TOWN OF WATERBURY, VERMONT

MUNICIPAL PLAN

2018

Adopted December 3, 2018

Celebration of the 5th Anniversary of Tropical Storm Irene - Photo by Gordon Miller

TABLE OF CONTENTS

7. Energy

7.1 Overview & Statutory Requirements

Title 24, Chapter 117, section §4382(a)(9) of Vermont Statutes outlines the information needed to be included in a municipal plan related to energy. Specifically it states:

"An energy plan, including an analysis of energy resources, needs, scarcities, costs and problems within the municipality, a statement of policy on the conservation of energy, including programs, such as thermal integrity standards for buildings, to implement that policy, a statement of policy on the development of renewable energy resources, a statement of policy on patterns and densities of land use likely to result in conservation of energy."

During the 2016 legislative session, the State of Vermont passed Act 174 which is an act related to improving the siting of energy projects. Act 174 outlines a path whereby regions and municipalities could receive "substantial deference"[5] before the Public Utility Commission (formerly the Public Service Board) if certain considerations were incorporated into a regional or municipal development plan. The standards outlined in Act 174 align with the primary goal of State of Vermont's Comprehensive Energy Plan which is to have 90% of the state's energy needs being generated from renewable sources by 2050 (90 by 50).

7.2 Relationship to the Waterbury Energy Plan

The energy chapter of this plan consists of the information contained herein, as well as the complete Waterbury Energy Plan that is hereby adopted by reference and included as Appendix B. This energy chapter is intended to provide an overview and highlights from the Waterbury Energy Plan without duplicating that information. The Energy Plan includes information on:

- Estimates of current energy use across transportation, heating, and electric sectors
- Targets for thermal and electric efficiency improvements, and use of renewable energy for transportation, heating, and electricity
- Evaluation of thermal-sector conservation, efficiency, and conversion to alternate heating fuels to achieve these targets

[5] According to Act 174 of 2016, "substantial deference" means that a land conservation measure or specific policy shall be applied in accordance with its terms unless there is a clear and convincing demonstration that other factors affecting the general good of the State outweigh the application of the measure or policy. The term shall not include consideration of whether the determination of energy compliance should or should not have been affirmative under 24 V.S.A. § 4352.

- Evaluation of transportation system changes and land use strategies needed to achieve these targets
- Resource maps to identify potential locations for renewable energy generation

The Energy Plan was developed by first examining the current Waterbury Town Plan to identify existing information to satisfy the requirements of Act 174, but also to ensure consistency between the two documents. The Energy Plan is intended to meet the standards outlined in Act 174, while also meeting the complete statutory requirements as noted above.

7.3 Act 174 Information

In general, the requirements of Act 174 work in conjunction with the existing statutory information required to be included in a municipal plan's energy chapter. Act 174 requires a more comprehensive analysis of existing conditions and requires the identification of targets for thermal, transportation, and electric sectors related to conversion or conservation of energy. Act 174 also identifies three distinct sections to identify this information including:

- Analysis & Targets
- Pathways & Implementation Actions
- Mapping

The Analysis & Targets section provides a baseline of information for where a region or municipality currently stands in terms of energy use and identifies the trajectories and pace of change needed to meet targeted reductions and conservation of energy. It includes information on current electricity use for residential and non-residential uses; existing and potential renewable resource generation; and current transportation energy use information. Additionally, 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 not identified as requirements. Targets are established for the years 2025, 2035, and 2050 which coincide with the State Comprehensive Energy Plan.

The Pathways & Implementation Actions section provides the basis for how Waterbury will meet its target year goals as noted in the Analysis & Targets. The implementation actions are categorized by:

1. Conservation & efficient use of energy

2. Reducing transportation demand and single occupancy vehicles trips, and encouraging the use of renewable sources for transportation
3. Patterns and densities of land use likely to result in conservation of energy
4. The siting of renewable energy generation

The implementation actions identified in this section focus primarily in areas where Waterbury or local partners such as Waterbury LEAP are working to support the community through local land use, transportation, and environmental planning activities.

Finally, the Mapping section allows the Town to visually identify where renewable energy generation is most suitable. This section combines resource information with specific known and possible constraints to the development of renewable energy generation. The mapping section also allows the opportunity to identify preferred locations for renewable energy development and areas that are unsuitable for development of any kind. In addition, the maps identify existing infrastructure to support renewable energy development.

In general, the mapping information looks at state-level data and breaks it down to a municipal perspective. From there, an analysis was done (as noted in Section I) regarding the potential renewable energy generation that might be possible based on resource areas and constraints. This information is useful to visualize what geographies throughout Waterbury are most ideally suited or best to avoid regarding renewable energy siting based on available resources or identified constraints. This is intended to be a starting point and not the only basis for siting.

This section also contains specific objectives regarding the development and siting of renewable energy resources that are reflected on the maps. One area was specifically recognized where development of any kind, including renewable energy development should be restricted. The Shutesville Hill Wildlife Corridor is identified and specifically mapped on the Forest Resources and Wildlife Connectivity Map 2-7 referenced in Chapter 6. Currently, Waterbury only includes preferred locations consistent with the Public Utility Commission's Net Metering Rules including but not limited to gravel pits, brownfield sites, or parking lots. Additional sites may be evaluated or considered in the future.

In order to address the requirements of Act 174, the Vermont Department of Public Service provided a guidance document that identifies how a municipality can meet the requirements including model language to be considered. When possible, this guidance was used to ensure consistency with statute and its intent for energy planning.

7.4 Waterbury Energy Planning

The Town of Waterbury developed its energy plan with three guiding principles in mind. These included renewable energy use, energy efficiency, and transportation efficiency. These three areas were explored in relation to the standards of Act 174 and local needs. The following is a summary of these guiding principles and outlines how Waterbury will work to help the State meet the specific energy targets established in the state's Comprehensive Energy Plan [6].

Renewable energy use:
Waterbury will support increased use of renewable energy by conducting land assessments to identify the most attractive sites for solar orchards and other renewable projects; establishing site review criteria for evaluating potential large scale renewable energy projects; encouraging greater use of renewables among municipal buildings; and facilitating small scale wind and solar use by local residents and businesses. Waterbury will strive to generate 10% of its total business, municipal and residential energy needs (about 58,000 kilowatt hours) through locally produced renewable energy by 2020.

Energy efficiency:
Waterbury will encourage greater energy efficiency among its residents, businesses, and municipalities. Waterbury will work with local groups to encourage greater use of energy audits and to utilize LEED certification as appropriate. Waterbury hopes that at least 25% of houses (or about 720 homes) and 25% of businesses will have undertaken energy audits, and taken substantial steps to improve their energy efficiency by 2020.

Transportation efficiency:
Waterbury will encourage greater transportation efficiency by supporting the expansion of public transportation, carpooling, and bike/ pedestrian access and to encourage greater use of electric and more fuel efficient vehicles. By 2020, Waterbury aims to reduce the use of fossil fuels for transportation by 20%.

In addition, the Town of Waterbury supports the work of the Waterbury Local Energy Action Partnership (LEAP) to achieve the following energy targets:

- Generating 10% of our total business, municipal and residential energy needs (about 58,000 kilowatt hours) through locally produced renewable energy by 2020.
- Completing energy audits and taking substantial steps to improve energy efficiency in at least 25% of houses (or about 720 homes) and 25% of businesses by 2020.
- Reducing the use of fossil fuels for transportation by 20% by 2020.

[6] Vermont Department of Public Service. 2011. Comprehensive Energy Plan: Vermont's Energy Future – Volume 1. Available at: www.vtenergyplan.vermont.gov

In addition, the Town of Waterbury utilized information provided by the Central Vermont Regional Planning Commission to address the Analysis & Targets, and Mapping requirements of Act 174. All of this information is included in the Energy Plan. A summary of specific data related to current energy use for transportation, thermal, and electricity. Complete information on these sectors is included in the Energy Plan.

Table 1. Current Transportation Energy Use

Data Category	Information
Total Number of Vehicles	3,945
Average Miles Traveled per Vehicle	12,500
Total Annual Miles Traveled	49,312,500
Average Gallons of Fuel Used per Vehicle per Year	576 (21.7 miles per gallon)
Total Gallons of Fuel Used per Year	2,651,209
Transportation Energy Used per year (in Billions)	319 BTUs
Average Cost per Gallon of Gasoline	$2.95
Gasoline Cost per Year	$7,821,067

Source: 2011-2015 U.S. Census Bureau - American Community Survey; Vermont Agency of Transportation

Table 2. Current Residential Heating Energy Use by Fuel Source

Fuel Source	Number of Households	Percent of Households	Heated Square Footage	BTUs (in Billions)
Natural Gas & Propane	814	35.8%	1,281,076	76.86
Electricity	26	1.14%	25,046	1.5
Fuel Oil	1,170	51.45%	1,914,031	114.8
Coal	0	0.0%	0	0
Wood	246	10.82%	478,224	28.7
Other (Includes renewable sources)	18	0.79%	14,130	0.8
No Fuel	0	0.0%	0	0
Total	**2,274**	**100%**	**3,712,507**	**222.8**

Source: 2011-2015 U.S. Census Bureau - American Community Survey

Table 3. Current Electricity Use

Use Sector	Current Regional Electricity Use
Residential	14,648 megawatt hours
Commercial and Industrial	27,962 megawatt hours
Total	42,610 megawatt hours

Source: Efficiency Vermont

7.5 Future Considerations

In order to better understand how Waterbury can provide its share of renewable energy generation to meet the state goal of 90% renewable energy by 2050, the current potential for renewable energy generation needs to be quantified. Table 4 provides an overview of the current potential renewable energy generation for the Town of Waterbury on the prime and secondary resource areas that have been identified. Renewable generation potential is calculated from mapping completed by the Central Vermont Regional Planning Commission and is based on the Determination Standards and associated guidance documents developed by the Department of Public Service. The renewable generation potential is expressed in megawatts (MW) and megawatt hours (MWh). It should be noted that not all areas will be available for development due to private ownership or interest in renewable energy development therefore the information in Table 4 may need to be further analyzed.

Table 4. Potential New Renewable Electric Energy Generation

Renewable Type	MW	MWh
Rooftop Solar	3.71	4,555
Ground-mounted Solar	725.06	889,210
Wind	302.95	928,837
Hydroelectric	.01	28
Biomass and Methane	Unknown	Unknown
Other	0	0
Total Renewable Generation Potential	1,031.73	1,822,630

Source: Central Vermont Regional Planning Commission & Department of Public Service

Finally, Table 5 identifies the total amount of new renewable energy that would need to be generated in Waterbury by 2050 to meet its share of the 90 by 50 goals. In addition to the total renewable energy target for 2050, Table 5 includes targets for intermediate years to help track progress towards the 2050 goal.

Table 5. Targets for New Renewable Electric Energy Generation

	2025	2035	2050
Total Renewable Generation Target (in MWh)	8,148	13,036	32,590

Source: Central Vermont Regional Planning Commission & Department of Public Service

7.6 Key Challenges and Trends

Based on the information included in the Energy Plan and noted above, Waterbury has more than enough resource area available to meet its share of renewable energy generation by 2050. With that in mind, the more specific challenges that will be faced relate to the guiding theme of the state comprehensive energy plan which assumes electricity is the primary power source to address the state's energy needs. As such, the following challenges and trends are noted for Waterbury.

Grid Capacity/Infrastructure Needs:

In order to effectively and efficiently transmit electricity throughout Waterbury, the electric grid and other infrastructure, specifically three phase power, need to be adequate to support renewable energy development for the foreseeable future. It will be important to have accurate and up-to-date inventories of existing facilities to ensure upgrades or improvements are targeted to most effectively support additional electric loads on the grid. For example, some areas of Waterbury do not currently have three phase power, however they do have prime resource areas to support renewable energy development. If three phase power is not in place, large scale renewable energy generation cannot currently be supported.

Livability Preferences:

A major component of energy use is related to transportation. The majority of residents in Waterbury use personal vehicles for their daily travel needs. Only a fraction of those vehicles utilize alternative fuels. According to Drive Electric Vermont [7], as of July 2017 there were a total of 1,768 passenger electric vehicles in the State of Vermont Department of Motor Vehicles registration database. This includes 1,387 plug in hybrid and 381 all electric passenger vehicles. Replacement of vehicles that utilize fossil fuels with those that use alternative fuels is a component of the transportation objectives noted in Waterbury's strategy to help achieve the state's goal of 90 by 50.

Related to vehicle use is personal choice for where to live. During the eighties and nineties, the trend was to build larger houses on large lots further out from the center of the community. Trends are indicating a desire to live closer to amenities which are associated with cities and village centers. The ability to walk or use transit is becoming more popular. There is less interest in maintaining a large house and large property.

As residents begin to age and younger individuals and families look to set down roots, large lot housing choices may no longer be the desired scenario. However, large lot developments still need to be accommodated and planned for as a rural lifestyle is still preferred by many Vermont residents. These factors will all contribute to changes in land use patterns that can support more energy efficient choices.

[7] http://www.driveelectricvt.com/buying-guide/why-go-electric

Alternative Transportation Options:

As noted previously, changes in lifestyle choices for residents of Waterbury will impact their choices for transportation methods. As trends towards more downtown-style living continue, public transit, walking, and bicycling are becoming more widely seen as the primary means of transportation. This trend will influence the need for families to have multiple personal vehicles in exchange for alternative transportation options.

As the primary public transit provider in Waterbury, Green Mountain Transit (GMT) is consistently evaluating their service routes and making changes based on needs and demands for ridership. This includes extending routes, changing times, or adding more buses in certain locations to meet the demand. More specific information regarding transportation options, trends, and choices can be found in the transportation chapter of this plan as well as the Regional Transportation Plan maintained by the Central Vermont Regional Planning Commission.

To help increase transportation options, Waterbury need to continually evaluate its land use regulations. This will help ensure density of development and mixing of uses will support alternative transportation options to maintain continuity and consistency into the future. These evaluations will also help Waterbury evolve as personal choices and trends change.

Development of Renewable Energy Generation:

Development of renewable energy generation will be a key component to achieve 90 by 50. The Waterbury Energy Plan identifies specific areas where resource areas exist for renewable energy generation. These areas focus on wind, solar, and hydroelectric as they are locationally constrained. Other renewable energy generation such as woody biomass, biogas, and other renewable technologies do not require specific conditions for the location of the generation facility, however they do require resources such as wood or other organics to provide the needed fuel.

Siting of all renewable energy generation facilities will take careful planning to ensure infrastructure (including three phase power), land use regulations (including zoning if applicable), and community support exists before the development can occur. In this regard the Waterbury Energy Plan does not specify locations beyond what has been identified by the Public Utility Commission in their Net Metering Rules as preferred locations [8] for renewable energy generation.

Changes in Technology:

As noted previously, the state's comprehensive energy plan and subsequently Waterbury Energy Plan are both written with electricity as the primary power source. This direction includes renewable energy technology that exists today such as wind, solar, hydroelectric, biomass, and biogas. As technologies change and

[8] Preferred locations are identified in the net metering rules include but are not limited to parking lots, expired gravel pits, landfills, brownfield sites, and municipally designated lands.

advancements are made in both efficiency and sources of renewable energy generation, the region's municipalities will need to be flexible and adaptable to these changes.

With this in mind, the Waterbury Regional Energy Plan acknowledges and recommends consideration for changes in technology that do not limit renewable energy development to known sources. This concept will need to be continually revisited to ensure current technologies are considered and outdated technologies are not recommended.

Weatherization:
Weatherization of buildings is a pathway that will work towards the energy goals related to conservation of energy. A portion of Waterbury's housing stock is older and was constructed at a time when no specific codes existed for energy efficiency. Now, with the passage of the Residential Building Energy Standards (RBES) and the Commercial Building Energy Standards (CBES), new construction is required to meet minimum thresholds for energy efficiency. This will ensure new construction addresses energy efficiency, however weatherization of existing construction will need to be addressed.

Incentives may be required to assist property owners in upgrading their current homes and buildings to include more efficient windows, doors, insulation, or mechanical systems. These upgrades can be costly which is often identified as the primary barrier to completing the needed changes. If incentives are available to assist property owners with weatherization projects, this may increase the efficiency of buildings while decreasing the consumption of energy. This could prove a viable alternative to new construction thereby extending the lifecycle of existing buildings throughout the region.

System Conversions:
Similar to weatherization, older existing buildings will commonly have outdated and inefficient mechanical systems. These often include oil based heating systems or wood-fired units. With advances in technology, cold weather heat pumps, high efficiency wood stoves, and other mechanical systems can provide efficiency improvements for existing buildings that will result in conservation of energy. As noted previously, new construction will generally include these high efficiency systems which will help address energy conservation. Like issues related to weatherization, however, the conversion to high efficiency systems will be a challenge as the costs for equipment and building modifications needed to install these systems may be cost prohibitive to many residents and business owners in the region. In this regard, identifying potential incentives will be beneficial to support conversions.

7.7 Goals and Objectives

The following section outlines the general goals that will help shape the energy future of Waterbury. Detailed goals and objectives are included in the Energy Plan, however the themes are included herein to provide an

overall sense of the direction being provided. As noted previously, energy touches multiple sectors and elements of the Waterbury Town Plan therefore these tenants are woven throughout the various plan sections for consistency and integration across multiple elements. It is agreed that a working group is needed to implement the Energy Plan that will be representative of various entities in the community including the Town of Waterbury, Waterbury LEAP, energy related businesses, building contractors, transportation providers, and private citizens.

Conservation and Efficiency:

Goal

1. Conservation and efficiency is practiced by individuals and organizations regarding building construction, heating systems, and daily choices.

Objectives

1. Increase conservation of energy by individuals and organizations.

2. Promote energy efficiency in the design, construction, renovation, operation, location and retrofitting of systems for buildings and structures.

3. Identify ways to decrease the use of fossil fuels for heating.

4. Demonstrated municipal leadership regarding efficiency of municipal buildings.

Reducing Transportation Energy Demand, Single-Occupancy Vehicle Use, and Encouraging Renewable or Lower-Emission Energy Sources for Transportation:

Goal

2. Support alternative transportation options and alternative fuel vehicles throughout Waterbury.

Objectives

5. Encourage increased use of transit as a primary method to complete daily trips and reduce demands on existing infrastructure such as roads and parking.

6. Promote the shift away from single-occupancy vehicle trips to reduce congestion, impacts to local facilities, and support alternative options for transportation needs.

7. Promote the shift away from gas/diesel vehicles to electric or non-fossil fuel transportation options to reduce dependency on non-renewable fuel sources for transportation.

8. Facilitate the development of walking and biking infrastructure to provide alternative transportation options for the community.

9. Demonstrated municipal leadership with respect to efficiency of municipal transportation to show an on-going commitment on behalf of the Town of Waterbury.

Patterns and Densities of Land Use Likely to Result in Conservation of Energy:

Goal

3. Land use objectives support compact development in mixed-use centers.

Objectives

10. The Town of Waterbury is committed to reducing sprawl and minimizing low-density development by encouraging density in areas where infrastructure exists or is planned to support growth.

11. Strongly prioritize development in compact, mixed-use centers when feasible and appropriate and identify ways to make compact development more feasible throughout the Town of Waterbury.

Development and Siting of Renewable Resources:

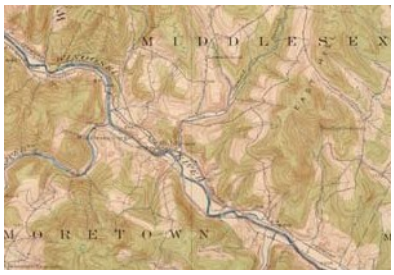
Goal

4. Renewable energy generation is sited to maximize potential while minimizing locally identified impacts.

Objectives

12. Evaluate generation from existing renewable energy generation including the identification of constraints, resource areas, and existing infrastructure by energy type.

13. Evaluate generation from potential renewable energy generation including the identification of constraints, resource areas, and existing infrastructure by energy type.



Central Vermont Regional Plan

2016

Adopted June 12, 2018
Effective July 17, 2018

Amendment Adopted October 13, 2020
Amendment Effective November 17, 2020

Central Vermont Regional Planning Commission
29 Main Street, Suite 4, Montpelier, Vermont 05602-2952
Phone: 802-229-0389 Fax: 802-223-1977
Email: cvrpc@cvregion.com Web: www.centralvtplanning.org

Table of Contents

7 Economic Element

A Appendices

M Maps

Energy Element

3

OVERVIEW & STATUTORY REQUIREMENTS

Title 24, Chapter 117, section §4348a(a)(3) of Vermont Statutes outlines the information needed to be included in the energy element of a region's plan. Specifically it states:

"An energy element, which may include an analysis of resources, needs, scarcities, costs, and problems within the region across all energy sectors, including electric, thermal, and transportation; a statement of policy on the conservation and efficient use of energy and the development and siting of renewable energy resources; a statement of policy on patterns and densities of land use likely to result in conservation of energy; and an identification of potential areas for the development and siting of renewable energy resources and areas that are unsuitable for siting those resources or particular categories or sizes of those resources."

During the 2016 legislative session, the State of Vermont passed Act 174 which is an act related to improving the siting of energy projects. Act 174 outlines a path whereby regions and municipalities could receive "substantial deference"[1] before the Public Utility Commission (formerly the Public Service Board) if certain considerations were incorporated into a regional or municipal development plan. The standards outlined in Act 174 align with the primary goal of State of Vermont's Comprehensive Energy Plan which is to have 90% of the state's energy needs being generated from renewable sources by 2050 (90 by 50).

RELATIONSHIP TO THE CENTRAL VERMONT REGIONAL ENERGY PLAN

The Energy Element of this plan consists of the information contained herein, as well as the complete Central Vermont Regional Energy Plan that is hereby adopted by reference and included as Appendix A-7. This energy element is intended to provide an overview and highlights from the Regional Energy Plan without duplicating that information. The Regional Energy Plan includes information on:

- Current energy use by thermal, electric, and transportation sectors
- Targets for reducing energy consumption by sector
- Targets for conversion to more fuel efficient technologies
- Implementation actions to address land use, transportation, and energy needs
- Resource maps to identify potential locations for renewable energy generation

[1] According to Act 174 of 2016, "substantial deference" means that a land conservation measure or specific policy shall be applied in accordance with its terms unless there is a clear and convincing demonstration that other factors affecting the general good of the State outweigh the application of the measure or policy. The term shall not include consideration of whether the determination of energy compliance should or should not have been affirmative under 24 V.S.A. § 4352.

The Central Vermont Regional Energy Plan was developed by first examining the existing Central Vermont Regional Plan to identify existing information to satisfy the requirements of Act 174, but also to ensure consistency between the two documents. The Regional Energy Plan is intended to meet the standards outlined in Act 174, while also meeting the complete statutory requirements as noted above.

ACT 174 INFORMATION

In general, the requirements of Act 174 work in conjunction with the existing statutory information required to be included in a regional plan's energy element. Act 174 requires a more comprehensive analysis of existing conditions and requires the identification of targets for thermal, transportation, and electric sectors related to conversion or conservation of energy. Act 174 also identifies three distinct sections to identify this information including:

- Analysis & Targets
- Pathways & Implementation Actions
- Mapping

The Analysis & Targets section provides a baseline of information for where a region or municipality currently stands in terms of energy use and identifies the trajectories and pace of change needed to meet targeted reductions and conservation of energy. It includes information on current electricity use for residential and non-residential uses; existing and potential renewable resource generation; and current transportation energy use information. Additionally, 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 not identified as requirements. Targets are established for the years 2025, 2035, and 2050 which coincide with the State Comprehensive Energy Plan.

The Pathways & Implementation Actions section provides the basis for how the region will meet their target year goals as noted in the Analysis & Targets. The implementation actions are categorized by:

1. Conservation & efficient use of energy
2. Reducing transportation demand and single occupancy vehicles trips, and encouraging the use of renewable sources for transportation
3. Patterns and densities of land use likely to result in conservation of energy
4. The siting of renewable energy generation

The implementation actions identified in this section focus primarily in areas where the Central Vermont Regional Planning Commission is already working to support its member municipalities through local land use, transportation, and environmental planning activities.

Finally, the Mapping section allows the region to visually identify where renewable energy generation is most suitable. This section combines resource information with specific known and possible constraints to the development of renewable energy generation. The mapping section also allows the opportunity to identify preferred locations for renewable energy development and areas that are unsuitable for development of any kind. In addition, the maps identify existing infrastructure to support renewable energy development.

In general, the mapping information looks at state-level data and breaks it down to a regional perspective. From there, an analysis was done (as noted in Section I) regarding the potential renewable energy generation that might be possible based on resource areas and constraints. This information is useful to visualize what geographies throughout Central Vermont are most ideally suited or best to avoid regarding renewable energy siting based on available resources or identified constraints. This is intended to be a starting point and not the only basis for siting.

This section also contains specific policy information regarding the development and siting of renewable energy resources that are reflected on the maps. It was determined that no specific locations would be identified at a regional level as being prohibited areas for the development of renewable energy generation. It was also determined that preferred locations identified at the regional level would be consistent with areas identified by the state including gravel pits, brownfield sites, or parking lots. This was done to allow the municipalities to decide if it was appropriate to identify these areas locally, rather than have this information dictated by the region.

The Regional Planning Commission did, however, identify additional possible constraints to be considered. These include elevations above 2,500 feet, slopes greater than 25%, municipally owned lands, and lakeshore protection buffer areas of 250 feet. The decision was made to include these resources as possible constraints to allow for further analysis by the region or the municipalities to determine if development of renewable energy generation facilities may be appropriate based on specific conditions.

In order to address the requirements of Act 174, the Vermont Department of Public Service provided a guidance document that identifies how a region can meet the requirements including model language to be considered. When possible, this guidance was used to ensure consistency with statute and its intent for energy planning.

REGIONAL ENERGY PLANNING

Beginning in 2016, the Central Vermont Regional Planning Commission began working on the development of a Regional Energy Plan that would meet or exceed the standards as identified in Act 174. To achieve this, the Board of Commissioners appointed a steering committee to help guide the process. The steering committee included representatives from various perspectives including the commission, state agencies, selectboards, planning commissions, local energy committees, utility providers, private energy developers, the business community, and transportation providers. This group provided the input and insight into the development of the

regional energy plan, which also includes the specific information to address the standards of Act 174.

Multiple sources of information were used to establish the regional overview of energy consumption and targets for reduction. These sources include the U.S. Census Bureau, the Vermont Department of Public Service, the Energy Action Network, the Vermont Energy Investment Corporation, The Vermont Department of Labor, the Vermont Agency of Transportation, and other sources.

Tables 1 through 3 identify the current energy use related to transportation, thermal, and electricity for the Central Vermont Regional Planning Commission area.

Table 1. Current Regional Transportation Energy Use

Transportation Data	Regional Data
Total # of Light Duty Vehicles	45,584
Average Miles per Vehicle	287,500 (12,500/vehicle)
Total Miles Traveled	567,650,000
Average Gallons Used per Vehicle per Year	12,239 (576/vehicle)
Total Gallons Use per Year	30,518,817
Transportation BTUs (Billion)	3,396
Average Cost per Gallon of Gasoline	$2.31
Gasoline Cost per Year	$70,488,465

Source: 2011-2015 U.S. Census Bureau - American Community Survey; Vermont Agency of Transportation

Table 2. Current Regional Residential Heating Energy Use by Fuel Source

Fuel Source	Regional Households	Regional % of Households	Regional Square Footage Heated	Regional BTU (in Billions)
Natural Gas & Propane	5,983	22.2%	9,632,438	578
Electricity	1,206	4.5%	1,494,263	90
Fuel Oil	14,238	52.9%	24,431,228	1,466
Coal	66	0.2%	132,664	8
Wood	5,031	18.7%	9,493,439	570
Other (Includes renewable sources)	392	1.5%	696,536	42
No Fuel	22	0.1%	42,680	3
Total	**26,938**	**100%**	**45,923,248**	**2755**

Source: 2011-2015 U.S. Census Bureau - American Community Survey

Table 3. Current Regional Electricity Use

Use Sector	Current Regional Electricity Use
Residential	241,268 megawatt hours
Commercial and Industrial	353,117 megawatt hours
Total	594,385 megawatt hours

Source: Efficiency Vermont

FUTURE CONSIDERATIONS

In order to better understand how the region can provide its share of renewable energy generation to meet the state goal of 90% renewable energy by 2050, the current potential for renewable energy generation needs to be quantified. Table 4 provides an overview of the current potential renewable energy generation for Central Vermont based on the prime and secondary resource areas that have been identified. Renewable generation potential is calculated from mapping completed by the Central Vermont Regional Planning Commission and is based on the Regional Determination Standards and associated guidance documents developed by the Department of Public Service. The renewable generation potential is expressed in megawatts (MW) and megawatt hours (MWh).

Table 4. Existing Potential New Regional Renewable Electric Energy Generation

Renewable Type	MW	MWh
Rooftop Solar	40	49,268
Ground-mounted Solar	15,622	19,160,098
Wind	23,050	70,671,678
Hydro	.01	28
Biomass and Methane	Unknown	Unknown
Other	0	0
Total Renewable Generation Potential	38,712.71	89,881,072

Source: Central Vermont Regional Planning Commission & Department of Public Service

Finally, Table 5 identifies the total amount of new renewable energy that would need to be generated by Central Vermont by 2050. In addition to the total renewable energy target for 2050, Table 5 includes targets for intermediate years to help track progress towards the 2050 goal.

Table 5. Regional Targets for New Renewable Electric Energy Generation

	2025	2035	2050
Total Renewable Generation Target (in MWh)	104,620	167,404	418,531

Source: Central Vermont Regional Planning Commission & Department of Public Service

KEY CHALLENGES AND TRENDS

Based on the information included in the Central Vermont Regional Energy Plan and noted above, Central Vermont has more than enough resource area available to meet its share of renewable energy generation by 2050. With that in mind, the more specific challenges that will be faced by the municipalities in Central Vermont are related to the guiding theme of the state comprehensive energy plan which assumes electricity is the primary power source to address the state's energy needs. As such, the following challenges and trends are noted for Central Vermont.

Grid Capacity/Infrastructure Needs

In order to effectively and efficiently transmit electricity throughout Central Vermont, the electric grid and other infrastructure, specifically three phase power, need to be adequate to support renewable energy development for the foreseeable future. It will be important to have accurate and up-to-date inventories of existing facilities to ensure upgrades or improvements are targeted to most effectively support additional electric loads on the grid. For example, some communities in Central Vermont do not currently have three phase power, however they do have prime resource areas to support renewable energy development. If three phase power is not in place, large scale renewable energy generation cannot currently be supported.

Livability Preferences

A major component of energy use is related to transportation. The vast majority of residents in the state, including Central Vermont, use personal vehicles for their daily travel needs. Only a fraction of the approximately 45,000 light duty vehicles in Central Vermont utilize alternative fuels. According to Drive Electric Vermont[2], as of July 2017 there were a total of 1,768 passenger electric vehicles in the State of Vermont Department of Motor Vehicles registration database. This includes 1,387 plug in hybrid and 381 all electric passenger vehicles. Replacement of vehicles that utilize fossil fuels with those that use alternative fuels is a component of the transportation policies noted in Central Vermont's strategy to help achieve the state's goal of 90 by 50.

Related to vehicle use is personal choice for where to live. During the eighties and nineties, the trend was to build larger houses on large lots further out from the center of the community. Trends are indicating a desire to live closer to amenities which are associated with cities and village centers. The ability to walk or use transit is becoming more popular. There is less interest in maintaining a large house and large property.

As residents begin to age and younger individuals and families look to set down roots, large lot housing choices may no longer be the desired scenario. However, large lot developments still need to be accommodated and planned for as a rural lifestyle is still preferred by many Central

[2] http://www.driveelectricvt.com/buying-guide/why-go-electric

Vermont residents. These factors will all contribute to changes in land use patterns that can support more energy efficient choices.

Alternative Transportation Options

As noted previously, changes in lifestyle choices for residents of Central Vermont will impact their choices for transportation methods. As trends towards more downtown style living continue, public transit, walking, and bicycling are becoming more widely seen as the primary means of transportation. This trend will influence the need for families to have multiple personal vehicles in exchange for alternative transportation options. As the primary public transit provider in Central Vermont, Green Mountain Transit (GMT) is consistently evaluating their service routes and making changes based on needs and demands for ridership. This includes extending routes, changing times, or adding more buses in certain locations to meet the demand. More specific information regarding transportation options, trends, and choices can be found in the transportation element of this plan as well as the Central Vermont Regional Energy Plan.

To help increase transportation options, municipalities are beginning to require amenities such as sidewalks, bicycle trails, or multi-use facilities to connect residential areas to activity centers with new land developments. This trend will continue to provide residents with choices for transportation options beyond the personal vehicle. Communities will need to continually evaluate their land use regulations to ensure density of development and mixing of uses will support alternative transportation options to maintain continuity and consistency into the future and to evolve as personal choices and trends change.

Development of Renewable Energy Generation

Development of renewable energy generation will be a key component to achieve 90 by 50. The Central Vermont Regional Energy Plan identifies specific areas where resource areas exist for renewable energy generation. These areas focus on wind, solar, and hydroelectric as they are locationally constrained. Other renewable energy generation such as woody biomass, biogas, and other renewable technologies do not require specific conditions for the location of the generation facility, however they do require resources such as wood or other organics to provide the needed fuel.

Siting of all renewable energy generation facilities will take careful planning to ensure infrastructure (including three phase power), land use regulations (including zoning if applicable), and community support exists before the development can occur. In this regard the Central Vermont Regional Energy Plan does not specify locations beyond what has been identified by the state as preferred locations[3] for renewable energy generation. This will provide opportunities for each municipality to identify locations that are preferred or restricted based on local insights and interests.

[3] Preferred locations are identified in the Central Vermont Regional Energy Plan and include parking lots, expired gravel pits, landfills, brownfield sites, and similar locations.

Changes in Technology

As noted previously, the state's comprehensive energy plan and subsequently the Central Vermont Regional Energy Plan are both written with electricity as the primary power source. This direction includes renewable energy technology that exists today such as wind, solar, hydroelectric, biomass, and biogas. As technologies change and advancements are made in both efficiency and sources of renewable energy generation, the region's municipalities will need to be flexible and adaptable to these changes.

With this in mind, the Central Vermont Regional Energy Plan acknowledges and recommends consideration for changes in technology that do not limit renewable energy development to known sources. This concept will need to be continually revisited to ensure current technologies are considered and outdated technologies are not recommended.

Weatherization

Weatherization of buildings is a pathway that will work towards the energy goals related to conservation of energy. A portion of Central Vermont's housing stock is older and was constructed at a time when no specific codes existed for energy efficiency. Now, with the passage of the Residential Building Energy Standards (RBES) and the Commercial Building Energy Standards (CBES), new construction is required to meet minimum thresholds for energy efficiency. This will ensure new construction addresses energy efficiency, however weatherization of existing construction will need to be addressed.

Incentives may be required to assist property owners upgrade their current homes and buildings to include more efficient windows, doors, insulation, or mechanical systems. These upgrades can be costly which is often identified as the primary barrier to completing the needed changes. If incentives are available to assist property owners with weatherization projects, this may increase the efficiency of buildings while decreasing the consumption of energy. This could prove a viable alternative to new construction thereby extending the lifecycle of existing buildings throughout the region.

System Conversions

Similar to weatherization, older existing buildings will commonly have outdated and inefficient mechanical systems. These often include oil based heating systems or wood-fired units. With advances in technology, cold weather heat pumps, high efficiency wood stoves, and other mechanical systems can provide efficiency improvements for existing buildings that will result in conservation of energy. As noted previously, new construction will generally include these high efficiency systems which will help address energy conservation. Like issues related to weatherization, however, the conversion to high efficiency systems will be a challenge as the costs for equipment and building modifications needed to install these systems may be cost prohibitive to many residents and business owners in the region. In this regard, identifying potential incentives will be beneficial to support conversions.

GOALS AND POLICIES

The following section outlines the general goals that will help shape the energy future of Central Vermont. Detailed goals and policies are included in the Central Vermont Regional Energy Plan, however the themes are included herein to provide an overall sense of the direction being provided. As noted previously, energy touches multiple sectors and elements of the 2016 Central Vermont Regional Plan therefore these tenants are woven throughout the various plan sections for consistency and integration across multiple elements.

GUIDING PRINCIPLE:

The Central Vermont Regional Planning Commission will support the state's comprehensive energy plan goal of having 90% of the state's energy needs generated from renewable sources by the year 2050.

CONSERVATION AND EFFICIENCY

GOAL: Conservation and efficiency is practiced by individuals and organizations regarding building construction, heating systems, and daily choices.

Policy: Increase conservation of energy by individuals and organizations.

Policy: Promote energy efficiency in the design, construction, renovation, operation, and retrofitting of systems for buildings and structures.

Policy: Identify ways to decrease the use of fossil fuels for heating.

REDUCING TRANSPORTATION ENERGY DEMAND, SINGLE-OCCUPANCY VEHICLE USE, AND ENCOURAGING RENEWABLE OR LOWER-EMISSION ENERGY SOURCES FOR TRANSPORTATION

GOAL: Support alternative transportation options and alternative fuel vehicles throughout the region.

Policy: Encourage increased use of transit as a primary method to complete daily trips and reduce demands on existing infrastructure such as roads and parking.

Policy: Promote the shift away from single-occupancy vehicle trips to reduce congestion, impacts to local facilities, and support alternative options for transportation needs.

Policy: Promote the shift away from gas/diesel vehicles to electric or non-fossil fuel transportation options to reduce dependency on non-renewable fuel sources for transportation.

Policy: Facilitate the development of walking and biking infrastructure to provide alternative transportation options for the community.

PATTERNS AND DENSITIES OF LAND USE LIKELY TO RESULT IN CONSERVATION OF ENERGY

GOAL: Land use policies support compact development in mixed-use centers

Policy: Central Vermont is committed to reducing sprawl and minimizing low-density development by encouraging density in areas where infrastructure exists or is planned to support growth.

Policy: Strongly prioritize development in compact, mixed-use centers when feasible and appropriate; and identify ways to make compact development more feasible throughout Central Vermont.

DEVELOPMENT AND SITING OF RENEWABLE RESOURCES

GOAL: Renewable energy generation is sited to maximize potential while minimizing locally identified impacts

Policy: Evaluate generation from existing renewable energy generation by municipality including the identification of constraints, resource areas, and existing infrastructure by energy type.

Policy: Evaluate generation from potential renewable energy generation by municipality including the identification of constraints, resource areas, and existing infrastructure by energy type.