CHITTENDEN COUNTY RPC
Communities Planning Together

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MEMORANDUM

To: Daryl Benoit, Town Planner; Charlotte Planning Commission; Charlotte Energy Committee
From: Chittenden County Regional Planning Commission
Date: February 12, 2018
Re: Analysis, Targets, and Maps for Enhanced Energy Planning

The purpose of this memo is to share CCRPC's updated *Municipal Energy Data Guide* for your municipality. This replaces the guide issued in April 2017. The guide can be accessed on the CCRPC website here: https://www.ccrpcvt.org/our-work/our-plans/regional-energy-plan/#energy-data-guides. The guide is intended to support municipal "Enhanced Energy Planning," which is needed to advance the State's energy goals. The State's energy goals are:

- To obtain 90% of all energy across all sectors (transportation, heating and electricity) from renewable sources by 2050, with the interim goals of 25% renewable by 2025 and 40% renewable by 2035;
- To reduce total energy consumption per capita by 15% by 2025, and by more than one third by 2050;
- To weatherize 25% of homes by 2020; and
- To reduce greenhouse gases by 50% from 1990 levels by 2028; and 75% by 2050.

The data in this guide provide an overview of current energy use and set targets for advancing the State's 2050 goals for energy use from heating, transportation, electricity, as well as the State's 2050 goals for renewable energy generation. Intermediate targets for 2025 and 2035 provide each municipality with checkpoints towards meeting these goals. This document incudes all data required to plan for these goals at a municipal level. Consistency with the goals above is measured through the Vermont Department of Public Service's "Energy Planning Standards for Municipal Plans." For the full standards, visit the Department of Public Service's website: http://publicservice.vermont.gov/content/act-174-recommendations-and-determination-standards. The data in this document meet the *Analysis and Targets* section of the Standards (Standards 4 and 5).

The projections in this guide are consistent with the ECOS Plan's Metropolitan Transportation Plan scenario. This Municipal Energy Data Guide replaces the one distributed to you in April 2017. The data in the Guide are subject to change until the ECOS Plan is adopted, likely in June 2018. The guide is meant to be only a starting point for discussions on how towns and the regions can begin to plan for meeting the Act 174 standards. It is a representation of possible conditions and should be used for planning purposes only. These data will not be used to assess whether energy generation projects, utilities or municipalities are meeting energy goals. More in-depth analysis or evaluation should be done to verify or confirm actual conditions for each scenario represented, as errors or omissions may exist in the data.

A. Current Energy Use and Generation

The data below are from various sources and represent actual current consumption and generation, rather than estimates from the Long-Range Energy Alternatives (LEAP) model. Estimates from the LEAP model are shown in Section B.

Table A1. Current Municipal Transportation Energy Use

Fossil Fuel Burning Light Duty Vehicles, 2015	2,986
Electric Light Duty Vehicles, July 2017	36
Sources:, Drive Electric Vermont, DMV	

Table A2. Number of Homes Heating with Delivered Fuels, 2015

Number of homes heating with Fuel oil, Kerosene	673 homes (46% of homes)
Number of homes heating with Propane	402 homes (27% of homes)
Percentage of Households Heating with Delivered Fuels	73% of homes
Sources: American Community Survey 2011-2015 5-Year Estimate	

Table A3. Recent Residential Energy Efficiency Projects

	2014	2015	2016
Home Performance with ENERGY STAR® Leads	32	39	21
Home Performance with ENERGY STAR® Projects	5	11	8
Total Residential Projects (includes Home Performance with ENERGY STAR® projects)	32	89	102
Source: Efficiency Vermont, October 2017			

Table A4. Electrical Energy Use, 2015

Residential Electric Energy Use (MWh)	16,058
Commercial and Industrial Electric Energy Use (MWh)	2,503
Total Electric Energy Use (MWh)	18,561
Sources: Efficiency Vermont, October 2017	

Table A5. Existing Renewable Electricity Generation

	Sites	Power (MW)	Energy (MWh)
Solar	201	4.2	4,067
Wind	4	.04	91
Hydroelectric	0	0	0
Biomass (Wood)	0	0	0
Other	0	0	0
Total	205	4.2	5,058
Source: Community Energy Dashboard, July 2017			

B. Projected Energy Use

Projected future energy use targets are drawn from the Long-range Energy Alternatives Planning (LEAP) analysis for Chittenden County, completed by the Vermont Energy Investment Corporation (VEIC). LEAP is an accounting framework that shows one possible path for Chittenden County and its municipalities to meet the State's energy goals required for enhanced energy plans. LEAP aggregates existing energy use data and forecasts the demand for energy and sources of energy over time, based on a set of anticipated economic and policy changes. For example, demographic projections are one component of projecting future energy use. LEAP is well suited for examining how energy systems might evolve over time to meet certain goals (in this case, Vermont's goal to gain 90% of energy from renewable sources by 2050). These targets show the direction and magnitude of change needed meet local, regional and state energy goals

It is also important to remember that the targets established by LEAP represent only one way to achieve each municipality's energy goals. Other strategies may allow the municipality to meet its goals (for example, switching some wood heating systems to heat pump systems). If desired, CCRPC will provide the spreadsheets and source materials used to calculate these data, and a municipality can revise their targets. Many of these targets are associated with concrete implementation actions. The Department of Public Service's Guidance on implementation actions can be found here: http://publicservice.vermont.gov/sites/dps/files/documents/Pubs_Plans_Reports/Act_174/Municipal%20Guidance_Final.pdf

For more information on the LEAP model, including its underlying assumptions, please see Draft 2018 ECOS Plan Supplement 6 – Energy Analysis, Targets, & Methodology, available here: http://www.ecosproject.com/2018-ecos-plan/

Table B1. Projected Transportation Energy Use, 2025-2050

	2025	2035	2050
Total Light Duty Transportation Energy Use (MMBtu)	176,372	111,720	48,692
Electricity Used for Light Duty Transportation (MMBtu)	2,352	16,212	34,216
Light Duty Electric Vehicles (% of Vehicle Fleet)	6%	41%	89%
Biofuel Blended* Energy Used for Light Duty Transportation (MMBtu)	174,020	95,508	14,476
Biofuel Blend*Light Duty Vehicles (% of Vehicle Fleet)	94%	59%	11%
Heavy-Duty Transportation Energy Use from Biodiesel (Percent of Total)	33%	58%	96%
Heavy-Duty Transportation Energy Use from Fossil Fuels (Percent of Total)	67%	42%	4%

**This measures biofuels blended with fossil fuels. A common example is gasoline with ethanol mixed in.*

Sources: VTrans, LEAP Model

Table B2. Projected Commercial and Industrial Thermal Energy Use, 2025-2050

	2025	2035	2050
Total Commercial and Industrial Thermal Energy Use (MMBtu)	59,570	56,741	50,188
Percent of Commercial and Industrial Establishments Weatherized by Target Year	17%	19%	33%
Energy Saved by Weatherization by Target Year (MMBtu)	3,202	4,440	10,700
Commercial and Industrial Establishments Using Heat Pumps (%)	19%	30%	33%
Commercial and Industrial Thermal Energy Use by Heat Pumps (MMBtu)	4,830	9,549	14,267
Commercial and Industrial Establishments Using Wood Heating (%)	8%	9%	10%
Commercial and Industrial Thermal Energy Use Attributable to Wood Heating (MMBtu)	7,208	9,928	14,535
Sources: LEAP Model, Department of Public Service, Department of Labor			

Table B3. Projected Residential Thermal Energy Use, 2025-2050

	2025	2035	2050
Total Residential Thermal Energy Use (MMBtu)	129,881	110,124	76,245
Percent of Residences Weatherized by Target Year	14%	36%	100%
Energy Saved by Weatherization by Target Year (MMBtu)	6,063	16,560	51,833
Percent of Residences Using Heat Pumps	18%	36%	60%
Residential Thermal Energy Use from Heat Pumps (MMBtu)	8,418	17,319	25,392
Residences Using Wood Heating (%)	14%	14%	14%
Residential Thermal Energy Use from Wood Heating (MMBtu)	23,851	23,874	20,976
Sources: LEAP Model, Department of Public Service			

Table B4. Projected Electrical Energy Use, 2025-2050

	2025	2035	2050
Without Industrial	14,137	18,019	23,351
Industrial Only	4,587	5,931	7,962
Total	18,724	23,950	31,313
Total Electric Energy Saved (MWh)	2,140	4,320	8,080
Residences that have increased their Electric Efficiency	26%	50%	84%
Commercial and Industrial Establishments that have Increased Their Electric Efficiency	26%	50%	84%

Source: LEAP Model

**Please note that industrial electricity use is recognized as the most difficult element to project in the LEAP model, because of regional discrepancies in data from the commercial and industrial sector. Therefore, projected electricity use and total energy use are reported two ways: with industrial electricity use included and excluded.*

Table B5. Projected Total Energy Use Per Capita (Including Industrial Electricity Use*) 2015-2050

	2015	2025	2035	2050
Total Energy Use (MMBtu)	468,523	429,710	360,302	281,965
Population	3,861	4,053	4,169	4,368
Total Energy Use Per Capita (MMBtu)	121	106	86	65
Reduction in Total Energy Use Per Capita since 2015	--	-13%	-29%	-47%

Source: LEAP Model

**Please note that industrial electricity use is recognized as the most difficult element to project in the LEAP model, because of regional discrepancies in data from the commercial and industrial sector. Therefore, projected electricity use and total energy use are reported two ways: with industrial electricity use included and excluded.*

Table B6. Projected Total Energy Use Per Capita (Excluding Industrial Electricity Use) 2015-2050

	2015	2025	2035	2050
Total Energy Use (MMBtu)	457,490	414,059	340,064	254,799
Population	3,861	4,053	4,169	4,368
Total Energy Use Per Capita (MMBtu)	118	102	82	58
Reduction in Total Energy Use Per Capita since 2015	--	-14%	-31%	-51%

Source: LEAP Model

**Please note that industrial electricity use is recognized as the most difficult element to project in the LEAP model, because of regional discrepancies in data from the commercial and industrial sector. Therefore, projected electricity use and total energy use are reported two ways: with industrial electricity use included and excluded.*

C. Projected Renewable Energy Generation Potential

This guide also reports how much wind and solar generation potential exists in the municipality, and sets targets for additional renewable energy generation within each municipality. However, the generation targets are technology neutral, meaning a municipality can use any form of renewable generation (wind, solar, biomass, hydroelectric, etc.) to meet its goals. For more information on how these targets were determined, please see Draft 2018 ECOS Plan Supplement 6 – Energy Analysis, Targets, & Methodology, available here: http://www.ecosproject.com/2018-ecos-plan/

Prime solar or wind areas are areas where models show the appropriate conditions for electricity generation, and where there are no constraints. Base solar or wind areas are areas where models show the appropriate conditions for electricity generation, but where there are possible constraints, which must be considered during development and may reduce the development potential of a site. The draft 2018 ECOS Plan indicates that *"development should be located to avoid state and local known constraints that have been field verified, and to minimize impacts to state and local possible constraints that have been field verified."* Please see Table C4 for the list of constraints.

A municipality's reported land available for wind and solar generation and generation potential are based on models of the elevation, slope, and aspect of land, or the modeled wind speed, in a municipality. These models do not remove existing impervious surfaces. Therefore, land-based generation potential may be over-estimated for municipalities with a high percentage of impervious surface, including Burlington, Winooski and Essex Junction.

Table C1. Land Available for Wind and Solar Generation

	Prime Potential	Base Potential
Solar	291 acres (1% of town)	10,647 acres (40% of town)
Wind	414 acres (2% of town)	19,056 acres (72% of town)

Source: CCRPC and the Department of Public Service, Vermont Center for Geographic Information

Table C2. Projected Renewable Electricity Generation Potential

	Power (MW)	Energy (MWh)
Rooftop Solar*	2	2,176
Ground-Mounted Solar* – Prime	26	44,536
Ground-Mounted Solar* – Base	177	217,625
Wind – Prime	17	50,731
Wind – Base	762	2,336,982
Hydro	See Hydro Map	
Biomass	See Biomass Map	
Methane	Unknown	Unknown
Other	Unknown	Unknown

Source: CCRPC and the Department of Public Service

*Rooftop solar potential is calculated by assuming that a certain percentage of rooftops can hold solar systems. Ground-mounted solar potential reports how much land could be developed with solar based on its aspect and elevation, and does not remove space taken up by impervious surfaces like roofs. Therefore, rooftop solar potential cannot be added to ground-mounted solar potential, as this would lead to some generation potential being double counted.

Table C3. New Renewable Electricity Generation Targets

	2025		2035		2050	
	Low	**High**	**Low**	**High**	**Low**	**High**
Generation Targets – Any Technology (MWh)	2,157	4,580	4,313	9,161	7,548	16,031

Sources: LEAP Model and CCRPC Modeling

These targets are in addition to what the municipality is already generating.

Table C4. State/Local Known and Possible Constraints

State Known Constraints	State Possible Constraints	Local Known Constraints	Local Possible Constraints
FEMA Floodways DEC River Corridors National Wilderness Areas State-significant Natural Communities and Rare, Threatened, and Endangered Species Vernal Pools (confirmed and unconfirmed) Class 1 and 2 wetlands (VSWI and advisory layers)	Agricultural Soils + Hydric Soils Act 250 Ag. Soil Mitigation Areas FEMA Special Flood Hazard Areas VT Conservation Design Highest Priority Forest Blocks (Forest Blocks – Connectivity, Forest Blocks – Interior, Forest Blocks - Physical Land Division) Highest Priority Wildlife Crossings Highest Priority Wildlife Crossings Protected Lands (State fee lands and private conservation lands) Deer Wintering Areas	None	Shoreland Setback and Buffer Area Surface Waters, Wetlands, and Buffer areas Flood Hazard Areas Special Natural Areas Wildlife habitat Historic Districts, Site, and Structures Slopes greater than 15% Land in Active Agriculture Water Supply Protection Scenic Views Significant Wildlife Habitat

Section D. Mapping

The maps in this section meet the Act 174 Mapping standards for your municipality. Municipal plans must include the maps contained within this section. These maps identify potential areas for development and siting of solar and wind generation which account for areas that are unsuitable for siting renewable energy generation because of the presence of state/local known and possible constraints, identified in table C4. Maps showing preferred sites/existing renewable generation facilities, hydro and biomass generation are also included.

These maps should be used in conjunction with complementary policies in the town plan. The map identifying constrained areas is a visual representation of the constraints listed above. A certified Enhanced Energy Plan means that a municipality's "land conservation measures and specific policies" might be given substantial deference during project review under 30 V.S.A. § 248. However, for these measures and policies to be given substantial deference, they must be clearly included in the text, as a map may lack sufficient clarity or granularity regarding the area in which a project is proposed.