753
	Plug In Hybrid	65	86	21
	Total	687	8,792	17,775

Road vehicles are not the only sources of fossil fuel-based transportation fuel demand in the Region. Reducing demand for fossil fuels from non-road vehicles is also a long-term priority to improve energy security and climate change resilience the Addison Region. **Table 14** shows the primary goal for reducing fossil fuel demand for non-road vehicles is encouraging fuel switching from traditional jet kerosene to sustainable aviation fuels (SAF).

GENERATION TARGETS

The PSD's "determination standards", or the standards to achieve "enhanced energy plans", require regional plans establish 2025, 2035, and 2050 targets for renewable energy production. ACRPC worked with PSD guidelines and the provided Generation Scenarios Tool to produce municipal and regional targets for new renewable generation. These targets are listed in **Table 15**.

These generation targets represent only one possible pathway to derive 90% total energy from renewable sources by 2050. The purpose of these targets is only to provide an idea for planning future electricity generation in our Region based on estimated demand.

Other potential electricity generation combinations exist and could be better suited for our Region. For instance, this model represents a generation mix that almost certainly would require industrial scale wind. Depending on individual municipalities' planning, this may not be practical, and a model with more solar and less wind generation might be more appropriate.

Table 14: CAP Regional, Non-Road Energy Targets (Thousand MMBTUs)

Fuel	2015	2025	2035	2050
Diesel	64	61	61	62
Biodiesel	2	4	8	14
Avgas	2	3	3	3
Jet Kerosene	83	82	69	48
Sustainable Aviation Fuel	-	1	16	37
Gasoline	22	20	21	21
Ethanol	2	2	2	3
Lubricants	18	14	14	14
Natural Gas	-	-	-	-
Total	193	187	194	202

Table 15: New Generation Targets

Municipality	Current Generation	Generation (MWh) Targets		
	2024	2025	2035	2050
Addison	5403	4294	6359	8296
Bridport	4178	3807	5638	7355
Bristol	9164	8083	11,970	15616
Cornwall	1659	2701	4000	5218
Ferrisburgh	14,376	7665	11,351	14809
Goshen	136	858	1270	1657
Leicester	621	2186	3236	4222
Lincoln	1084	3362	4978	6495
Middlebury	44,759	27,623	40,904	53,366
Monkton	2161	3943	5839	7617
New Haven	37,044	6946	10,286	13,419
Orwell	1528	3419	5062	6605
Panton	8166	2493	3691	4816
Ripton	521	2450	3628	4733
Salisbury	1039	3013	4463	5822
Shoreham	2302	3957	5859	7644
Starksboro	1277	3866	5725	7469
Vergennes	14,093	6280	9300	12,133
Waltham	728	931	1378	1798
Weybridge	1668	1870	2769	3613
Whiting	992	1098	1627	2123
Total	**152,898**	**100,843**	**149,333**	**194,826**

The targets analysis using the generation scenarios tool found that annual generation from local renewable energy sources must increase to 100,843 MWhs, 149,333 MWhs, and 194,826 MWhs, by 2025, 2035, and 2050, respectively. As summarized in Chapter 2 of this Plan and detailed in **Table 7**, the Region has a nameplate capacity of about 87.69 MWs and produces about 152,898 MWh of electricity annually from renewable generation as of December 2024. The Region has exceeded its 2025 total generation target early (152% of total generation target), currently produces enough electricity to meet 102% of its 2035 total generation target, and currently generates about 78% of its 2050 renewable generation target.

The Region's electricity demand may increase somewhat, perhaps significantly, over current demand levels by 2035 and 2050. It is quite likely that generation data and targets will change over coming decades. If reduction of industrial electrical demand proves overly optimistic, then additional generation might well be needed. If energy efficiency improvements produce less demand reduction for direct use electricity or heating, and substantial EV uptake occurs, this could also impact generation needs for the Region. Additional housing developments will also likely increase demand and the need for new generation.

Conversely, technological developments in the energy sector are progressing rapidly and new electric, heating, and transportation technologies may require less energy than currently anticipated. To address these concerns, distributed generation targets for this plan were generated using population and electricity demand estimates that grow gradually over time. Annual population growth was estimated at about 1%, whereas electricity demand was projected to grow 1.5% annually. As such, these projections are best viewed as educated estimates of what will need to be done to usher in the energy future of the Region and meet state standards.

ACRPC supports additional orderly expansion of the Region's renewable generation capacity and will continue to evaluate impacts of new generation to determine both the feasibility of targets and how they relate to the Region's demand.

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HABITAT BLOCKS, RENEWABLE ENERGY GENERATION TARGETS, AND CLIMATE CHANGE RESILIENCE

Conserving large, contiguous habitat blocks in the Addison Region helps maintain the region's ecological functioning. Connected and healthy habitats provide spaces for work and recreation, support wildlife, and sustain local food systems. They also directly contribute to climate change mitigation goals. Intact habitats support biodiversity, facilitate species migration, and sustain ecosystem services such as carbon sequestration, flood attenuation, wind buffering, and drought resistance—services that are increasingly critical to preventing and responding to changing climatic conditions. Conserving these areas also reduces landscape disruptions that can amplify greenhouse gas emissions through increased soil disruption and the need for expanded infrastructure. Habitat conservation and strategic energy planning are complementary components of a regional energy plan that seeks to increase the region's climate change resilience.

To evaluate how renewable energy development could proceed without compromising high-value habitat blocks, an ACRPC conducted GIS-based spatial analysis. This analysis relied on data from the Vermont Agency of Natural Resources (ANR), Vermont Center for Geographic Information (VCGI), and the Department of Public Service. First, technical potential for solar and wind energy was assessed across the county using land cover data, slope thresholds, and proximity to transmission infrastructure. Next, land was screened for compatibility with both land conservation priorities and renewable energy siting requirements, with further filters applied to remove hydric soils, wetlands, and steep slopes. Finally, core habitat blocks were identified and excluded from the developable land base. This approach examined whether remaining land area available for renewable energy development was sufficient to meet the region's renewable energy targets while advancing climate pollution reduction objectives. Results can be viewed in **Table 16** below and in **Map 12** and **13** in Appendix E.

The analysis demonstrates that Addison County has more than sufficient land available to meet its renewable electricity generation targets without encroaching upon core conservation blocks. Both the 2050 generation target of 194,826.08 MWhs of domestic, renewable energy generation and an even more aspirational target of 100% of current demand—275,079 MWhs—are well within reach. Even after excluding all high-value ecological areas from the more restrictive "preferred sites" locations, substantial technically suitable land remains for distributed, utility-scale solar and wind projects. The Region's future generation potential is even greater when considering the role that future rooftop solar will play in our energy transition. This finding underscores the feasibility of decoupling renewable energy development from habitat loss in our communities and reinforces the County's commitment to climate resilient energy planning. By pursuing energy development goals through conservation-aware siting, The Addison Region can preserve local biodiversity, protect the ecological assets that are foundational to long-term climate adaptation and community well-being, and pursue orderly energy development. Therefore, this Plan requires that commercial scale energy generation projects in the Region avoid core habitat blocks as identified in the study above and locate in other areas, in line with municipal plans better suited to development.

Table 16: Regional Ground-based Solar and Wind Potential, Controlling for Habitat Blocks

	Prime sites, no constraint	Prime sites, no constraint, no habitat blocks	Preferred sites	Preferred sites, no habitat blocks
SOLAR				
MW	1,424	847	854	494
MWh	1,871,403	1,113,383	1,123,075	649,800
WIND				
MW	579	495	149	86
MWh	1,143,140	977,053	294,807	170,572

Appendix B: Plan Goals, Objectives, Actions, and Impact

Appendix B provides the complete list of recommended Goals, Objectives, and Actions to support the energy needs of the Region. It does not intend to serve as an exhaustive or exclusive list of proposals for facilitating the region's energy goals. However, it is indicative of the types of proposals that ACRPC supports, adoption of which the RPC would welcome. Following each of the proposed actions is a brief assessment of how their implementation may impact the three primary energy goals of this plan: the energy justice, climate change resilience, and energy security of the Region.

EJ: Environmental Justice
CCR: Climate Change Resilience
ES: Energy Security

GOAL 1: Build regional capacity for energy planning and public engagement to support the transition to renewable energy and improved energy efficiency.

Objective 1:

Educate consumers regarding efficiency and energy conservation.

a. Regularly host a regional energy fair. **EJ:** Accessible programming for all income levels | **CCR:** Promotes low-carbon technologies | **ES:** Highlights local energy generation options

Objective 2:

Expand targeted ACRPC energy services for municipalities.

a. Expand the regional staff position to focus on developing municipal energy projects and advising municipalities on regulations and enforcement. **EJ:** Reduces planning burden on under-resourced municipalities | **CCR:** Advances low-GHG projects | **ES:** Supports domestic energy development

b. Work with municipalities to learn what types of energy projects are needed in each town. **EJ:** Planning capacity less dependent on local taxbase | **ES:** Planning support of domestic energy projects.

GOAL 2:

Increase the Region's thermal energy efficiency through municipal leadership and support for residential and commercial heating improvements to meet local and State targets of 90% renewable energy by 2050.

Objective 1:

Promote energy efficiency in municipal buildings.

a. Work with towns to develop and implement MERP energy assessment recommendations, including facilitating access to grant or bond funding and group purchasing programs to reduce costs. **EJ:** Reduces municipal costs and taxpayer burden | **CCR:** Reduces GHG emissions and improves infrastructure | **ES:** Reduces imported fuel dependence

b. Advocate for a state-wide, municipal utility tracking software to support ongoing evaluation of the costs and benefits of municipal energy efficiency and weatherization projects. **EJ:** Closes information gap between municipalities | **CCR:** Tracks progress toward emissions reductions

Objective 2:

Encourage local and sustainably harvested wood and efficient wood heating.

a. Promote EPA III approved energy efficient wood stoves through education and outreach. **EJ:** Improves indoor/outdoor air quality | **CCR:** Reduces heating GHG emissions | **ES:** Uses domestically available fuel

b. Promote sustainable timber harvest from regional and town forests, in accordance with Natural Resources goals, to provide local heating and electricity fuel sources, prioritizing access for low-income citizens. **EJ:** Reduces energy burden for low-income residents; improves air quality compared to older heating methods | **CCR:** Produces less GHG than fossil fuels | **ES:** Provides domestic fuel source and reduces imports

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Objective 3:

Support weatherization efforts and optimize building design for energy conservation.

a. Coordinate with CVOEO, Neighborworks, Efficiency Vermont, VEEP, and CEAC's Energy Navigator program to encourage weatherization participation, including event support, grant assistance, project development, and education/outreach collaboration. **EJ:** Improves access to assistance programs for low-moderate income residents | **CCR:** Reduces fossil fuel demand and improves home resilience | **ES:** Reduces imported fuel dependence

b. Promote the installation of air source and geothermal heat pumps. EJ: Improves air quality | CCR: Reduces heating GHG emissions | **ES:** Reduces imported fuel demand

c. Support thermal energy network development and explore community-based utility models (municipal, neighborhood, cooperative) that build local capacity and resilience. **EJ:** Could reduce and stabilize low-income heating costs | **CCR:** Utilizes waste heat, reduces fossil fuel demand | **ES:** Reduces imported fuel dependence

d. Encourage municipalities, businesses, organizations and homeowners to build to higher energy standards (RBES/CBES "Stretch energy code") and work with willing local planning commissions to incorporate these standards into municipal plans and zoning regulations. **EJ:** Reduces energy costs and improves building safety/comfort; provides planning assistance to under-resourced municipalities | **CCR:** Reduces building sector GHG emissions; increases likelihood of GHG reduction success | **ES:** Reduces imported fuel demand; supports local energy solutions.

GOAL 3: Modernize the Region's electrical systems and promote efficient energy use in buildings.

Objective 1:

Support energy conservation and efficient use of electricity in buildings.

a. Discourage the use of "always on" lighting in parking lots and other indoor and outdoor lighting in public places. Encourage the use of technology like motion sensors to light areas when needed. **ES:** Reduces non-solar hour electricity demand

b. Advocate for the availability of smart meter technology to help consumers understand and regulate their electricity usage. **EJ:** Helps consumers manage energy use and costs | **ES:** Reduces non-solar hour electricity demand

Objective 2:

Work with municipalities, electric utilities and community groups to modernize grid infrastructure and support the clean energy transition.

a. Help the Region's municipalities investigate and install, or purchase, cost-effective municipal solar and/or wind net-metered facilities to power municipal energy use. **EJ:**Reduces taxpayer energy burden | **CCR:** Reduces municipal GHG emissions | **ES:** Reduces imported fuel dependence

b. Work with GMP to ensure that during the transition to distributed electric generation and increasing consumer reliance on electricity for power, that GMP improves the distribution and transmission grid and substations improves regularly to continue to provide cost effective, reliable service and opportunity for growth to all communities in the Region and eliminates the congestion currently occurring in the Addison Region. **CCR:** Reduces grid vulnerability and supports clean generation | **ES:** Supports local energy generation

c. Advocate for appropriate cost allocation policies: globalizing costs for residential-scale distributed generation while requiring commercial/industrial generators to fund improvements necessary for their projects. **EJ:** Prevents undue burden on communities | **CCR:** Supports climate-friendly grid modernization | **ES:** Supports domestic energy supply

d. Share info with VELCO, GMP and VECOOP to ensure that targets for renewable generation in the Region and across the state are optimized to enhance the cost effectiveness of the transmission and distribution system for the State of Vermont. Support grid upgrades where they will provide the greatest cost/benefit. **EJ:** Economic efficiency reduces energy burden | **CCR:** Improves climate adaptation resource efficiency | **ES:** Reduces cost and improves price stability

e. Strongly encourage the Region's electric utilities to adopt the new standards for digital substations from the National Electrical Manufacturers Association. **EJ:** Reduces price spikes during high demand | **CCR:** Supports renewable generation and grid resilience | **ES:** Improves regional energy security

f. Suggest that new renewable energy projects in the region be designed in such a way so that they are "storage ready," or are capable of being connected to onsite or nearby storage projects without significant retrofitting. **EJ:** Reduces future retrofit costs and stabilizes prices | **CCR:**Enables intermittent renewable integration | **ES:** Improves domestic energy system functioning

g. Require newly installed generation systems to meet the following standards when relevant IEEE1547-2018, IEEE2800-2022, IEEE 2030-2011, and IEEE 2030.7-2017 for connection to the grid. **CCR:** Enables safe low-GHG technology deployment | **ES:** Improves utility-scale renewable functioning

GOAL 4: Reduce transportation energy consumption by transitioning to electric vehicles and promoting mode shift away from single-occupancy vehicles.

Objective 1:

Support the development of electric vehicle infrastructure and promote EV adoption.

a. Plan for and install electric vehicle charging infrastructure on municipal property. **EJ:** Expands charging access for those unable to install at home | **CCR:** Accelerates transition to electric vehicles | **ES:** Enables use of domestic electricity

b. Encourage major employers in the Region to install (additional) EV charging stations for employees. **EJ:** Expands charging access for those without home charging | **CCR:** Integrates EVs into commuting | **ES:** Reduces imported commute fuels

c. Develop an EV Readiness report that includes strategic infrastructure improvement recommendations as well as assessments of municipal fleets. **CCR:** Identifies EV adoption progress and barriers | **ES:** Supports transportation infrastructure transition

d. Promote the Drive Electric Vermont website and resources. **EJ:**Reduces information gaps about EV programs | **CCR:** Provides decarbonization information | **ES:** Informs about non-imported fuel options

Objective 2:

Reduce vehicle miles traveled and support the development of alternative transportation options.

a. Support Walk-Bike Council of Addison County efforts to increase safe walking and biking access by facilitating complete streets infrastructure and helping municipalities secure funding for incremental bicycle and pedestrian improvements. **EJ:** Expands affordable transportation access and minimizes municipal costs | **CCR:** Reduces fossil fuel transportation demand | **ES:** Eliminates fuel use for active transportation

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b. Support public transit expansion by working with TVT to improve rural service access, encouraging municipal representation on transit boards, promoting park-and-ride and ride-sharing programs, and advocating for enhanced public transit access during planning proceedings. **EJ:** Expands affordable transportation access | **CCR:** Reduces single-occupancy vehicle fossil fuel demand | **ES:** Reduces imported transportation fuel demand

c. Support employer programs to encourage telecommuting, carpooling, vanpooling, for employees' commute trips. **EJ:** Reduces energy burden for rural/extended commuters | **CCR:** Reduces employee fossil fuel demand | **ES:** Reduces imported fuel demand

GOAL 5: Transition medium and heavy-duty transportation to cleaner fuel alternatives.

Objective 1:

Support improvements to rail infrastructure and encourage cleaner fuels for large vehicle fleets.

a. Support transportation goals for expanding passenger and freight rail service (see Transportation Section) to reduce vehicle miles traveled and fossil fuel consumption. **EJ:** Provides lower cost long-distance travel | **CCR:** Reduces light and heavy-duty vehicle GHG emissions | **ES:** Reduces imported transportation fuel demand

b. Work with Clean Cities Coalition to encourage large vehicle fleets to switch to conventional natural gas use in situations in which switching to EVs or renewable natural gas is not feasible. **EJ:** Improves air and noise quality | **CCR:** Reduces GHG emissions compared to diesel

GOAL 6: Advance renewable electricity generation while protecting natural resources.

Objective 1:

Encourage municipal renewable energy generation.

a. Analyze the feasibility and support the installation of additional municipal solar and/or wind net-metering facilities that are compliant with the standards enumerated in this plan to off-set municipal electric use. **EJ:** Reduces energy-related tax burden | **CCR:** Reduces climate impact and hardens emergency facilities | **ES:** Reduces imported fuel reliance

Objective 2:

Support responsible siting and development of renewable energy resources.

a. Work closely with the municipalities impacted by proposed energy development projects to ensure responsibly sited and developed renewable energy projects are implemented in the region. **EJ:** Prevents unfair community impacts | **CCR:** Reduces opposition to clean energy | **ES:** Builds support for domestic generation

b. Expand regional and local energy storage and promote local microgrids to improve energy system reliability and resiliency. **EJ:** Addresses rural energy disruption frequency | **CCR:** Enables renewable balancing and weather resilience | **ES:** Improves domestic energy functionality

c. Support local on-farm or residential scale renewable distributed generation projects. **EJ:**Avoids new burdens in already-developed spaces | **CCR:** Reduces fossil fuel demand and improves system resilience | **ES:** Reduces electricity and fuel imports

d. Support municipal enhanced energy plans by the development of generation utilities in identified preferred locations over the development on other sites. **EJ:** Reduces undue community burden | **CCR:** Avoids undermining other climate goals

Objective 3:

Encourage compact settlement patterns and conserve forest land as renewable resources.

a. Support housing goals for compact development, infill, village center growth, and shared utility infrastructure (see Housing Section) to reduce transportation energy demand and enable efficient energy systems. **EJ:** Reduces transportation costs and energy burden | **CCR:** Reduces transportation and heating fuel demand | **ES:** Reduces imported fuel dependence

b. Discourage the conversion of forest blocks and other important ecosystems into exclusively energy generating sites. **EJ:** Maintains ecosystem services | **CCR:** Maintains CO2 sequestration and storm buffering

Appendix C: Energy Units and Conversions

This plan uses multiple units of measurement to describe current and future energy use. Definitions and conversions for those units are described below.

Table 17: Unit Conversions

Power and Energy Unit Definitions	
Btu	A British thermal unit (Btu) is a measure of the heat content of fuels or energy sources.
MMBtu	One million British thermal units (MMBtu).
KW	A kilowatt (kW) is a unit for measuring power that is equivalent to one thousand watts. It is often used to describe bgeneration capacity.
KWh	A kilowatt- hour (kWh) is a measure of power usage as a function of time. For example, one kilowatt-hour is one hour of using elect icity at a rate of 1,000 watts.
MW	A megawatt (MW) is a unit for measuring power that is equivalent to one thousand kilowatts. It is often used to describe generation capacity.
MWh	A megawatt- hour (MWh) is a measure of power usage as a function of time. For example, one megawatt-hour is one hour of using electricity at a rate of 1,000 kilowatts.
GW	A gigawatt (GW) is a unit for measuring power that is equivalent to one million kilowatts. It is often used to describe generation capacity.
GWh	A gigawatt-hour (GWh) is a measure of power usage as a function of time. For example, one gigawatt-hour is one hour of using electricity at a rate of one million kilowatts.
Energy Unit Conversions	
1 kWh of electricity	3,412 BTUs
1 MWh	1,000 kWh
1 MW	1,000 kW
1 GWh	1,000 MWh
1 trillion BTUs	1012 BTUs
1 gallon of heating oil	138,500 BTUs
1 cord of wood	20,000,000 BTUs

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Appendix D: Comprehensive Energy Targets List

LEAP Targets

TOTAL ENERGY FUEL SWITCHING TARGETS

Table 18: Total Energy Demand Reduction Targets by Sector

Target Energy Demand Targets (Thousand MMBTU)				
	2025	2035	2050	Change
Residential	1,332	946	731	(982)
Commercial	832	735	727	(263)
Industrial	1,068	1,101	1217	160
Total	3,232	2,782	2675	(1,085)

Table 19: Residential total fuel switching target

CAP Mitigation Total Regional Residential Sector Final Energy Demand (Thousand MMBTUs)				
Fuel	2015	2025	2035	2050
Electricity	345	311	413	482
Wood	394	317	173	79
Propane	302	225	107	40
Wood Pellets	98	30	22	18
Biodiesel	-	24	145	110
Heating Oil	525	389	71	-
Biogas	-	2	4	2
Total	1,713	1,332	946	731

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Table 20: Commercial total energy fuel switching target

CAP Mitigation Total Regional Commercial Sector Final Energy Demand (Thousand MMBTUs)				
Fuel	2015	2025	2035	2050
Electricity	317	335	396	409
Gasoline	31	34	36	38
Kerosene	0	0	0	-
Wood	76	80	90	108
Ethanol	2	2	2	3
Solar	8	20	21	23
Heat	-	-	24	39
Propane	194	106	30	1
Residual Fuel Oil	5	2	2	2
Wood Pellets	-	4	12	19
Biodiesel	-	6	46	64
Heating Oil	220	105	23	-
Biogas	-	9	13	16
Natural Gas	138	127	40	6
Total	990	832	735	727

Table 21: Industrial total energy fuel switching target

CAP Mitigation Total Regional Commercial Sector Final Energy Demand (Thousand MMBTUs)				
Fuel	2015	2025	2035	2050
Electricity	260	253	237	251
Natural Gas	302	339	270	95
Gasoline	26	24	25	27
Kerosene	1	1	1	1
Diesel	161	128	44	-
LPG	16	16	15	14
Wood	19	11	11	12
Biogas	-	38	150	411
Ethanol	2	2	3	3
Lubricants	9	6	7	7
Biodiesel	-	62	144	188
Residual Fuel Oil	9	6	6	6
Wood Waste Solids	5	1	1	1
Asphalt and Road Oil	248	181	189	200
Total	1,057	1,068	1,101	1,217

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THERMAL EFFICIENCY AND FUEL SWITCHING TARGETS

Table 22: CAP Mitigation Regional Residential New Cold Climate Heat Pumps

Technology	2025	2035	2050
ASHP 2 Head	1,103	2,957	4,366
ASHP Central	1,715	4,631	6,804
ASHP HE	1,619	4,343	6,412
GSHP HE	200	537	792
Total	4,637	12,468	18,374

Table 23: Regional Residential New Retrofits (Number of Housing Units)

Technology	2025	2035	2050
Baseline Scenario	1,232	2,378	4,178
CAP Mitigation	3,356	7,253	11,734

Table 24: Regional Residential New Heat Pump Water Heaters (Number of Units)

Scenario	2025	2035	2050
Baseline Scenario	246	250	257
CAP Mitigation	3,048	10,151	13,928

Commercial

Table 25—CAP Mitigation Regional Commercial New Cold Climate Heat Pumps

	2025	2035	2050
New CCHP	2,336	7,064	9,034

TRANSPORTATION TARGETS

Table 26: CAP Mitigation Regional Commercial New Cold Climate Heat Pumps

	Passenger Car			Light Truck			Medium Duty			Heavy Duty		
Fuel	**2025**	**2035**	**2050**	**2025**	**2035**	**2050**	**2025**	**2035**	**2050**	**2025**	**2035**	**2050**
Electricity	11	93	192	14	167	295	20	165	352	10	81	147
Natural Gas	-	-	-	-	-	-	-	-	-	-	-	-
Gasoline	416	202	26	1,050	477	64	147	98	26	0	0	0
Diesel	2	1	0	20	12	1	190	108	22	283	91	9
LPG				-	-	-	2	1	0	-	-	-
Ethanol	35	21	3	90	50	7	13	10	3	0	0	0
CNG	-	-	-	-	-	-	-	-	-	-	-	-
Biodiesel	0	0	0	1	1	0	13	14	5	20	12	2
Total	465	317	222	1,176	707	368	384	396	408	312	183	159

Table 27: CAP Mitigation Regional Non-Road Final Energy Demand (Thousand MMBTUs)

Fuel	*2015*	*2025*	*2035*	*2050*
Diesel	64	61	61	62
Biodiesel	2	4	8	14
Avgas	2	3	3	3
Jet Kerosene	83	82	69	48
Sustainable Aviation Fuel	-	1	16	37
Gasoline	22	20	21	21
Ethanol	2	2	2	3
Lubricants	18	14	14	14
Natural Gas	-	-	-	-
Total	193	187	192	202

Table 28: CAP Mitigation Regional EV and PHEV Stock (Number of Vehicles)

Vehicle Type		*2025*	*2030*	*2050*
Passenger Vehicle EV and PHEV Stock	Battery Electric	606	6,250	14,719
	Plug In Hybrid	115	88	20
	Total	721	6,338	14,739
Light Duty Truck EV and PHEV Stock	Battery Electric	622	8,705	17,753
	Plug In Hybrid	65	86	21
	Total	687	8,792	17,775

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ENERGY EFFICIENCY TARGETS

Table 29 below represents total achievable EE savings through the implementation of improvements listed in tables 32 and 33. Tables 30 and 31 show the benefits of these efficiency measures on the peak demand pressure on the grid.

Table 29: Municipal Program Achievable Electric Energy Efficiency Savings (MWh)

		2025	2030	2035	2040	2050
Residential	Incremental Annual	76	79	86	83	93
Residential	Cumulative Annual	150	510	858	1,082	1,584
Non-Residential	Incremental Annual	76	69	69	68	79
Non-Residential	Cumulative Annual	152	498	765	747	690
Total	Incremental Annual	152	148	155	151	172
Total	Cumulative Annual	302	1,008	1,623	1,829	2,273

Table 30: Municipal Program Achievable Electric Energy Summer Capacity (MWh)

		2025	2030	2035	2040	2050
Residential	Incremental Annual	0.006	0.005	0.006	0.006	0.007
Residential	Cumulative Annual	0.013	0.037	0.057	0.065	0.068
Non-Residential	Incremental Annual	0.013	0.011	0.011	0.010	0.012
Non-Residential	Cumulative Annual	0.026	0.082	0.126	0.120	0.105
Total	Incremental Annual	0.019	0.016	0.017	0.016	0.019
Total	Cumulative Annual	0.039	0.120	0.183	0.184	0.173

Table 31: Municipal Program Achievable Electric Energy Efficiency Savings (MWh)

		2025	2030	2035	2040	2050
Residential	Incremental Annual	0.02	0.02	0.02	0.02	0.02
Residential	Cumulative Annual	0.03	0.10	0.17	0.22	0.33
Non-Residential	Incremental Annual	0.01	0.01	0.01	0.01	0.01
Non-Residential	Cumulative Annual	0.02	0.07	0.11	0.11	0.10
Total	Incremental Annual	0.03	0.03	0.03	0.03	0.03
Total	Cumulative Annual	0.05	0.18	0.29	0.33	0.43

Table 32: Regional Residential Incremental Annual MWh by End-Use

		2025	2030	2035	2040	2050
Residential	Incremental Annual	0.02	0.02	0.02	0.02	0.02
Residential	Cumulative Annual	0.03	0.10	0.17	0.22	0.33
Non-Residential	Incremental Annual	0.01	0.01	0.01	0.01	0.01
Non-Residential	Cumulative Annual	0.02	0.07	0.11	0.11	0.10
Total	Incremental Annual	0.03	0.03	0.03	0.03	0.03
Total	Cumulative Annual	0.05	0.18	0.29	0.33	0.43

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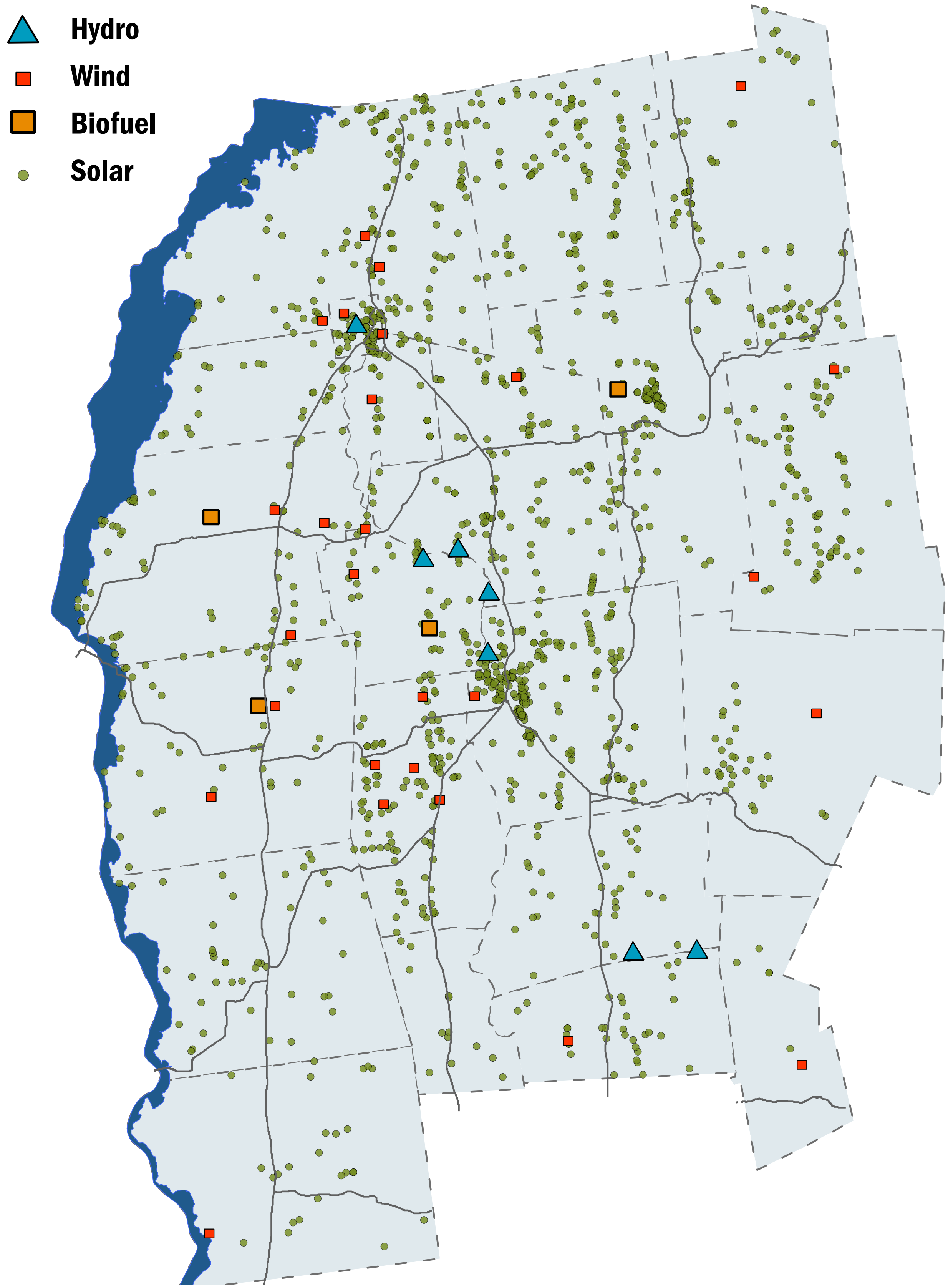
Appendix E: Energy Map Package

As part of its efforts to discover energy generation potential within the Region, the ACRPC created a series of maps depicting generation resources and also potential constraints. These maps show data as required by the Department of Public Service Determination Standards and are a required element of enhanced energy planning. The maps show areas that are potentially appropriate or inappropriate locations for future renewable generation facilities. The maps are a planning tool only and may not precisely indicate locations where siting a facility is acceptable. When proposing a generation facility, applicants must verify the presence or absence of the natural resources and other specific characteristics of the site as a part of the application. The following maps are included below:

1. Existing Generation Facilities: This map presents existing generation facilities greater than 15kW in capacity as well as existing transmission lines and 3-phase power lines in the region.
2. Known Constraints: This map presents the established constraints on land development.
3. Potential Constraints: suggests where conditions would likely require mitigation, and thus which may prove a site unsuitable for development after site-specific study, based on statewide or regional/local policies that are currently adopted or in effect.
4. Wind Potential: This map includes wind speed potential for the Region as well as proximity to 3-phase power lines. Known constraint areas are excluded.
5. Solar Potential: This map includes prime and base solar potential for the Region as well as proximity to 3-phase power lines. Known constraint areas are excluded.
6. Unconstrained Prime Wind: This map identifies areas with potential for wind development that have no constraints impacting them, including no intersection with habitat blocks as identified in Natural Resources maps 8 & 9.
7. Unconstrained Prime Solar: This map identifies areas with potential for solar development that have no constraints impacting them, including no intersection with habitat blocks as identified in Natural Resources maps 8 & 9.
8. Preferred Locations: This map incorporates preferred locations for solar generation previously identified in Municipal Enhanced Energy Plans within the Region, rooftops in coordination with the State priority to develop generation in proximity to demand and avoid green fields (gradient scale).
9. Transmission resources and constraints: This map demonstrates a key challenge for Addison County energy generation and electrification efforts with a depiction of the constrained electric distribution network in the Region.
10. Transportation Infrastructure: Comprised of three maps that include EV charger locations public transportation lines and park and ride locations, and bike trail infrastructure.

Map 1: Existing Generation



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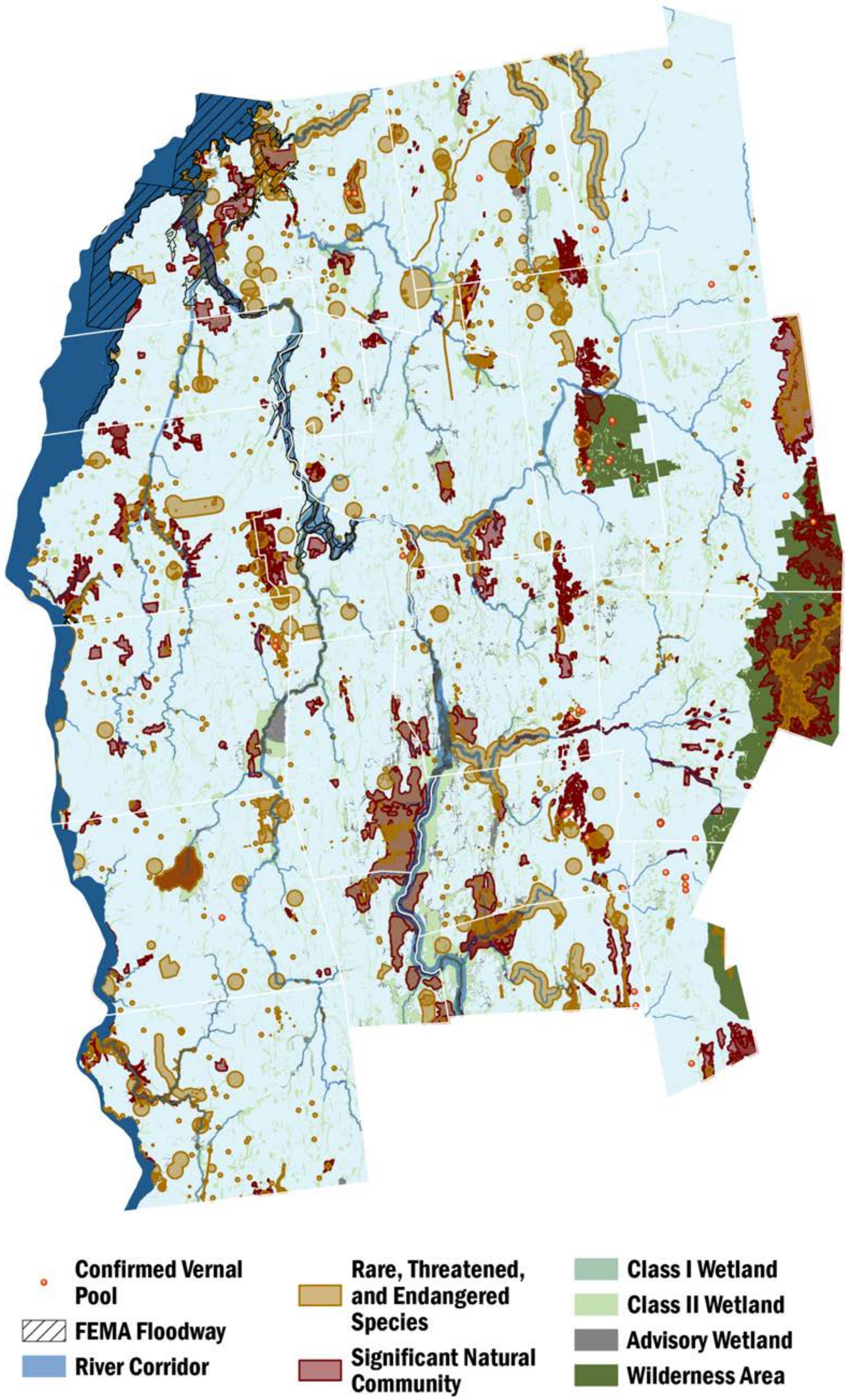
Map 2: Known Constraints



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Map 3: Possible Constraints

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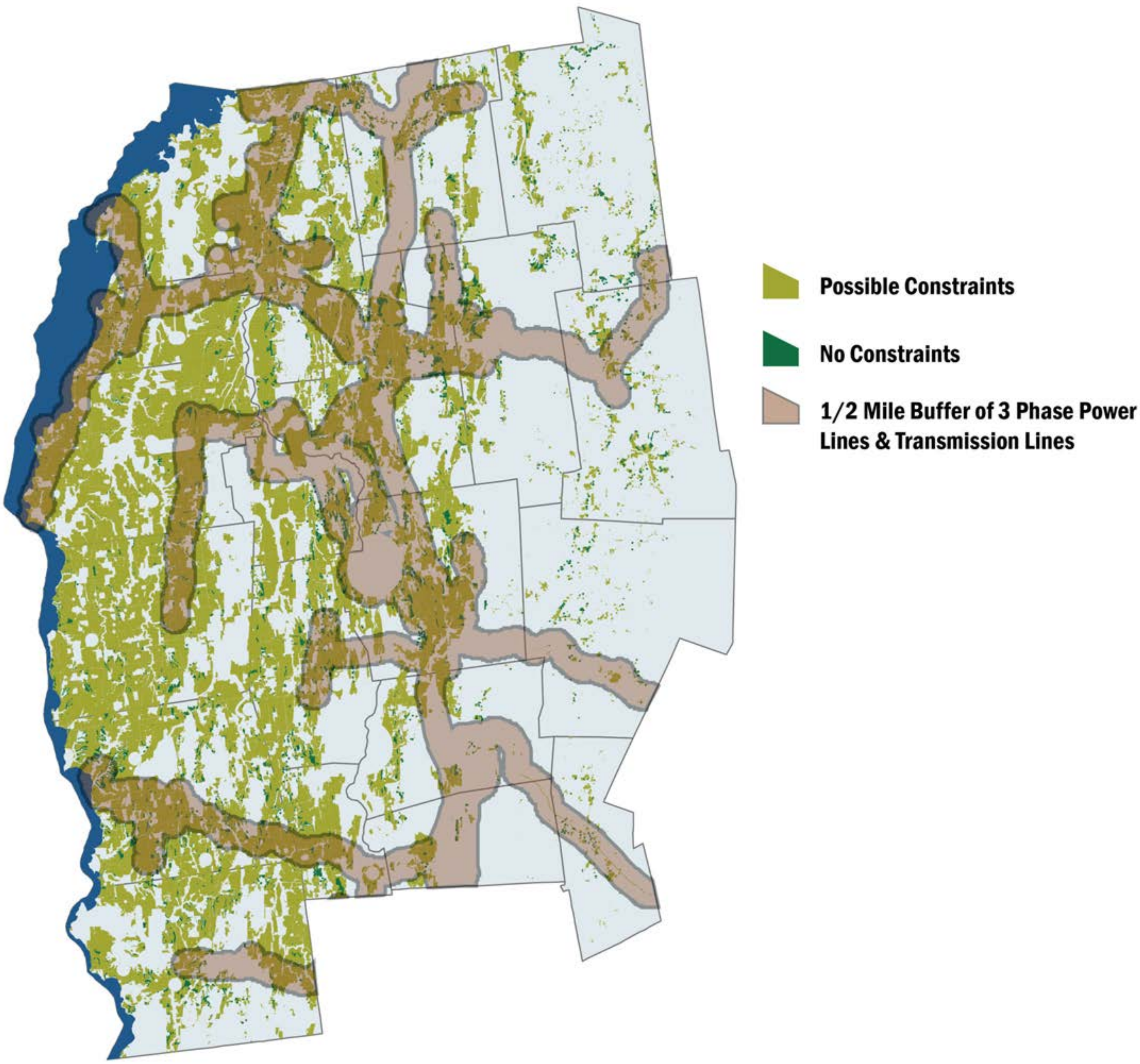
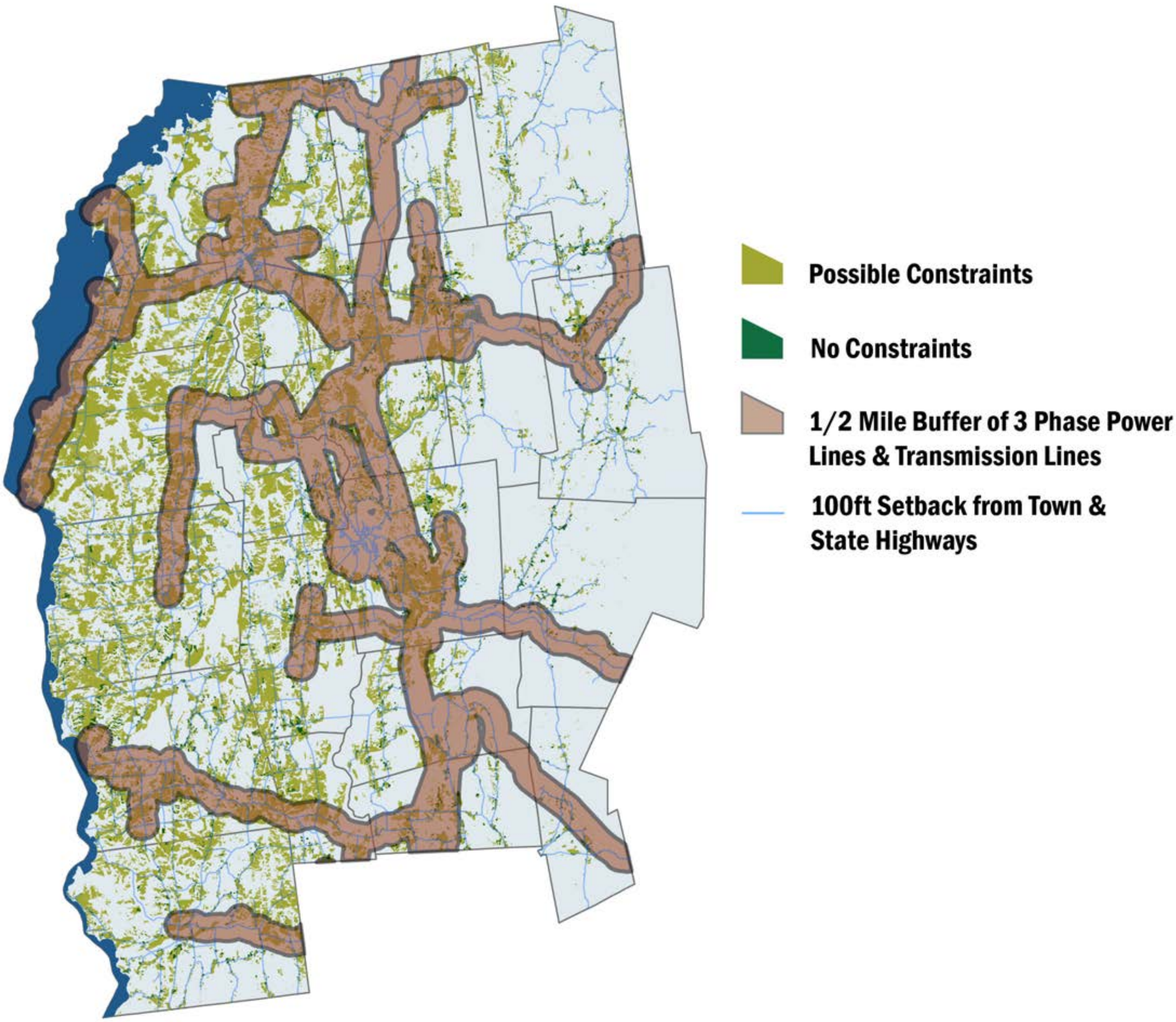
Map 4: Wind Potential



Map 5: Ground Mount Solar Potential



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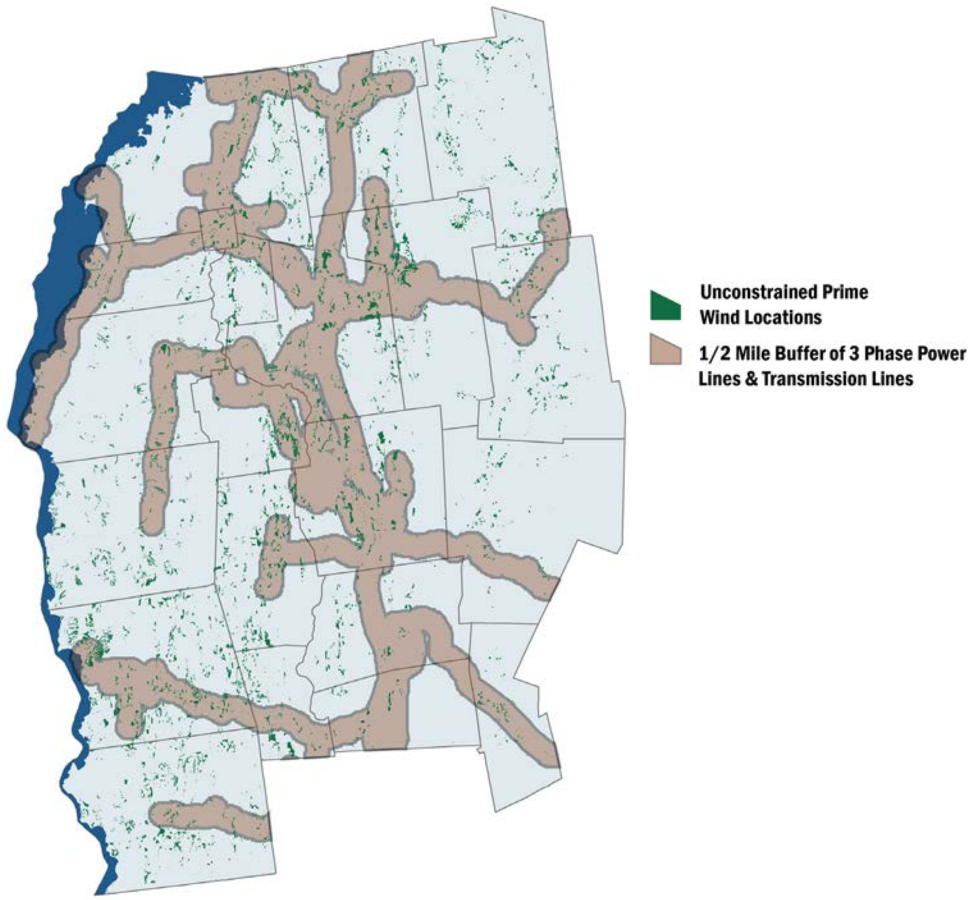
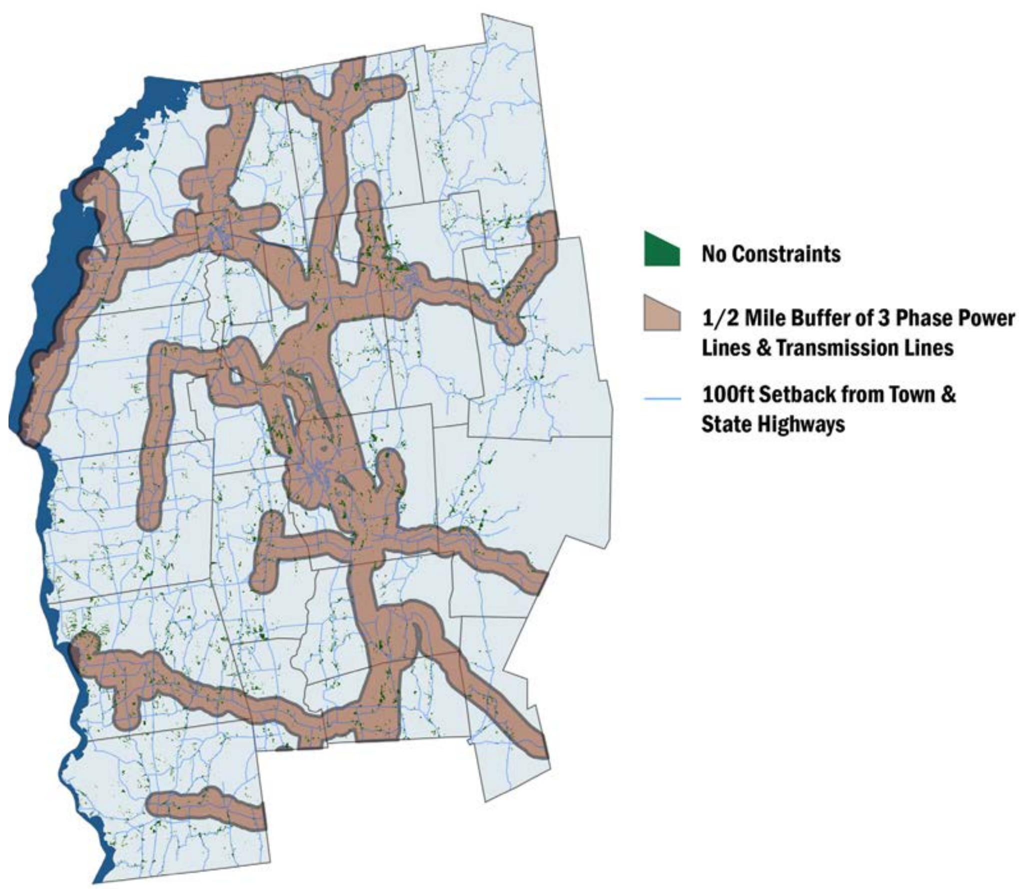
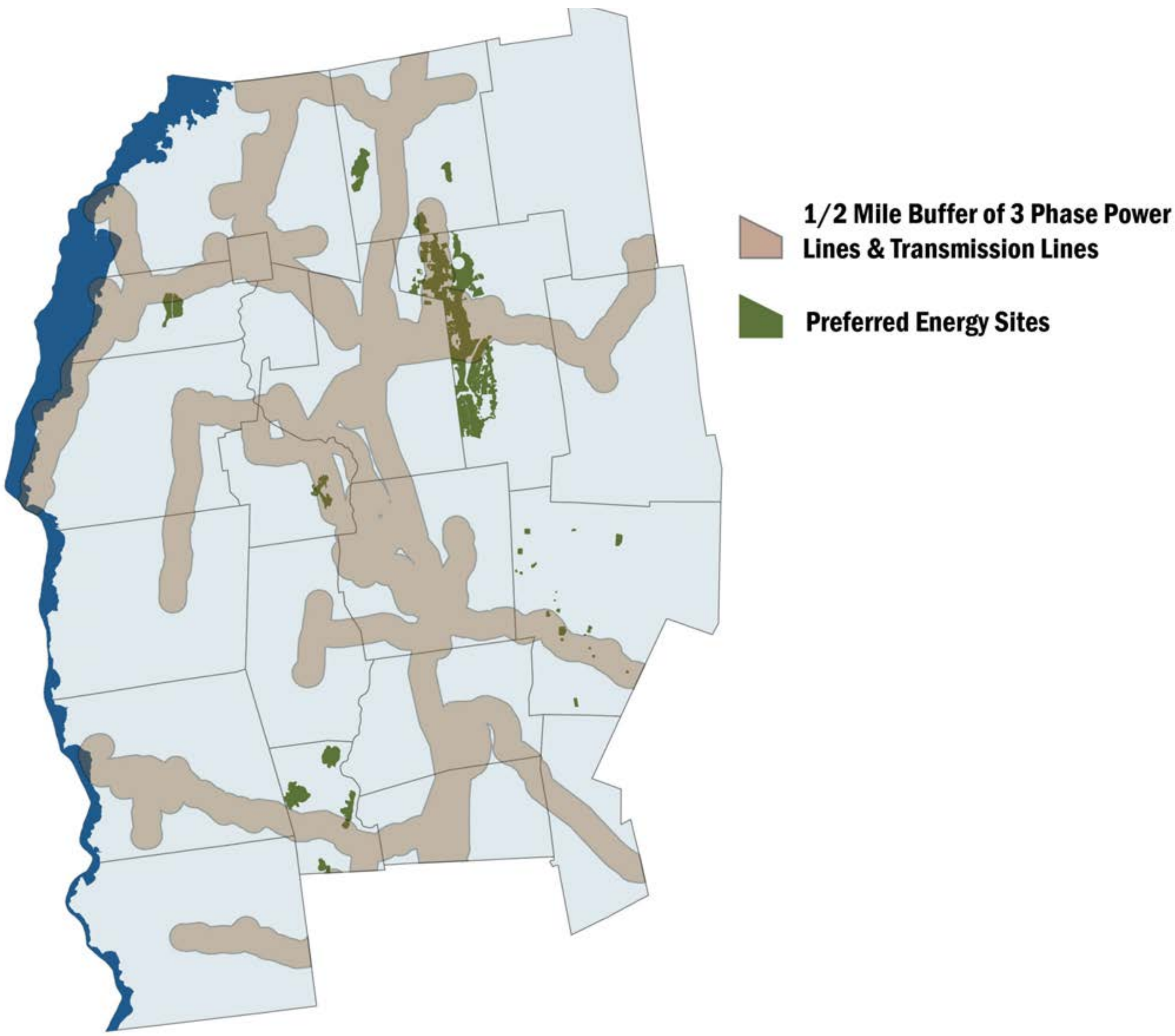
Map 6: Unconstrained Prime Wind Energy



Map 7: Unconstrainted Prime Ground Solar Energy



Map 8: Preferred Sites



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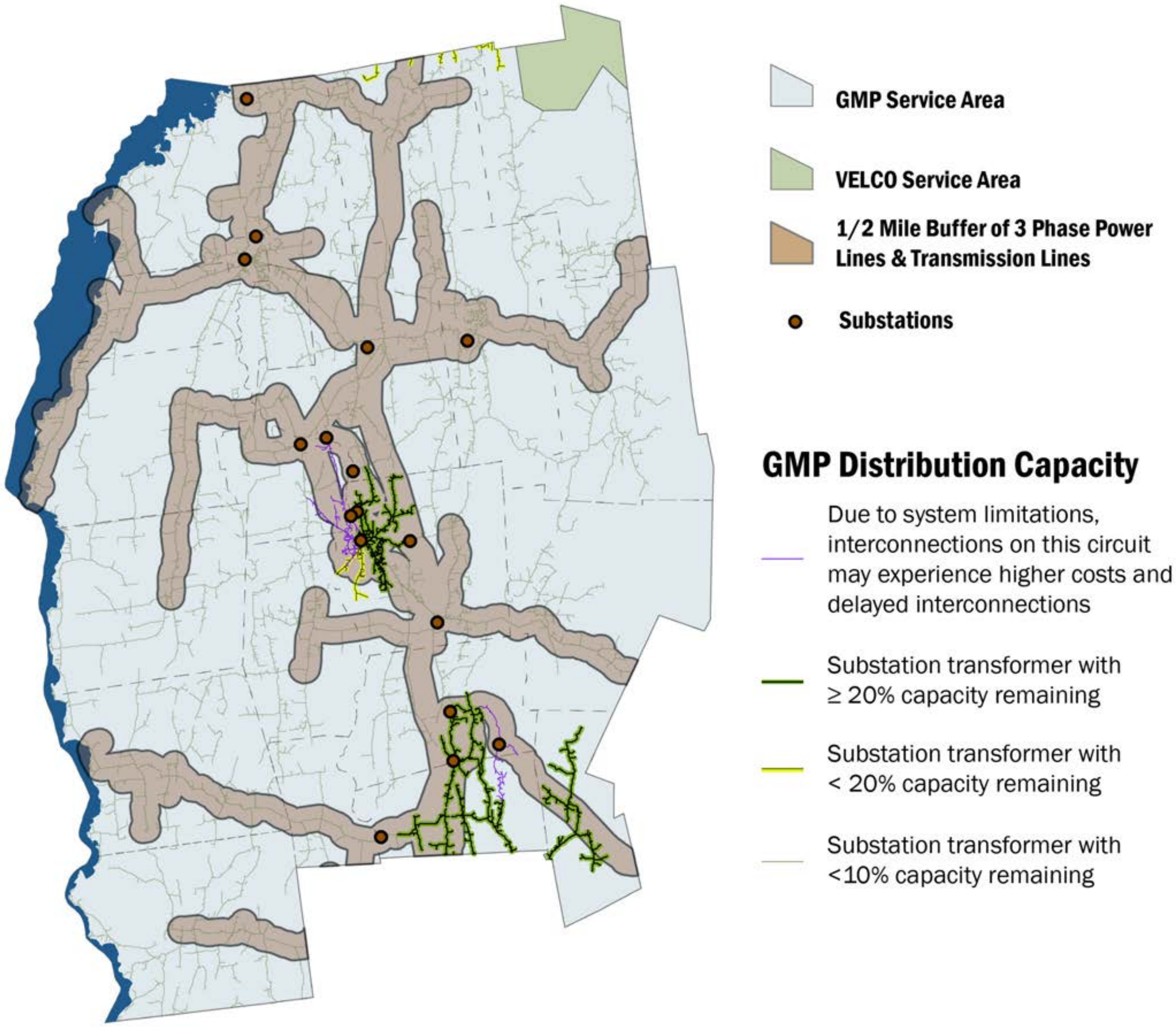
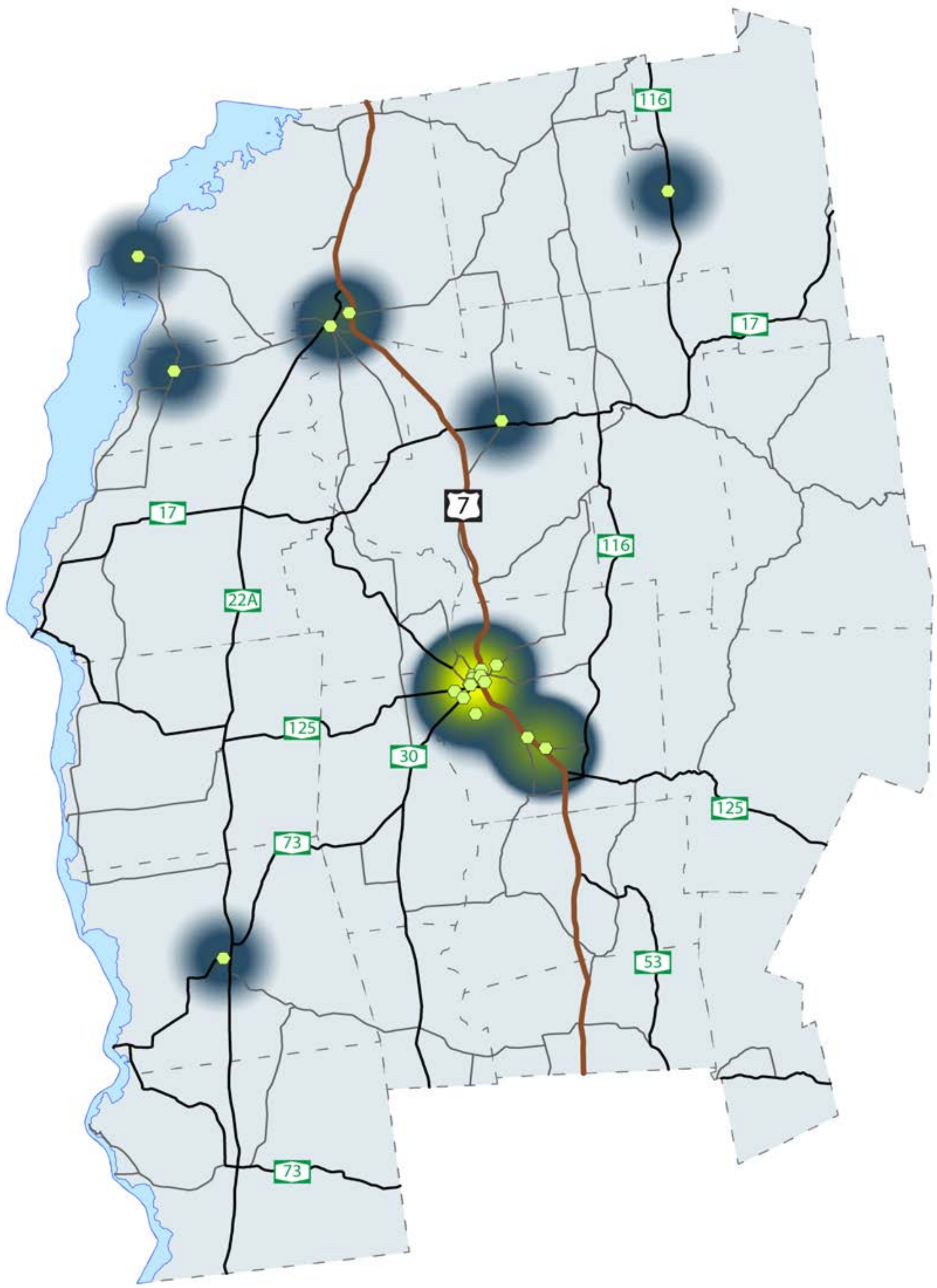
Map 9: Transmission Resources



Map 10a: EV Charger Locations



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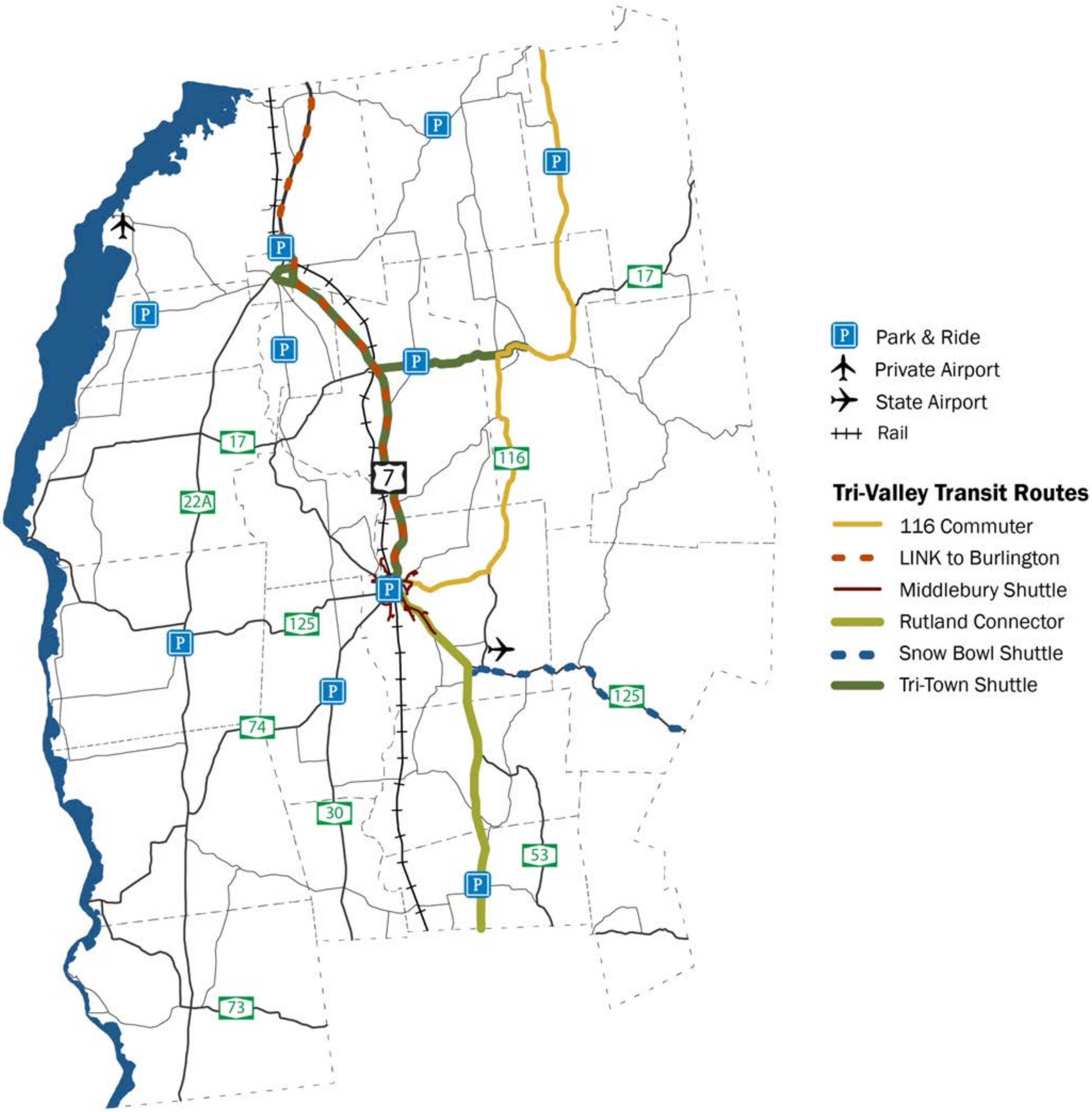
Map 10b



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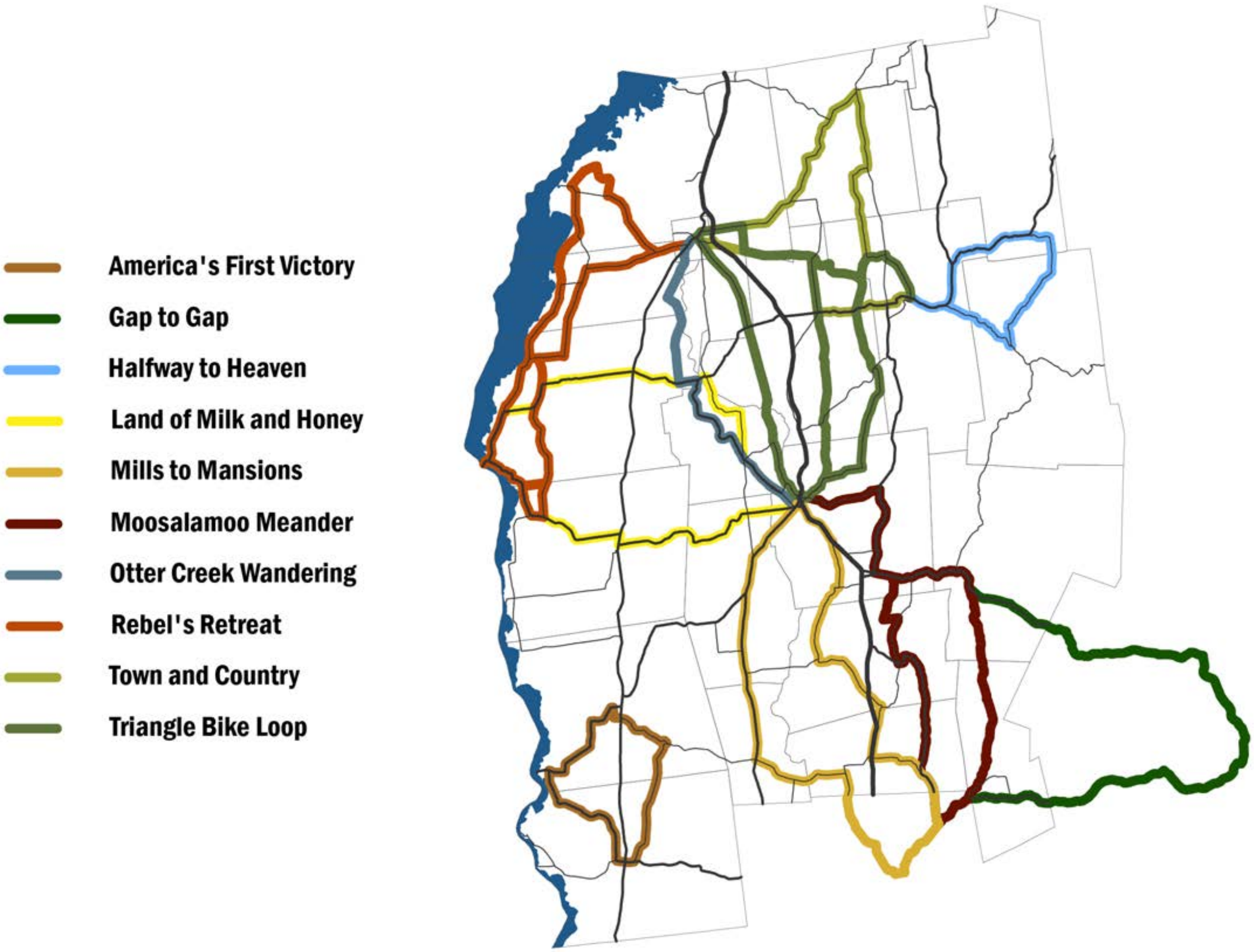
Map 10c



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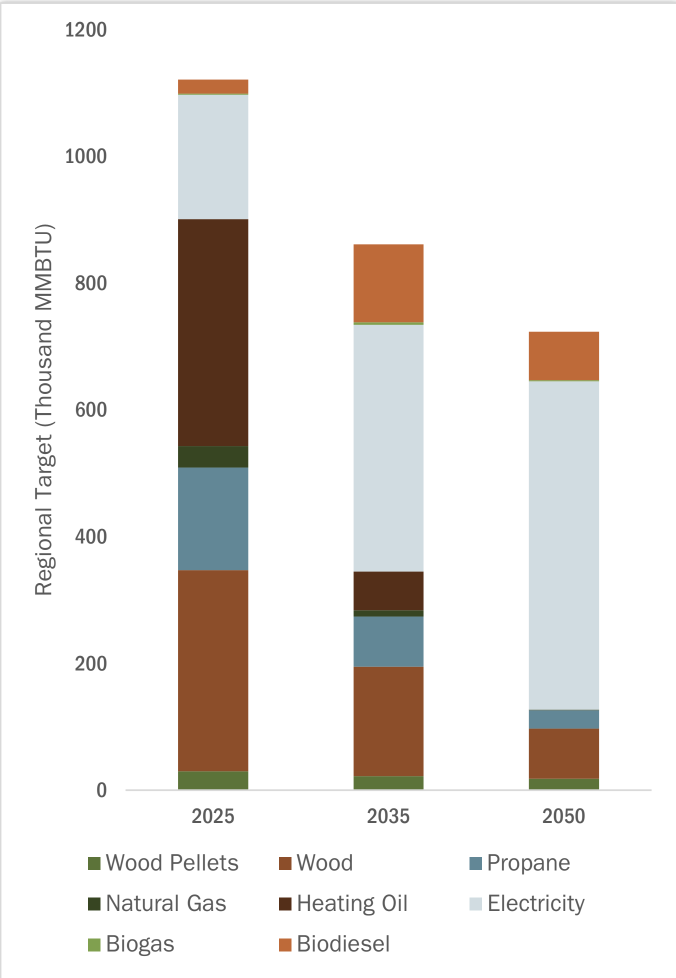
Appendix F: Target Generation Methodology

LEAP Model



Energy targets were created by the Department of Public Service using the LEAP (Long-range Energy Alternatives Planning) software to create a model of the demand for and supply of total energy usage in Vermont and the Addison Region. Full details of the LEAP Model methods, data sources and assumptions may be found as Appendix 103D to the 2022 Comprehensive Energy Plan. LEAP software is a system that allows users to create complex models of future energy use. The LEAP model does not identify specific costs that would be incurred in the future. Instead, it compares 2050 costs among various scenarios, in order to achieve the least-cost alternative to meet legislative goals. The LEAP model also includes impacts that do not result in out-of-pocket costs, such as impacts of pollution. Because of the model's complexity, it is difficult to explain comprehensively. The following scenarios provide some background on the methodology and the inputs used to create both statewide and regional models in LEAP. Appendix A presents the full model results for the Region and the state and as well as a more thorough explanation of the model assumptions and methodology. Targets for generation within the Region were developed by the Addison County Regional Planning Commission in partnership with the Department of Public Service based upon the needs projected in the LEAP model.

The model created in LEAP actually contains two scenarios. The first scenario—the reference scenario—models what we will achieve based on current trends. The second scenario is designed to achieve the goal of meeting Vermont's greenhouse gas reduction obligations under the Global Warming Solutions Act (GWSA). This scenario, called the "CAP Mitigation" scenario, is adapted from the Vermont Total Energy Study (TES) Total Renewable Energy and Efficiency Standard (TREES) local scenarios. More information regarding the TES can be found on the Department of Public Service website.

To meet the GWSA goals, total energy use will need to decline despite a growing population and economy. Electricity use will increase with the intensified use of heat pumps as primary heating sources and the use of electric vehicles. Because those choices are powered by electricity, and electricity is three to four times more efficient compared to fossil fuels, overall energy use will decrease both regionally and statewide. The difference in total energy demand between the reference scenario and the CAP Mitigation scenario is a key point. This difference represents the amount of total energy demand that will need to be eliminated to reach the State's and Region's energy goals by 2050.

This LEAP model was developed for the state Comprehensive Energy Plan and disaggregated for each regional planning commission accounting for share in population, housing units, industries, commercial floorspace, number of vehicles and presence of natural gas pipelines. More information on the LEAP modeling inputs and assumptions can be found in Appendix D of the 2022 Vermont Comprehensive Energy Plan. This disaggregated "share" represents only one of the many paths the Region may take to attain its energy goals

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and sets a mandatory aspirational target for the Region to achieve. The Regional Targets are further disaggregated to the municipal scale by the ACRPC based on consumption in each sector (transportation, electric, thermal heating). While these estimates use best available data, they should not be considered a unit-by-unit audit of energy use. Rather, they serve as a starting point for better understanding our region's current energy use patterns, the cost drivers, and what we need to do to achieve long-range energy goals

Because different fuels are measured in different units (e.g., gallons, cords, pounds, cubic feet), the results of the LEAP model can be difficult to compare. To help make comparisons between fuel types easier, the ACRPC has decided to report the scenario results in a standard unit: BTUs.

Please refer to the Department of Public Service's Act 174 Landing Page which has guidance for regions and municipalities and a host of tools used in the analyses that support this plan. This supplement provides additional, not comprehensive, methodological information so as not to duplicate that which is already laid out by the State.

Vermont's Regional Planning Commissions have been tasked with developing reasonable estimates for local consumption across the transportation, heating, and electric energy sectors While these estimates use best available data, they should not be considered a unit-by-unit audit of energy use. Rather, they serve as a starting point for better understanding our Region's current energy use patterns, the cost drivers, and what we need to do to achieve long-range energy goals. Note, estimates and targets are frequently given in British Thermal Units (BTUs) and millions of BTUs (MMBTUs) in order to allow for comparison between different energy types.

Current residential and commercial & industrial electricity usage data is provided by Efficiency Vermont (both municipal and regional totals - see supplement), transportation and thermal sector data is estimated via the Municipal Consumption Tool which pulls from a variety of sources including the Vermont Department of Public Service, American Community Survey, Vermont Department of Labor, the Vermont Department of Motor Vehicles, and DriveElectric (VEIC) (see supplement for specifics). Using the regionalized LEAP results provided by the Department of Public Service, targets are established to provide milestones for thermal efficiency; renewable energy use; and conversion of thermal and transportation energy from fossil fuel based to renewable resources. These milestones are intended to help the Region measure progress towards the overall goals and are not identified as requirements. Regional LEAP targets were disaggregated using each municipality's share of current regional energy use, municipal disaggregation factors were calculated for transportation (Light Duty Vehicles), residential thermal, commercial thermal, residential electric, and commercial electric. Targets are established for the years 2025, 2035, and 2050 which coincide with the State Comprehensive Energy Plan (update 2022). Targets include both a "business as usual" baseline and the CAP (Climate Action Plan) mitigation scenario targets. A summary of results is included below and referenced throughout this appendix. Municipal analyses and targets are available on the ACRPC website and in the supplement.

RESIDENTIAL HEATING ENERGY USE AND COST ESTIMATES

The following explains the series of steps that ACRPC has taken to calculate estimates of Residential Heating Energy use, square footage, and costs for the Addison Region. According to the Department of Public Service, residences in New England use somewhere about 45,000 to 80,000 BTUs of heat energy per square foot annually, averaging statewide at about 110 MMBTUs per residence per year for space and water heating. Space heating is by far the biggest use, and older building stock can require significantly more energy to heat.

Caveats:

- ACS data is based on random sampling over a multi-year period with large margins of error especially for rural communities like many in the Addison Region. As of the writing of this plan, it remains the most consistent and comprehensive data available on residential heating.
- ACS data identifies only one primary source of heating. In reality, many residents use two or more resources.

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Data (ACS 2022-2025 5-Year Estimates used)

a. B25117 Tenure by House Heating Fuel,
b. B25010: Average Household Size of Occupied Units by Tenure,
c. DP04 Selected Housing Characteristics,
d. Total Housing Units.
e. ACRPC downloaded the data sets referred above by town and aggregated them in excel (Tables).

House heating fuel is categorized on the ACS questionnaire as follows:

Utility Gas: This category includes gas piped underground from a central system to serve the neighborhood. The only utility in Vermont that delivers gas in this manner (i.e. natural gas) is Vermont Gas, which serves a portion of our and its service area is well outside of our Region. A small number of ACS respondents indicated that they heated with "utility gas." It is most likely that they confused this source with bottled, tank or LP gas. We therefore made adjustments to account for this error.

Bottled, Tank, or LP Gas: This category includes liquid propane gas stored in bottles or tanks that are refilled or exchanged when empty. This is the second most dominant heat source for owner- and renter-occupied homes.

Electricity: This category includes electricity that is generally supplied by means of above or underground electric power lines. Census data does not distinguish between types of electric heat (e.g. resistance vs. heat pumps). We assume that additional homes in this category since the last plan and in the future are new heat pumps and not new resistance heat.

Fuel Oil, Kerosene, etc.: This category includes fuel oil, kerosene, gasoline, alcohol, and other combustible liquids. This category (oil) is the leading source of heat in the Region overall, and for both owner- and renter-occupied homes.

Coal or coke: This category includes coal or coke that is usually distributed by truck. Some households in our Region use anthracite in stoves, furnaces, and boilers. There are very few of these, if any, still in the Region, as the margin of error suggests potential to be zero.

Wood: This category includes purchased wood, wood cut by household members on their property or elsewhere, driftwood, sawmill or construction scraps, or the like. Wood is the third largest source of heat in the Region for owner-occupied homes, much of which is likely cordwood.

Solar Energy: This category includes heat provided by sunlight that is collected, stored, and actively distributed to most of the rooms. It is difficult to anticipate what residents mean when they select this option; consequently, we combined this estimate with the "other fuel" class.

Other Fuel: This category includes all other fuels not specified elsewhere. This category very likely consists of non-fossil fuel sources, but it is difficult to make further assumptions.

COMMERCIAL ESTIMATES

A worksheet, Municipal Consumption, created by the Department of Public Service, which uses data from the Vermont Department of Labor's Economic and Labor Market Information website: http://www.vtlmi.info. The worksheet determines the municipality's share of the regional commercial building stock and applies assumptions from the Energy Information Institute's Survey of Commercial Uses. The estimate does not include industrial uses, which are highly variable.

TRANSPORTATION ESTIMATES

This data was developed using the Department of Public Service's Municipal Consumption worksheet. The total number of vehicles comes from American Community Survey (ACS) 5-Year Estimates. Average annual VMTs account for slightly longer-than-average commutes and more incidental trips in the rural and commuter parts of our region. Total vehicle miles traveled assumes an average fuel economy of 22 miles per gallon. Registered ICE (internal combustion engine) vehicles are assumed to travel 12,000 miles per year which is the mid-range of the provided estimate. Registered EVs were determined by the Vermont Energy Investment Corporation (Drive Electric) and use the low estimate provided by the Dept. of Public Service's average of 9,000 VMTs

Table 35: Municipal consumption summary disaggregation

Town	Transportation Percent of Region (MMBtu)	Thermal Residential Percent of Region	Thermal Commercial Percent of Region	Electric Commercial Percent of Region	Electric Residential Percent of Region	Total Electric
Addison	4.2%	4.3%	4.3%	3.0%	5.3%	4.1%
Bridport	3.8%	3.6%	3.6%	2.1%	4.0%	3.1%
Bristol	10.8%	10.4%	10.4%	7.2%	9.4%	8.3%
Cornwall	3.1%	3.4%	3.4%	0.4%	4.2%	2.3%
Ferrisburgh	8.5%	9.0%	9.0%	5.1%	10.3%	7.7%
Goshen	0.6%	0.6%	0.6%	0.1%	0.5%	0.3%
Leicester	3.5%	4.2%	4.2%	0.3%	3.5%	1.9%
Lincoln	4.2%	3.8%	3.8%	0.4%	3.7%	2.1%
Middlebury	16.0%	19.5%	19.5%	57.6%	15.8%	36.7%
Monkton	6.2%	5.0%	5.0%	0.5%	5.9%	3.2%
New Haven	6.1%	4.5%	4.5%	4.1%	5.2%	4.6%
Orwell	3.2%	3.5%	3.5%	1.2%	3.8%	2.5%
Panton	2.1%	1.9%	1.9%	1.0%	2.9%	2.0%
Ripton	1.7%	1.9%	1.9%	0.9%	1.7%	1.3%
Salisbury	3.6%	4.0%	4.0%	1.5%	4.0%	2.7%
Shoreham	3.9%	3.6%	3.6%	3.2%	4.0%	3.6%
Starksboro	5.9%	5.0%	5.0%	0.7%	4.9%	2.8%
Vergennes	7.4%	7.0%	7.0%	9.7%	5.5%	7.6%
Waltham	1.5%	1.2%	1.2%	0.2%	1.3%	0.8%
Weybridge	2.3%	2.1%	2.1%	0.5%	2.9%	1.7%
Whiting	1.3%	1.3%	1.3%	0.2%	1.3%	0.8%

per EV annually taking into account early trends in EV adoption including reducing trips in adverse weather and use of alternative transportation modes as well as the high percentage of our Region's population that who is retired and thus without a daily commute.

ELECTRICITY ESTIMATES

Efficiency Vermont provides an annual report with compiled data from the most recent three years, based on that provided by utilities serving the region. ACRPC has compiled all of the annual reports from EVT into a single report providing data between 2015 and 2023.

Thermal Efficiency & Fuel Switching Targets (Residential & Commercial)

Targets for thermal efficiency of residential and commercial structures are based on a methodology developed by the regional Long-range Energy Alternatives Planning (LEAP) analysis carried out by the Department of Public Service and then disaggregated using municipal share of regional energy use determined via the Municipal Consumption Tool. See the Municipal Consumption Summary (live) tab in the Municipal Consumption Tool to see how each regional target was disaggregated to the municipal scale. See **Table 35**

ELECTRICAL EFFICIENCY TARGETS

Efficiency and conservation measures are integrated into the thermal sector targets. Electricity efficiencies were embedded into the 20-year load forecast used in the updated LEAP model, thus are not an output of their own (and why the Public Service Department removed the Electric Sector tab of the updated Analysis & Targets Tool). Therefore, electric efficiency targets were provided separately in the EEU Potential Study Data Sheet and disaggregated to the regional scale using

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Resource	Acres/ MW	Capacity Factor	MWh/MW
Solar	7	15.0%	1314
Rooftop Solar	1.5	14.5%	1270
Wind	40	22.5%	1971
Large Wind	10	30.0%	2628
Natural Gas	0.343	75.0%	6570
Biomass	6.375	70.0%	6132
Hydro	1	50.0%	4380

the recommended methodology. Municipal disaggregation (Located in the Addison Region Co. Disaggregation (EVT) Dashboard tab) uses the Total Electric percentage which comes from the Municipal Consumption Tool Summary and is copied to the Information tab in the EEU Potential sheet.

FUEL SWITCHING TRANSPORTATION TARGETS

This table displays a target for switching from fossil fuel-based vehicles to EVs. This target is calculated using the Regional LEAP data and disaggregates the regional target based on the municipal share of current transportation consumption as estimated in the Municipal Consumption Sheet. The targets are cumulative.

Generation Targets

EXISTING RENEWABLE ENERGY GENERATION

Significant effort was made to aggregate the most comprehensive list of existing renewable energy generation sites possible for the region. The Department of Public Service periodically provides an updated Distributed Generation Inventory which includes projects that have been submitted to the Public Utility Commission and are less than <5MW. Unfortunately, crowd-sourced Energy Atlas that is unfortunately 7+ years out of date. Data from the most recent data set provided in the dashboard were cross referenced with the DG data provided by the PSD.

Capacity Factor is the ratio of actual electrical energy output over a given period of time to the theoretical maximum over that same period (the theoretical maximum energy output of a given installation being continuous operation at full nameplate capacity over the relevant time period).

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 7 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) * (0.15 capacity factor).

ROOFTOP SOLAR ENERGY POTENTIAL

Rooftop solar potential data is sourced from the Vermont Center for Geographic Information (VCGI) dataset named Town Rooftop Solar Potential – Act 174 2022. As explained in the release notes, these estimates use a geographic information system (GIS) model of building footprints to determine the total surface area of rooftops suitable for solar photovoltaic panels (accounting for amount of solar radiation, slope, aspect, shading of nearby objects, and minimum size of rooftop viable for solar panels). Using published data for solar radiation, the VCGI data also estimates an annual solar energy production potential for each suitable rooftop, summarized by municipality, applying a capacity factor of 13.76% as published by the U.S. Environmental Protection Agency. The total system capacity in megawatts is then estimated using the formula below. Rooftop MW of capacity = (number of annual MW) * ((0.145 capacity factor) * (8760 hours per year)). This was further curtailed by ACRPC to provide a conservative estimate as roof and condition could not be integrated at this point in analyses.

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

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estimate the amount of production using the formula below. Wind MWh of energy = (number of MW) * (8760 hours per year) * (0.225 capacity factor).

CALCULATING RENEWABLE ENERGY GENERATION TARGETS

Municipalization is based on a weighted average of the following factors agreed upon by ACRPC energy committee: Land Area: 20%, Existing Generation: 10%, Demand: 50%, Population: 20%. The target selected was the maximum available of 25% In-State Generation. All data used and targets generated can be found in the ACRPC Generation Scenarios Tool.

STATE KNOWN AND POSSIBLE CONSTRAINT DEFINITIONS AND DESCRIPTIONS

The following is a list of the known, possible, and regional constraints that were used and referenced in the mapping section of this document. A definition of the constraint including source of the data is provided. As discussed in the report, RPCs supported a coordinated effort by the Department of Public Service, VCGI, and ANR to aggregate these layers which are now available via the Act 174 tab of the DHCD Planning Atlas.

KNOWN CONSTRAINTS

Vernal Pools (confirmed and unconfirmed layers)

Source: Vermont Fish and Wildlife, 2009 - present Vernal pools are temporary pools of water that provide habitat for distinctive plants and animals. Data was collected remotely using color infrared aerial photo interpretation. “Potential” vernal pools were mapped and available for the purpose of confirming whether vernal pool habitat was present through site visits. This layer represents both those sites which have not yet been field-visited or verified as vernal pools, and those that have.

Department of Environmental Conservation (DEC) River Corridors

Source: DEC Watershed Management District Rivers Program, January 2015 River corridors are delineated to provide for the least erosive meandering and floodplain geometry toward which a river will evolve over time. River corridor maps guide State actions to protect, restore and maintain naturally stable meanders and riparian areas to minimize erosion hazards. Land within and immediately abutting a river corridor may be at higher risk to fluvial erosion during floods. River corridors encompass an area around and adjacent to the present channel where fluvial erosion, channel evolution and down-valley meander migration are most likely to occur. River corridor widths are calculated to represent the narrowest band of valley bottom and riparian land necessary to accommodate the least erosive channel and floodplain geometry that would be created and maintained naturally within a given valley setting.

Federal Emergency Management Agency (FEMA) Floodways

Source: FEMA Floodway included in Zones AE – FEMA Map Service Center These are areas subject to inundation by the 1-percent-annual-chance flood event determined by detailed methods. A “Regulatory Floodway” means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.

State-significant Natural Communities and Rare, Threatened, and Endangered Species

Source: Vermont Fish and Wildlife, National Heritage Inventory. The Vermont Fish and Wildlife Department’s Natural Heritage Inventory (NHI) maintain a database of rare, threatened and endangered species and natural (plant) communities in Vermont. The Element Occurrence (EO) records that form the core of the Natural Heritage Inventory database include information on the location, status, characteristics, numbers, condition, and distribution of elements of biological diversity using established Natural Heritage Methodology developed by NatureServe and The Nature Conservancy. An Element Occurrence (EO) is an area of land and/or water in which a species or natural community is, or was, present. An EO should have practical conservation value for the Element as evidenced by potential (or historical) presence and/or regular recurrence at a given location. For species Elements, the EO often corresponds with the local population, but when appropriate may be a portion of a population or a group of nearby populations (e.g., metapopulation).

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National Wilderness Areas

Source: United States Department of Agriculture Forest Service. A parcel of Forest Service land congressionally designated as wilderness. Class 1 and Class 2.

WETLANDS

Source: Vermont Significant Wetland Inventory (VSWI) and advisory layers The State of Vermont protects wetlands which provide significant functions and values and also protects a buffer zone directly adjacent to significant wetlands. Wetlands in Vermont are classified as Class I, II, or III based on the significance of the functions and values they provide. Class I and Class II wetlands provide significant functions and values and are protected by the Vermont Wetland Rules. Any activity within a Class I or II wetland or buffer zone which is not exempt or considered an "allowed use" under the Vermont Wetland Rules requires a permit. Class I wetlands have been determined to be, based on their functions and values, exceptional or irreplaceable in its contribution to Vermont's natural heritage and, therefore, merits the highest level of protection. All wetlands contiguous to wetlands shown on the VSWI maps are presumed to be Class II wetlands, unless identified as Class I or III wetlands, or unless determined otherwise by the Secretary or Panel pursuant to Section 8 of the Vermont Wetland Rules.

POSSIBLE CONSTRAINTS

Agricultural Soils

Source: Natural Resources Conservation Service (NRCS) "Primary agricultural soils" are defined as "soil map units with the best combination of physical and chemical characteristics that have a potential for growing food, feed, and forage crops, have sufficient moisture and drainage, plant nutrients or responsiveness to fertilizers, few limitations for cultivation or limitations which may be easily overcome, and an average slope that does not exceed 15 percent. Present uses may be cropland, pasture, regenerating forests, forestland, or other agricultural or silvicultural uses. The soils must be of a size and location, relative to adjoining land uses, so that those soils will be capable, following removal of any identified limitations, of supporting or contributing to an economic or commercial agricultural operation. Unless contradicted by the qualifications stated above, primary agricultural soils include important farmland soils map units with a rating of prime, statewide, or local importance as defined by the Natural Resources Conservation Service of the United States Department of Agriculture.

FEMA Special Flood Hazard Areas

The land area covered by the floodwaters of the base flood is the Special Flood Hazard Area (SFHA) on National Flood Insurance Program (NFIP) maps. The SFHA is the area where the NFIP's floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies.

Protected Lands

State fee land and private conservation lands are considered protected lands. Other state level, nonprofit and regional entities also contribute to this dataset. The Vermont Protected Lands Database is based on an updated version of the original Protected Lands Coding Scheme reflecting decisions made by the Protected Lands Database Work Group to plan for a sustainable update process for this important geospatial data layer.

Act 250 Ag Mitigation Parcels

Source: Vermont Department of Agriculture All projects reducing the potential of primary agricultural soils on a project tract are required to provide "suitable mitigation," either "onsite or offsite," which is dependent on the location of the project. This constraint layer includes all parcels in the Act 250 Ag Mitigation Program as of 2006.

Deer Wintering Areas (DWA)

Source: Vermont Department of Fish and Wildlife Deer winter habitat is critical to the long-term survival of white-tailed deer (Odocoileus virginianus) in Vermont. Being near the northern extreme of the white-tailed deer's range, functional winter habitats are essential to maintain stable populations of deer in many years when and where yarding conditions occur. Consequently, deer wintering areas are considered under Act 250 and other local, state, and federal regulations that require the protection of important wildlife habitats. DWAs are generally characterized by rather dense softwood (conifer) cover, such as hemlock, balsam fir, red spruce, or white pine. Occasionally DWAs are found in mixed forest with a strong softwood component or even on found west facing hardwood slopes in conjunction with softwood cover. The DWA were mapped on mylar overlays on topographic maps and based on small scale aerial photos.

Vermont Conservation Design include the following Highest Priority Forest Blocks:

- **Connectivity, Interior, and Physical Landscape Diversity**
  - **Source:** Vermont Department of Fish and Wildlife The lands and waters identified in this constraint are the areas of the state that are of highest priority for maintaining ecological integrity. Together, these lands comprise a connected landscape of large and intact forested habitat, healthy aquatic and riparian systems, and a full range of physical features (bedrock, soils, elevation, slope, and aspect) on which plant and animal natural communities depend.
- **Hydric Soils**

o Source: Natural Resources Conservation Service A hydric soil is a soil that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part. This constraint layer includes soils that have hydric named components in the map unit.

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