Windham Regional Plan
Energy Chapter: Appendix A
Regional LEAP Targets

Below are the original targets provided by the Department of Public Service for the region serviced by WRC. These regional targets were disaggregated from the State targets based on the assumptions in 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.

Categories	WRC Share of Statewide Total	Source	Used for:
Population	7.5%	Generation Scenario Tool (for consistency)	Share of non-road transportation. Note: All transportation related natural gas demand was allocated to CCRPC
Housing Units	6.4%	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	15.9%	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	7.5%	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 CCRPC
Light Trucks	7.7%		
Medium Duty Vehicles	9.5%		
Heavy Duty Vehicles	8.6%		
NAICS Codes	7.3%	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.

Summary slides on the LEAP Modeling Report can be found as Appendix E to the 2022 Comprehensive Energy Plan . Please note that some assumptions in the modelling were revised following the issuing the of the Comprehensive Energy Plan.

The Vermont Pathways Report, prepared for the Agency of Natural Resources, also provides information on the analysis done using the model, including some of the revisions made after the CEP was published (see Table 1 pg 1).

WRC Region LEAP Targets

Key:

- Residential Energy Demand by Fuel
- Commercial Energy Demand by Fuel
- Industrial Energy Demand by Fuel
- Transportation: Vehicle Energy Demand by Fuel
- Gross GHG Emissions for Each Sector

Totals Row

- Gray — Baseline
- Table Color — CAP Total

Baseline Total Regional **Residential** Sector Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	460	367	399	419	429	438
Wood	525	503	434	395	379	367
Propane	403	358	335	322	319	319
Wood Pellets	130	44	38	35	34	34
Biodiesel	-	-	-	-	-	-
Heating Oil	701	644	567	523	504	490
Biogas	-	-	-	-	-	-
Natural Gas	-	-	-	-	-	-
Total	**2,219**	**1,915**	**1,772**	**1,694**	**1,665**	**1,646**

CAP Mitigation Total Regional **Residential** Sector Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	460	415	483	551	618	643
Wood	525	423	309	231	165	105
Propane	403	300	218	143	72	53
Wood Pellets	130	40	33	29	26	24
Biodiesel	-	32	145	194	186	146
Heating Oil	701	518	262	95	-	-
Biogas	-	-	-	-	-	-
Natural Gas	-	-	-	-	-	-
Total	**2,219**	**1,728**	**1,450**	**1,243**	**1,067**	**972**

Baseline Regional **Residential** Thermal Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	69	106	136	155	164	169
HP	1	41	72	89	98	101
HPWH	1	1	1	1	1	1
Electric Resistance	23	20	17	16	15	15
Wood	525	503	434	395	379	367
Propane	274	255	232	219	215	215
Wood Pellets	130	44	38	35	34	34
Biodiesel	-	-	-	-	-	-
Heating Oil	658	600	523	479	460	445
Biogas	-	-	-	-	-	-
Natural Gas	-	-	-	-	-	-
Total	**1,657**	**1,509**	**1,364**	**1,284**	**1,253**	**1,229**

CAP Mitigation Regional **Residential** Thermal Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	69	152	217	281	343	365
HP	*1*	*79*	*133*	*186*	*239*	*261*
HPWH	*1*	*13*	*28*	*44*	*59*	*60*
Electric Resistance	*23*	*17*	*12*	*8*	*5*	*4*
Wood	525	423	309	231	165	105
Propane	274	217	157	106	58	39
Wood Pellets	130	40	33	29	26	24
Biodiesel	-	29	129	164	141	102
Heating Oil	658	478	233	81	-	-
Biogas	-	-	-	-	-	-
Natural Gas	-	-	-	-	-	-
Total	**1,657**	**1,338**	**1,079**	**891**	**734**	**635**

Baseline Regional **Residential** New Cold Climate Heat Pumps						
Technology	**2020**	**2025**	**2030**	**2035**	**2040**	**2050**
ASHP 2 Head	229	693	1,315	1,680	1,857	1,951
ASHP Central	350	1,059	2,011	2,569	2,840	2,983
ASHP HE	336	1,018	1,931	2,468	2,727	2,865
GSHP HE	42	126	239	305	337	354
Total	**957**	**2,896**	**5,495**	**7,022**	**7,761**	**8,154**

CAP Mitigation Regional **Residential** New Cold Climate Heat Pumps						
Technology	**2020**	**2025**	**2030**	**2035**	**2040**	**2050**
ASHP 2 Head	244	1,471	2,705	3,946	5,192	5,825
ASHP Central	380	2,288	4,220	6,179	8,170	9,078
ASHP HE	359	2,161	3,972	5,794	7,625	8,555
GSHP HE	44	267	491	716	942	1,057
Total	**1,027**	**6,187**	**11,388**	**16,635**	**21,929**	**24,515**

Regional **Residential** New Retrofits (Number of Housing Units)						
Scenario	**2020**	**2025**	**2030**	**2035**	**2040**	**2050**
Baseline Scenario	796	1,643	2,427	3,172	3,944	5,575
CAP Mitigation	1,271	4,478	7,685	9,678	11,671	15,656

Regional **Residential** New Heat Pump Water Heaters (Number of Units)						
Scenario	**2020**	**2025**	**2030**	**2035**	**2040**	**2050**
Baseline Scenario	279	329	331	334	335	342
CAP Mitigation	279	4,067	8,781	13,544	18,360	18,583

Baseline Total Regional **Commercial** Sector Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	1,093	1,061	1,072	1,075	1,070	1,058
Gasoline	106	117	120	123	125	130
Kerosene	2	1	1	1	1	1
Wood	261	274	292	310	326	371
Ethanol	7	8	8	8	9	9
Solar	27	70	72	74	76	78
Heat	-	-	-	-	-	-
Propane	669	466	453	448	467	491
Residual Fuel	17	7	7	7	7	7
Wood Pellets	-	-	-	-	-	-
Biodiesel	-	-	-	-	-	-
Heating Oil	758	437	380	330	288	228
Biogas	-	-	-	-	-	-
Natural Gas	-	-	-	-	-	-
Total	**2,938**	**2,443**	**2,406**	**2,377**	**2,370**	**2,375**

CAP Mitigation Total Regional **Commercial** Sector Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	1,093	1,157	1,262	1,365	1,428	1,411
Gasoline	106	117	120	123	125	130
Kerosene	2	1	1	0	-	-
Wood	261	274	292	310	326	371
Ethanol	7	8	8	8	9	9
Solar	27	70	72	74	76	78
Heat	-	-	54	81	135	135
Propane	669	366	233	105	6	2
Residual Fuel	17	7	7	7	7	7
Wood Pellets	-	14	29	42	55	66
Biodiesel	-	22	105	158	213	222
Heating Oil	758	364	189	78	-	-
Biogas	-	-	-	-	-	-
Natural Gas	-	-	-	-	-	-
Total	**2,938**	**2,400**	**2,371**	**2,352**	**2,380**	**2,432**

Baseline Regional **Commercial** New Cold Climate Heat Pumps						
	2020	**2025**	**2030**	**2035**	**2040**	**2050**
New CCHP	448	1,361	2,590	3,306	3,656	3,841

CAP Mitigation Regional **Commercial** New Cold Climate Heat Pumps						
	2020	**2025**	**2030**	**2035**	**2040**	**2050**
New CCHP	448	8,052	16,011	24,352	29,930	31,144

Baseline Total Regional **Industrial** Sector Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	355	345	335	322	326	342
Natural Gas	-	-	-	-	-	-
Gasoline	35	34	34	35	36	37
Kerosene	1	1	2	2	2	2
Diesel	219	242	236	234	235	238
LPG	21	21	21	20	20	20
Wood	26	14	15	15	15	16
Biogas	-	-	-	-	-	-
Ethanol	2	3	3	3	3	4
Lubricants	12	9	9	9	9	10
Biodiesel	-	16	20	20	21	18
Residual Fuel Oil	12	8	8	8	8	8
Wood Waste Solids	6	1	1	1	1	1
Asphalt and Road Oil	337	247	252	257	262	273
Total	**1,029**	**941**	**935**	**927**	**939**	**968**

CAP Mitigation Total Regional **Industrial** Sector Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	355	345	335	322	326	342
Natural Gas	-	-	-	-	-	-
Gasoline	35	33	34	34	35	36
Kerosene	1	1	2	2	2	2
Diesel	219	174	117	59	-	-
LPG	21	21	21	20	20	20
Wood	26	14	15	15	15	16
Biogas	-	-	-	-	-	-
Ethanol	2	3	3	4	4	4
Lubricants	12	9	9	9	9	10
Biodiesel	-	84	139	195	256	256
Residual Fuel Oil	12	8	8	8	8	8
Wood Waste Solids	6	1	1	1	1	1
Asphalt and Road Oil	337	247	252	257	262	273
Total	**1,029**	**941**	**935**	**927**	**939**	**968**

Baseline Total Regional **Passenger Car** Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	1	11	21	45	86	170
Gasoline	789	583	525	473	406	280
Diesel	6	3	1	1	1	1
Ethanol	53	45	42	39	35	25
CNG	-	-	-	-	-	-
Biodiesel	0	0	0	0	0	0
Total	**849**	**642**	**589**	**558**	**528**	**476**

CAP Mitigation Total Regional **Passenger Car** Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	1	14	55	125	192	259
Gasoline	789	560	429	272	146	35
Diesel	6	2	1	1	0	0
Ethanol	53	48	41	29	17	4
CNG	-	-	-	-	-	-
Biodiesel	0	0	0	0	0	0
Total	**849**	**625**	**525**	**427**	**355**	**298**

Baseline Total Regional **Light Truck** Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	0	3	7	16	35	82
Natural Gas	-	-	-	-	-	-
Gasoline	1,681	1,506	1,327	1,185	1,051	869
Diesel	32	31	33	34	31	28
Ethanol	115	117	106	98	90	79
CNG	-	-	-	-	-	-
Biodiesel	1	2	3	3	3	2
Total	**1,829**	**1,659**	**1,476**	**1,336**	**1,210**	**1,059**

CAP Mitigation Total Regional **Light Truck** Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	0	19	101	228	331	403
Natural Gas	-	-	-	-	-	-
Gasoline	1,681	1,433	1,060	650	332	87
Diesel	32	28	23	16	7	2
Ethanol	115	123	101	69	39	10
CNG	1	0	0	0	0	0
Biodiesel	1	2	2	2	1	0
Total	**1,830**	**1,604**	**1,288**	**965**	**711**	**502**

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	112	215	241	270	304	353
Diesel	170	281	305	329	350	383
LPG	1	3	4	5	6	8
Ethanol	8	17	19	23	26	32
Biodiesel	6	18	26	29	31	28
Total	**297**	**534**	**597**	**656**	**718**	**806**

CAP Mitigation Regional **Medium Duty** Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	-	26	102	219	333	468
Natural Gas	-	-	-	-	-	-
Gasoline	112	195	174	130	87	34
Diesel	170	252	213	143	83	29
LPG	1	3	3	2	1	0
Ethanol	8	17	17	14	10	4
Biodiesel	6	18	21	18	13	7
Total	**297**	**510**	**529**	**526**	**528**	**542**

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	630	325	236	188	168	143
Ethanol	0	0	0	0	0	0
Biodiesel	21	21	20	16	15	11
Total	**651**	**346**	**256**	**205**	**183**	**154**

CAP Mitigation Regional **Heavy Duty** Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Electricity	-	10	41	87	127	159
Natural Gas	-	-	-	-	-	-
Gasoline	0	0	0	0	0	0
Diesel	630	305	184	98	50	119
Ethanol	0	0	0	0	0	0
Biodiesel	21	22	18	13	8	2
Total	**651**	**337**	**244**	**197**	**185**	**1,965**

Baseline Regional **Non-Road** Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Diesel	85	80	81	81	81	82
Biodiesel	3	5	7	7	7	6
Avgas	3	3	4	4	4	4
Jet Kerosene	110	110	111	111	112	113
Sustainable Aviation Fuel	-	-	-	-	-	-
Gasoline	29	27	27	27	27	28
Ethanol	2	2	2	2	2	3
Lubricants	23	18	18	18	18	18
Natural Gas	-	-	-	-	-	-
Total	**255**	**246**	**249**	**251**	**252**	**254**

CAP Mitigation Regional **Non-Road** Final Energy Demand (Thousand MMBTUs)						
Fuel	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Diesel	85	80	81	81	81	82
Biodiesel	3	6	8	10	13	19
Avgas	3	3	4	4	4	4
Jet Kerosene	110	108	99	91	82	64
Sustainable Aviation Fuel	-	2	11	21	30	49
Gasoline	29	27	27	27	27	28
Ethanol	2	2	3	3	3	3
Lubricants	23	18	18	18	18	18
Natural Gas	-	-	-	-	-	-
Total	**255**	**247**	**251**	**255**	**259**	**268**

Baseline Regional **Passenger Car EV and PHEV Stock** (Number of Vehicles)						
Vehicle Type	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Battery Electric	17	594	1,280	2,750	5,274	10,947
Plug In Hybrid	41	160	182	274	449	825
Total	**58**	**755**	**1,462**	**3,024**	**5,723**	**11,772**

CAP Mitigation Regional **Passenger Car EV and PHEV Stock** (Number of Vehicles)						
Vehicle Type	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Battery Electric	17	815	3,518	8,405	13,341	19,794
Plug In Hybrid	41	155	145	119	76	27
Total	**58**	**970**	**3,664**	**8,524**	**13,417**	**19,821**

Baseline Regional **Light Duty Truck EV and PHEV Stock** (Number of Vehicles)						
Vehicle Type	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Battery Electric	2	126	274	634	1,413	3,551
Plug In Hybrid	24	94	190	384	745	1,759
Total	**26**	**219**	**463**	**1,019**	**2,157**	**5,311**

CAP Mitigation Regional **Light Duty Truck EV and PHEV Stock** (Number of Vehicles)						
Vehicle Type	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Battery Electric	2	848	5,050	11,877	17,986	24,221
Plug In Hybrid	24	89	123	118	78	29
Total	**26**	**937**	**5,173**	**11,994**	**18,064**	**24,250**

Baseline Regional **Greenhouse Gas Emissions** (Thousand Metric Tonnes CO2e)						
Sector	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Transportation	275	240	220	207	194	175
Residential	80	72	65	60	59	58
Commercial	109	73	68	64	63	61
Industrial	22	23	23	23	23	23
Electricity	27	28	22	18	27	48
Total	512	436	397	372	365	364

CAP Mitigation Regional **Greenhouse Gas Emissions** (Thousand Metric Tonnes CO2e)						
Sector	**2015**	**2025**	**2030**	**2035**	**2040**	**2050**
Transportation	275	227	175	116	69	29
Residential	80	59	35	17	5	4
Commercial	109	61	40	24	13	13
Industrial	22	18	14	10	5	5
Electricity	27	30	37	45	30	9
Total	512	395	300	211	123	60