Regional LEAP Targets

These are the original targets provided to CVRPC by the Department of Public Service; these were disaggregated from the State targets based on the table below.

Overview - LEAP Regionalization for Regional Planning Commission Enhanced Energy Planning

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 workbook includes a simple disaggregation of those results for each of the regions based on key drivers of energy demand. This has been done for:

1. The **Baseline** (business-as-usual) scenario developed to estimate Vermont/regional energy demand under normal policy and programmatic conditions and
2. The **Central GWSA Mitigation ("CAP Mitigation")** scenario developed to meet the state's GHG reduction requirements.

Share of Statewide:	CVRPC	Source	Used for:
Population	10.2%	Generation Scenario Tool (for consistency)	Share of non-road transportation. Note: All transportation related natural gas demand was allocated to CCRPC
Housing Units	11.1%	Data submitted via RPCs in data template - almost all from the American Community Survey	Residential non-natural gas energy demand & technology adoption (total and thermal energy use, new CCHPs)
Commercial Floorspace	11.2%	Data submitted via RPCs in data template - almost all used SQ FT / Employee * Number of Employees Method; SQFT/Employee from Jim Sullivan (BCRC), Number of Employees from VDOL and/or Census	Commercial non-natural gas energy demand & technology adoption (total consumption, new CCHPs)
Passenger Cars	10.0%	DMV Registration Database	On-Road Transportation Energy Use (Passenger Car, Light Trucks, Medium and Heavy Duty). Note: All transportation related natural gas demand was allocated to
Light Trucks	10.5%		
Medium Duty	9.4%		

Medium Duty Vehicles	9.4%		Note: All transportation related natural gas demand was allocated to CCRP
Heavy Duty Vehicles	9.8%		
NAICS Codes	8.9%	Census Data on NAICS Manufacturing Codes (31-33)	Industrial Data
Natural Gas - Residential	0.0%	VGS Historical Usage Data	Residential, Commercial, and Industrial Sector Natural Gas Usage
Natural Gas - Commercial	0.0%		
Natural Gas - Industrial	0.0%		

Resources

Full details of the LEAP Model methods, data sources and assumptions may be found as **Appendix D to the 2022 Comprehensive Energy Plan**: https://publicservice.vermont.gov/content/2022-cep-analysis-greenhouse-gas-emission-reduction-pathways-vermont

Appendix E to the Comprehensive Energy Plan also provides a summary of the report in Appendix D in slide format, although please note that some assumptions in the modelling were revised following the issuing the of the Comprehensive Energy Plan: https://publicservice.vermont.gov/sites/dps/files/documents/CEP_AppendixE_LEAPModelingSlides.pdf

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 publised (see Table 1 pg 1): https://climatechange.vermont.gov/sites/climatecouncilsandbox/files/2022-03/Pathways%20Analysis%20Report_Version%202.0.pdf

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. Additional methods and municipal breakouts can be found on CVRPC's website as municipal breakouts are published throughout the Spring of 2024.

ADD MUNICIPAL DISAGGREGATION TABLE!

(add to residential weatherization target These target percentages are lower than those targets include in the 2018 Enhanced Energy Plan because instead of using the historical 5year housing unit % increase rate, CVRPC used the midpoint between the 2015-2020 rate (+1.8%) and the almost 12% rate associated with our housing needs assessment including in this regional plan update. Thus a 7% increase of housing units was used when converting the LEAP targets into target percentages.)

Baseline Total Regional **Residential** Sector Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	797	636	691	725	743	758
Wood	910	872	752	685	657	635
Propane	699	619	580	558	552	552
Wood Pellets	225	76	66	61	59	58
Biodiesel	-	-	-	-	-	-
Heating Oil	1,214	1,115	982	906	874	848
Biogas	-	-	-	-	-	-
Natural Gas	-	-	-	-	-	-
Total	**3,845**	**3,318**	**3,071**	**2,935**	**2,885**	**2,852**

CAP Mitigation Total Regional **Residential** Sector Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	797	719	837	955	1,071	1,114
Wood	910	733	535	400	286	182
Propane	699	520	378	248	125	93
Wood Pellets	225	69	57	50	45	42
Biodiesel	-	55	251	336	321	254
Heating Oil	1,214	898	453	165	-	-
Biogas	-	-	-	-	-	-
Natural Gas	-	-	-	-	-	-
Total	**3,845**	**2,994**	**2,511**	**2,154**	**1,849**	**1,683**

Baseline Regional **Residential** Thermal Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	120	184	236	269	284	293
HP	1	70	125	155	169	175
HPWH	2	2	2	2	2	2
Electric Resistance	40	34	30	27	26	26
Wood	910	872	752	685	657	635
Propane	475	442	402	380	373	372
Wood Pellets	225	76	66	61	59	58
Biodiesel	-	-	-	-	-	-
Heating Oil	1,140	1,040	906	830	797	771
Biogas	-	-	-	-	-	-
Natural Gas	-	-	-	-	-	-
Total	**2,870**	**2,614**	**2,363**	**2,224**	**2,170**	**2,129**

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

Baseline Regional **Residential** New Cold Climate Heat Pumps						
Technology	**2020**	**2025**	**2030**	**2035**	**2040**	**2050**
ASHP 2 Head	397	1,200	2,278	2,911	3,218	3,381
ASHP Central	607	1,835	3,483	4,451	4,919	5,169
ASHP HE	583	1,763	3,346	4,275	4,725	4,964
GSHP HE	72	218	414	528	584	614
Total	**1,658**	**5,017**	**9,521**	**12,166**	**13,446**	**14,127**

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

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

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

Baseline Total Regional **Commercial** Sector Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	771	749	756	759	755	747
Gasoline	74	83	85	87	88	92
Kerosene	1	1	1	1	1	1
Wood	184	194	206	219	230	262
Ethanol	5	6	6	6	6	6
Solar	19	50	51	52	53	55
Heat	-	-	-	-	-	-
Propane	472	329	320	316	330	346
Residual Fuel Oil	12	5	5	5	5	5
Wood Pellets	-	-	-	-	-	-
Biodiesel	-	-	-	-	-	-
Heating Oil	535	309	268	233	203	161
Biogas	-	-	-	-	-	-
Natural Gas	-	-	-	-	-	-
Total	**2,073**	**1,723**	**1,697**	**1,677**	**1,672**	**1,675**

CAP Mitigation Total Regional **Commercial** Sector Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	771	816	890	963	1,007	995
Gasoline	74	83	85	87	88	92
Kerosene	1	1	0	0	-	-
Wood	184	194	206	219	230	262
Ethanol	5	6	6	6	6	6
Solar	19	50	51	52	53	55
Heat	-	-	38	57	96	96
Propane	472	258	164	74	4	2
Residual Fuel Oil	12	5	5	5	5	5
Wood Pellets	-	10	20	30	39	46
Biodiesel	-	16	74	111	150	156
Heating Oil	535	256	133	55	-	-
Biogas	-	-	-	-	-	-
Natural Gas	-	-	-	-	-	-
Total	**2,073**	**1,693**	**1,673**	**1,659**	**1,679**	**1,716**

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

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

Baseline Total Regional **Industrial** Sector Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	432	420	408	392	397	416
Natural Gas	-	-	-	-	-	-
Gasoline	43	41	42	42	43	45
Kerosene	1	2	2	2	2	2
Diesel	267	295	287	285	286	290
LPG	26	26	25	25	25	24
Wood	32	18	18	18	19	20
Biogas	-	-	-	-	-	-
Ethanol	3	3	3	4	4	4
Lubricants	15	11	11	11	11	12
Biodiesel	-	19	25	25	25	22
Residual Fuel Oil	15	9	9	10	10	10
Wood Waste Solids	8	1	2	2	2	2
Asphalt and Road Oil	411	301	307	313	319	332
Total	**1,253**	**1,146**	**1,139**	**1,129**	**1,143**	**1,179**

CAP Mitigation Total Regional **Industrial** Sector Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	432	420	408	392	397	416
Natural Gas	-	-	-	-	-	-
Gasoline	43	41	41	41	42	44
Kerosene	1	2	2	2	2	2
Diesel	267	212	143	72	-	-
LPG	26	26	25	25	25	24
Wood	32	18	18	18	19	20
Biogas	-	-	-	-	-	-
Ethanol	3	4	4	5	5	5
Lubricants	15	11	11	11	11	12
Biodiesel	-	102	169	238	312	312
Residual Fuel Oil	15	9	9	10	10	10
Wood Waste Solids	8	1	2	2	2	2
Asphalt and Road Oil	411	301	307	313	319	332
Total	**1,253**	**1,146**	**1,139**	**1,129**	**1,143**	**1,179**

Baseline Total Regional **Passenger Car** Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	1	15	28	60	116	228
Gasoline	1,059	782	704	634	545	376
Diesel	8	3	2	1	1	1
Ethanol	72	60	56	52	46	34
CNG	-	-	-	-	-	-
Biodiesel	0	0	0	0	0	0
Total	**1,139**	**861**	**790**	**748**	**708**	**639**

CAP Mitigation Total Regional **Passenger Car** Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	1	19	73	168	257	347
Gasoline	1,059	751	575	365	196	48
Diesel	8	3	2	1	1	0
Ethanol	72	64	55	38	23	5
CNG	-	-	-	-	-	-
Biodiesel	0	0	0	0	0	0
Total	**1,139**	**838**	**705**	**572**	**477**	**400**

Baseline Regional **Passenger Car EV and PHEV Stock** (Number of Vehicles)						
Vehicle Type	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Battery Electric	22	797	1,717	3,688	7,073	14,681
Plug In Hybrid	55	215	244	368	602	1,106
Total	**77**	**1,012**	**1,961**	**4,056**	**7,675**	**15,788**

CAP Mitigation Regional **Passenger Car EV and PHEV Stock** (Number of Vehicles)						
Vehicle Type	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Battery Electric	22	1,093	4,719	11,272	17,892	26,546
Plug In Hybrid	55	208	195	160	101	36
Total	**77**	**1,301**	**4,913**	**11,431**	**17,994**	**26,582**

Baseline Total Regional **Light Truck** Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	0	5	10	22	48	112
Natural Gas	-	-	-	-	-	-
Gasoline	2,306	2,066	1,820	1,625	1,442	1,192
Diesel	44	42	45	46	43	38
Ethanol	158	160	146	134	123	108
CNG	-	-	-	-	-	-
Biodiesel	1	3	4	4	4	3
Total	**2,509**	**2,275**	**2,024**	**1,832**	**1,660**	**1,453**

CAP Mitigation Total Regional **Light Truck** Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	0	25	138	313	455	552
Natural Gas	-	-	-	-	-	-
Gasoline	2,306	1,965	1,453	892	456	119
Diesel	44	38	32	22	10	3
Ethanol	158	169	139	94	53	14
CNG	1	0	0	0	0	0
Biodiesel	1	3	3	3	2	1
Total	**2,510**	**2,200**	**1,766**	**1,324**	**975**	**688**

Baseline Regional **Light Duty Truck EV and PHEV Stock** (Number of Vehicles)						
Vehicle Type	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Battery Electric	3	173	375	870	1,937	4,871
Plug In Hybrid	33	128	260	527	1,021	2,413
Total	**36**	**301**	**635**	**1,397**	**2,959**	**7,284**

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

Baseline Total Regional **Medium Duty** Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	-	0	0	1	1	1
Natural Gas	-	-	-	-	-	-
Gasoline	111	213	239	268	301	350
Diesel	168	278	302	325	347	379
LPG	1	3	4	5	6	8
Ethanol	8	17	19	22	26	32
Biodiesel	6	18	26	28	31	28
Total	**294**	**528**	**591**	**649**	**711**	**798**

CAP Mitigation Regional **Medium Duty** Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	-	26	101	217	330	463
Natural Gas	-	-	-	-	-	-
Gasoline	111	193	172	128	86	34
Diesel	168	249	210	142	82	28
LPG	1	3	3	2	1	0
Ethanol	8	17	17	14	10	4
Biodiesel	6	18	21	18	13	7
Total	**294**	**505**	**524**	**521**	**523**	**536**

Baseline Regional **Heavy Duty** Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	-	0	0	0	0	0
Natural Gas	-	-	-	-	-	-
Gasoline	0	0	0	0	0	0
Diesel	718	370	269	215	191	163
Ethanol	0	0	0	0	0	0
Biodiesel	24	24	23	19	17	12
Total	**742**	**394**	**292**	**233**	**208**	**176**

CAP Mitigation Regional **Heavy Duty** Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	-	12	47	99	145	181
Natural Gas	-	-	-	-	-	-
Gasoline	0	0	0	0	0	0
Diesel	718	347	210	111	57	12
Ethanol	0	0	0	0	0	0
Biodiesel	24	25	21	14	9	3
Total	**742**	**384**	**278**	**225**	**211**	**195**

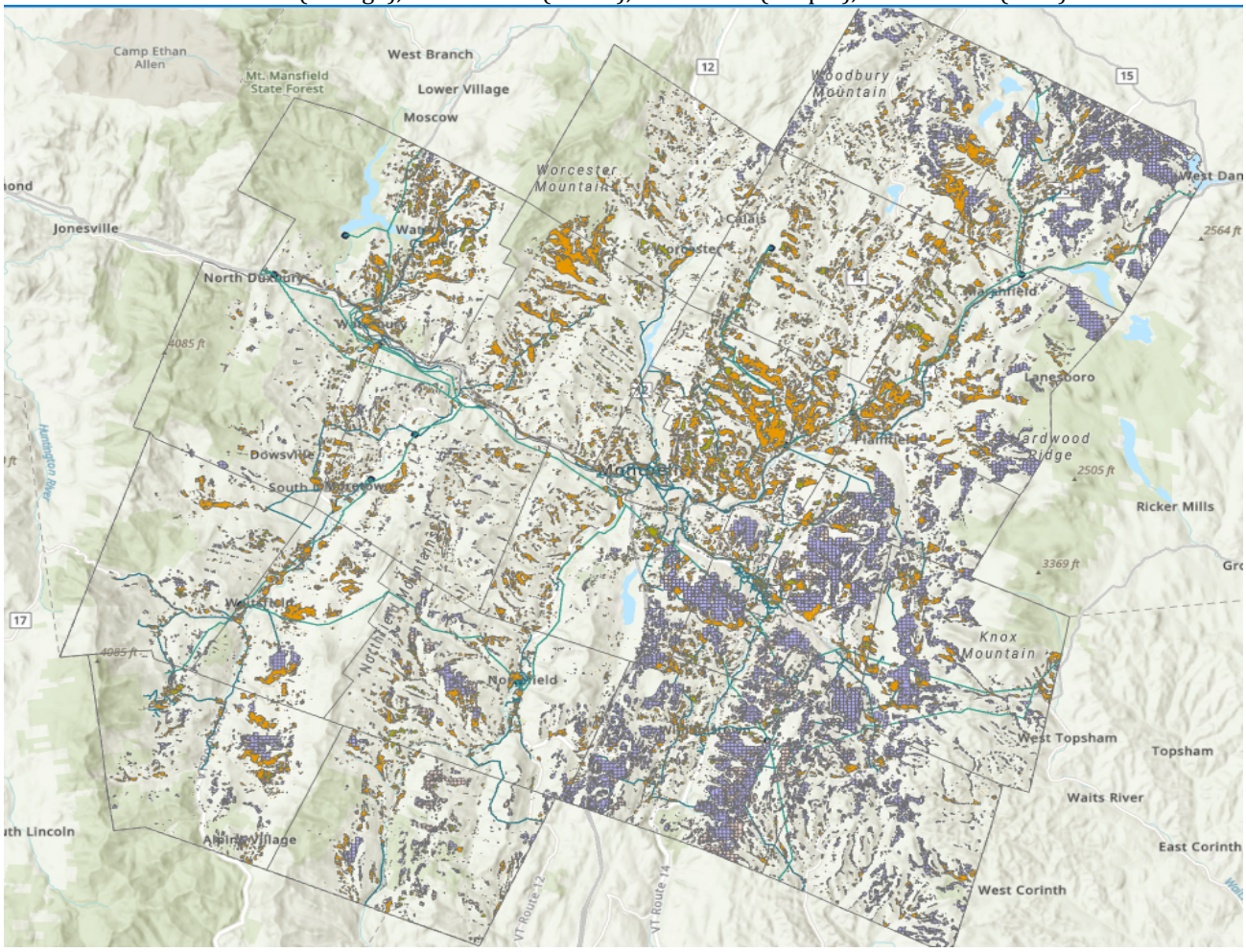
Baseline Regional **Non-Road** Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Diesel	114	108	109	109	110	111
Biodiesel	4	7	9	10	10	8
Avgas	4	5	5	5	5	5
Jet Kerosene	148	148	149	150	151	152
Sustainable Aviation Fuel	-	-	-	-	-	-
Gasoline	40	36	37	37	37	37
Ethanol	3	3	3	3	3	4
Lubricants	31	24	24	24	25	25
Natural Gas	-	-	-	-	-	-
Total	**344**	**332**	**336**	**338**	**340**	**342**

CAP Mitigation Regional **Non-Road** Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Diesel	114	108	109	109	110	111
Biodiesel	4	8	11	14	18	26
Avgas	4	5	5	5	5	5
Jet Kerosene	148	146	134	122	110	86
Sustainable Aviation Fuel	-	2	15	28	40	66
Gasoline	40	36	37	37	37	37
Ethanol	3	3	4	4	4	4
Lubricants	31	24	24	24	25	25
Natural Gas	-	-	-	-	-	-
Total	**344**	**333**	**338**	**343**	**349**	**360**

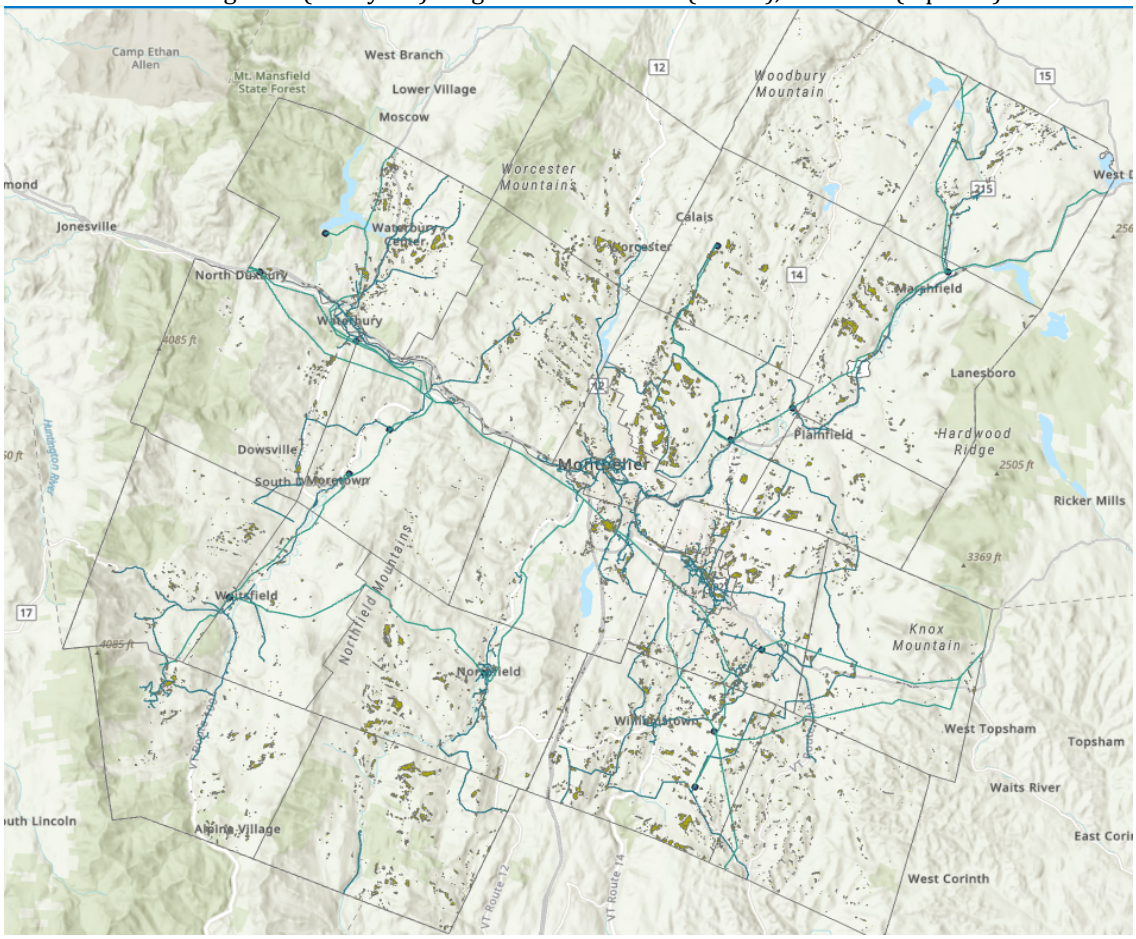
Baseline Regional **Greenhouse Gas Emissions** (Thousand Metric Tonnes CO2e)						
Sector	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Transportation	356	308	281	262	244	216
Residential	138	125	112	105	102	100
Commercial	77	51	48	45	44	43
Industrial	27	28	28	27	28	28
Electricity	28	29	22	19	28	51
Total	626	540	491	458	446	437

CAP Mitigation Regional **Greenhouse Gas Emissions** (Thousand Metric Tonnes CO2e)						
Sector	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Transportation	356	292	224	148	88	37
Residential	138	102	60	30	10	7
Commercial	77	43	28	17	9	9
Industrial	27	22	17	12	6	7
Electricity	28	31	39	48	34	10
Total	626	490	368	255	147	70

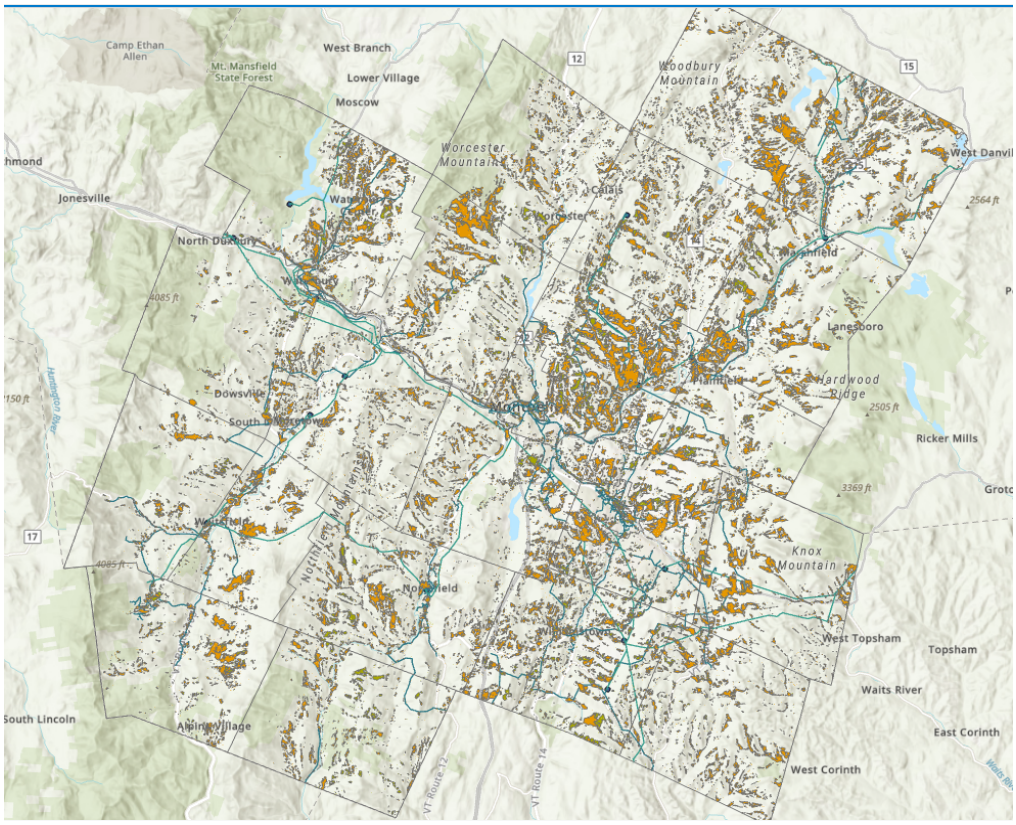
Draft Figure 3 (no layout): Regional Solar and Wind Resource Potential Aggregate Regional Land Base Solar (Orange), Prime Solar (Green), Base Wind (Purple), Prime Wind (Pink)



Draft Figure 4 (no layout): Regional Prime Solar (Green), teal lines (3 phase)



Draft Figure 5 (no layout); Base Solar (Orange); teal lines (3 phase)



Municipal Rooftop potential has also been mapped and will be available online Spring 2024 both in a viewer at the regional scale and in draft maps for each municipality. In the interim rooftop potential can be viewed in the Act 174 tab of the DHDC Planning Atlas, and a webinar walking through recommended ways to use it is available on the webinar and workshops page of the CVRPC webpage.

Draft Figure 6(no layout) Existing and Potential Hydroelectric Facilities
black triangles existing hydroelectric; empty triangles potential according to early 2000s state study/report)