

PUBLIC HEARINGS NOTICE

TWO RIVERS-OTTAUQUECHEE REGIONAL COMMISSION

Notice is hereby given by the Two Rivers-Ottawuechee Regional Commission of two Public Hearings to be held for the purpose of hearing comments on the proposed amendments to the Two Rivers-Ottawuechee Regional Plan. The Regional Plan covers all lands within the towns of Barnard, Bethel, Bradford, Braintree, Bridgewater, Brookfield, Chelsea, Corinth, Fairlee, Granville, Hancock, Hartford, Hartland, Newbury, Norwich, Pittsfield, Plymouth, Pomfret, Randolph, Rochester, Royalton, Sharon, Stockbridge, Strafford, Thetford, Topsham, Tunbridge, Vershire, West Fairlee, and Woodstock. A copy of the proposed amendments to the Two Rivers-Ottawuechee Regional Plan are available for review at the Two Rivers-Ottawuechee Regional Commission's office during normal business hours and on the Two Rivers-Ottawuechee Regional Commission's website: www.trorc.org.

Hearing Dates:

Wednesday, April 12, 2017 at 6:30PM: Bethel Town Hall, 134 S Main St, Bethel, VT

Thursday, April 13, 2017 at 6:30PM: Thetford Town Hall, 3910 VT Route 113, Thetford, VT

Outlined below is a list of section headings of the Regional Plan chapters that have amendments proposed:

1. Definitions
2. Energy
3. Healthy Communities
4. History and Development
5. Implementation Matrix
6. Working Landscape

Also proposed for adoption is the Two Rivers-Ottawuechee Regional Energy Implementation Plan (to be adopted by reference as part of the Regional Plan) and related appendices. This includes:

1. Energy Implementation Plan
2. Appendix A: TRORC LEAP Outputs and Methodology
3. Appendix B: Energy Mapping
4. Appendix C: Energy Targets
5. Appendix D: Guide to Farming Friendly Solar

Dated this 22nd of February, 2017, Woodstock, Vermont

William B. Emmons, Chair

Peter G. Gregory, AICP, Executive Director

March 1, 2017

To: TRORC Selectboard Chairs
TRORC Planning Commission Chairs
Abutting Regional Planning Commission Executive Directors
Department of Housing and Community Development
Other Interested Parties

From: Peter G. Gregory, AICP, Executive Director

RE: TRORC Regional Plan Amendments

Two Rivers-Ottauquechee Regional Commission has initiated a process to update several sections of the TRORC Regional Plan. Currently, we are looking to adopt the following changes to the Plan in late June:

- **Definitions** – New definitions have been added to this chapter in an effort to further clarify important terms used in this document.
- **Energy** – This chapter has been revised with more up-to-date data, and the TRORC Energy Implementation Plan (EIP) has been adopted by reference as part of this chapter. Content that is addressed in the EIP has been removed from this chapter to avoid unnecessary duplication.
- **Healthy Communities** – The Healthy Communities chapter is an entirely new component of the regional plan.
- **History and Development** – This chapter has been updated to make the data and information in it current.
- **Implementation Matrix** – The Implementation Matrix now includes new columns that address potential cost of implementation, funding sources and general task priority. Any new action items included in the chapters which are under consideration for adoption (Healthy Communities, Working Landscape) were added to the matrix.
- **Working Landscape** – The narrative of this chapter has been entirely revamped, with the intention of addressing the challenges that our region's agricultural and forestry operations face, while also discussing possible solutions. Policies in this chapter have been edited, but are largely the same as what is in the 2015 Regional Plan.
- **TRORC Energy Implementation Plan and Appendices** – This document will be adopted by reference as part of the TRORC Energy chapter in the Regional Plan. The purpose of this document is to meet Enhanced Energy Planning standards set by the Department of Public Service which will allow the Regional Plan to receive a Determination of Energy Compliance. This Determination will allow TRORC to review local Enhanced Energy Plans. Plans which receive a Determination of Energy Compliance will receive a higher level of consideration under any Section 248 review proceedings.

128 King Farm Rd.
Woodstock, VT 05091
802-457-3188
trorc.org

Attached to this memorandum is the Public Hearing Notice, laying out the formal opportunities to react to this proposal, and the draft amendments under consideration.

William B. Emmons, III, Chair
Peter G. Gregory, AICP, Executive Director

The TRORC Board reviewed these updates at their meetings on January 25, 2017 and February 22, 2017, and subsequently approved going to public hearing. The Board encourages your participation in these hearings, and welcomes written comments at—or prior to—the hearings.

Please contact me if you have any questions.

Sincerely,



Peter G. Gregory, AICP
Executive Director, TRORC

I. DEFINITIONS

Accepted Management Practices (AMP) - Methods of activity generally approved by regulatory authorities and practitioners as acceptable and common to that type of operation. AMPs may not be the best methods, but are acceptable. Agriculture has AMPs typically documented in agency regulations. Other industries may also have AMPs, documented in regulation or not. Professional associations often list AMPs or similarly named methods of conduct for their members.

Active Living - Active living is a way of life that integrates physical activity in daily routines.

Active Transportation - Active transportation refers to any form of human-powered transportation – walking, cycling, using a wheelchair, in-line skating or skateboarding. There are many ways to engage in active transportation, whether it is walking to the bus stop, or cycling to school/work.

Adaptive Reuse - The development of a new use for an older building or for a building originally designed for a special or specific purpose.

Affordable Housing - According to 24 VSA §4303, affordable housing means either of the following, based on tenure:

- a. Housing that is owned by its inhabitants whose gross annual household income does not exceed eighty percent of the county median income, or eighty percent of the standard metropolitan statistical area income if the municipality is located in such an area, as defined by the United States Department of Housing and Urban Development, and the total annual cost of the housing, including principal, interest, taxes, insurance, and condominium association fees is not more than thirty percent of the household's gross annual income.
- b. Housing that is rented by its inhabitants whose gross annual household income does not exceed eighty percent of the county median income, or eighty percent of the standard metropolitan statistical area income if the municipality is located in such an area, as defined by the United States Department of Housing and Urban Development, and the total annual cost of the housing, including rent, utilities, and condominium association fees, is not more than thirty percent of the household's gross annual income.

Aging in Place - Allows individuals to remain at home or within a supportive living community as they age, without requiring the need to move as their needs increase over time.

Agriculture - The production, keeping or maintenance, for sale, lease or personal use, of plants and animals useful to man, including but not limited to: forages and sod crops; grains and seed crops; dairy animals and dairy products, poultry and poultry products; livestock, including beef cattle, sheep, swine, horses, ponies, mules, or goats, or any mutations or hybrids thereof, including the breeding and grazing of any or all of such animals; bees and apiary products; fur animals; trees and forest products; fruits of all kinds, including grapes, nuts and berries; vegetables; nursery, floral, ornamental and greenhouse products; or lands devoted to a soil conservation or forestry management program.

1 **Archaeological Site** - Land or water areas which show evidence or artifacts of human, plant or
2 animal activity, usually dating from periods of which only vestiges remain.

3
4 **Aquifer Protection Area (APA)** - The surface and subsurface area contributing significantly to
5 the surface and/or subsurface recharge and maintenance of an aquifer. APAs can often include
6 upland watersheds of surface waters contributing significantly to the maintenance and operation of
7 aquifers below the surface or downstream.

8
9 **Assimilative Capacity Study** - Scientifically valid research documenting the physical, cultural,
10 economic, ecological or other characteristics and of an area or site and that area's or site's ability to
11 host different changes to its characteristics before significant alterations in its function or character
12 are created.

13
14 **Base Flood Elevation (BFE)** - The elevation of the water surface elevation resulting from a
15 flood that has a 1 percent chance of equaling or exceeding that level in any given year. On the
16 Flood Insurance Rate Map the elevation is usually in feet, in relation to the National Geodetic
17 Vertical Datum of 1929, the North American Vertical Datum of 1988, or other datum referenced
18 in the Flood Insurance Study report, or the average depth of the base flood, usually in feet, above
19 the ground surface.

20
21 **Best Available Technology (BAT)** - Methods and products for design, operation, maintenance,
22 retrofit and function of activities which will result in the best reduction of undesired byproducts or
23 effects currently achievable. BAT achievability is based upon the owner/operator's ability to
24 implement the methods or products within their economic means. This type of technology is
25 usually considered to be the "state-of-the-art" and achieves the best performance available.

26
27 EXAMPLES: Woodstoves achieving best EPA particulate standard performance, highest
28 efficiency factory stack scrubbers, water treatment systems producing water of same or
29 higher quality as the receiving water body.

30
31 **Best Management Practices (BMP)** - Methods of activity generally established by regulatory
32 authorities and practitioners as the best manner of operation. BMPs are generally more stringent
33 than AMPs. BMPs may not be established for all industries or in agency regulations, but are often
34 listed by professional associations and regulatory agencies as the best manner of operation for a
35 particular industry practice.

36
37 **Best Practical Technology (BPT)** - Methods and products for design, operation, maintenance,
38 retrofit and function of activities which will result in the best reduction of undesired byproducts or
39 effects within the practical means of the owners/operators while providing a practical cost/benefit
40 ratio. For example, removing ninety-eight percent of a pollutant from a waste stream may be
41 practical, but removing the last two percent may be impractical for the cost required and the
42 relatively insignificant gain in cleanliness.

43
44 EXAMPLES: Woodstove operation schedule rotations, catalytic converter retrofits for
45 woodstoves versus mandatory stove upgrades, artificial wetland pretreatment of
46 agricultural runoff versus onsite treatment plant investment or storage/hauling.

Built Environment - The built environment includes all of the physical parts of where we live and work (e.g., homes, buildings, streets, open spaces, and infrastructure).

Build-out - An estimate of the projected population, employment, traffic, utilities, and types/sizes of land uses in a project area or other designated area in accordance with the current zoning and other applicable regulations.

Capital Improvements Program (CIP) - A proposed timetable or schedule of all future capital improvements to be carried out during a specific period and listed in order of priority, together with cost estimates and the anticipated means of financing each project.

Class A and B Waters - Class A waters are managed for enjoyment of water in its natural condition, as public drinking water supplies (with disinfection and filtration) or as high quality waters which have significant ecological values. Class B waters are managed for aesthetic values, recreation on and in the water, public water supply with disinfection and filtration, high quality habitat for aquatic biota, fish and wildlife, irrigation and other agricultural uses. The Secretary of the Agency of Natural Resources may designate by permit portions of Class B waters as “Mixing Zones”, or “Waste Management Zones”, for any waste that has been properly treated to comply with federal and state effluent requirements.

Cluster - A development design technique that concentrates building in specific areas on the site to allow the remaining land to be used for recreation, common open space, and preservation of environmentally sensitive features.

Cultural Facilities - Establishments such as museums, art galleries, botanical and zoological gardens of a historic, educational or cultural interest which are not operated commercially.

Designated Growth Centers - As defined by Act 183 – *An Act Relating To Creation of Designated Growth Centers and Downtown Tax Credit Program*.

Dwelling, Commercial – A commercial residential building, including but not limited to, a hotel, motel, rooming house, nursing home group home, residential care facility, or dormitory which is usually occupied in exchange for the periodic payment of a fee, contribution, donation or other object or service having value.

Dwelling, Single Family – A detached building used as a single living unit. “Single-family dwelling” is synonymous with this definition.

Dwelling, Two-Family – A building containing two living units. “Duplex” is synonymous with this definition.

Dwelling, Multi-Family – A building containing three or more living units.

Dwelling Unit – See “Living Unit.”

Dwelling Unit, Accessory (ADU) - Efficiency or one-bedroom apartments that are clearly subordinate to a single-family dwelling, with facilities and provisions for independent living (e.g., sleeping, food preparation, and sanitation). These units must comply with the following:

- i. Have sufficient wastewater capacity.
- ii. Do not exceed 30 percent of the total habitable floor area of the single-family dwelling they are subordinate to.

Environmentally Significant Wetland - Those wetlands designated by the Vermont Water Resources Panel as "Significant Wetlands", and those other wetlands designated as "significant" according to the wetlands designation rules are included in this category. As of February 23, 1990 the Water Resources Panel classified wetlands into three (3) groups. Classes 1 and 2 are "Significant Wetlands." Most of those wetlands designated on the National Wetlands Inventory (NWI) Maps are identified as Class 2 wetlands. Those wetlands contiguous to the mapped NWI wetlands are also included as Class 2 wetlands. Any wetland meeting the minimum criteria for significance established by the Water Resources Panel or a Town may be included in this category.

Establishment – A commercial business that operates within a building or structure. A single building or structure can contain more than one distinct establishment.

Expansion Areas - Land that extends the cohesive core of Regional Growth Areas or Designated Downtowns, Villages, or Growth Centers, with or without the presence of municipal sewer or water service. The land should be adjacent, as defined in 24 VSA §2791, to the cohesive core.

Fixed Route Service - A transportation service that travels along a predetermined route, with known stops, according to an established time schedule.

Flood Insurance Rate Map (FIRM) - official map of a community, on which the Federal Insurance Administrator has delineated both the special flood hazard areas and the risk premium zones applicable to the community. In some communities the hazard boundaries are available in paper, pdf, or Geographic Information System formats as a Digital Flood Insurance Rate Map (DFIRM).

Floodplain - Floodplains are those areas likely to be flooded once every one hundred years ("the 100-year flood zone") or have a one percent chance of being flooded per year as minimally determined by the Federal Emergency Management Agency (FEMA) or better sources.

Floodway - The floodway is that area of a stream channel and its surrounding floodplain areas that must be kept clear to hold the 100-year flooding event floodwaters without substantial increases in the flood height. Any flood height increase of more than one foot is substantial. Floodways are determined by the Federal Emergency Management Agency (FEMA) or better sources.

Fluvial Erosion - Erosion caused by streams and rivers. Fluvial erosion can be catastrophic when a flood event causes a rapid adjustment of the stream channel size and/or location.

Forest Block - A contiguous area of forest in any stage of succession and not currently developed for non-forest use. A forest block may include recreational trails, wetlands, or other natural features that do not themselves possess tree cover, and uses exempt from regulation under subsection 4413(d) of Title 24.

Forest Fragmentation - The division or conversion of a forest block by land development other than by a recreational trail or use exempt from regulation under subsection 4413(d) of Title 24.

Impervious Surface - Any hard-surfaced, man-made area that does not readily absorb or retain water, including but not limited to building roofs, roadways, parking and driveway areas, graveled areas, sidewalks, and paved recreation areas.

Inclusionary Zoning - Inclusionary zoning bylaws require a specified percentage of housing units in new planned unit development or subdivision to meet certain affordability standards, and comply with the following:

- a. Conform with municipal plan housing policies.
- b. Be determined based on municipal affordable housing needs, both rental and for sale.
- c. Include development incentives that contribute toward the economic feasibility of providing affordable housing units (ex: density bonuses and waivers).
- d. Require that, once built, affordable housing availability will be maintained through income qualification for residents, the promotion of affirmative marketing, and rent and resale pricing that remains affordable for a specified period of time on designated affordable units, as written in municipal bylaws.

Interchange - A grade separated system of access to and from major highways.

Intermodal - Transportation by more than one means of conveyance - as by foot, bike, car, truck, rail, air, etc.

Level of Service (LOS) - Level of service is a qualitative measure defined as the ability of a maximum number of vehicles to pass over a given section of roadway or through an intersection during a specified time period, while maintaining a given operating condition.

1. **LOS A:** Highest LOS which describes primarily free-flow traffic operations at average travel speeds. Vehicles are completely unimpeded in their ability to maneuver within the traffic stream. Stopped delay at intersections is minimal.
2. **LOS B:** Represents reasonably unimpeded traffic flow operations at average travel speeds. The ability to maneuver within the traffic stream is only slightly restricted and stopped delays are not bothersome. Drivers are not generally subjected to appreciable tensions.
3. **LOS C:** Represents stable traffic flow operations. However, ability to maneuver and change lanes may be more restricted than in LOS B, and longer queues and/or adverse signal coordination may contribute to lower average travel speeds. Motorists will experience an appreciable tension while driving.

4. **LOS D:** Borders on a range in which small increases in traffic flow may cause substantial increases in approach delay and, hence, decreases in speed. This may be due to adverse signal progression, inappropriate signal timing, high volumes or some combinations of these.
5. **LOS E:** This represents traffic flow characterized by significant delays and lower operating speeds. Such operations are caused by some combination of adverse progression, high signal density, extensive queuing at critical intersections, and inappropriate signal timing.
6. **LOS F:** This represents traffic flow characterized by extremely low speeds. Intersection congestion is likely at critical signalized locations, with high approach delays resulting. Adverse signal progression is frequently a contributor to this condition.

Living Unit – Building or part thereof that has a toilet, lavatory, kitchen facilities and one or more bedrooms that is reasonably private and separate from other living units. A single living unit may include one or more bedrooms, toilets and lavatories in an attached or detached building, such as a garage, provided that the attached or detached buildings does not include kitchen facilities. The terms “Unit” and “Dwelling Unit” are synonymous with this definition. The terms “dwelling,” “single-family dwelling,” “two-family dwelling” or “multi-family dwelling” shall not include boarding houses, dormitories, group homes or other similar buildings.

Major Development – Development that meets any one of the eight specific criteria that qualify a development as resulting in substantial regional impact (see ~~XIII~~ XIV, section A) according to this Plan.

Maximum Peak Hour Service Volume - The maximum number of vehicles which have a reasonable expectation of passing over a given roadway section or through a given intersection under prevailing road and traffic conditions during a specified hour of time.

New Town Center - as defined in 24 VSA §2791(11): the area planned for, or developing as, a community’s central business district. Composed of compact, pedestrian-friendly, multistory, and mixed use development that is characteristic of a traditional downtown and supported by planned or existing urban infrastructure, including curbed streets with sidewalks and on-street parking, stormwater treatment, sanitary sewers and public water supply.

NFIP - National Flood Insurance Program.

No Adverse Impact - No Adverse Impact floodplain management is where the action of one property owner does not adversely impact the rights of other property owners, as measured by increased flood peaks, flood stage, flood velocity, and erosion and sedimentation.

Open Space - Any parcel or area of land or water essentially unimproved and set aside, dedicated, designated or reserved for public or private use or enjoyment, or for the use and enjoyment of owners and occupants of land adjoining or neighboring such open space.

Peak Hour - As it is used in describing traffic volumes, it represents the hour of a twenty-four hour period in which the highest traffic volumes occur on a segment of roadway or at an intersection.

Passive Outdoor Recreation - Leisure time activities which use an outdoor public or private space that are not dependent upon structural facilities such as swimming pools, ball courts, etc.

Planned Unit Development (PUD) - Planned unit development is a design approach that balances intensive settlement with open land. Also known as “clustered housing”, developments can be designed to conserve energy; depending on the nature of construction, savings can be accrued on construction costs. PUDs facilitate efficient provision of municipal services such as fire protection, school transportation, road construction or maintenance. The undeveloped open space reserved in PUDs is an asset for the landowners and municipalities. PUD design strategies should be employed in planning for development or subdivision of rural land in the region.

Principal – Means foremost or chief.

Principal (Primary) Retail - A business whose primary use is the supply of merchandise or wares to the end consumer. Examples include (but are not limited to), supermarkets, hardware stores, dry-goods stores, pharmacies, big box stores, etc.

Pristine Waters - Those waters having Class A status and those waters predominantly in their natural state relatively unaffected by human activity physically or aesthetically. Undeveloped lakes and ponds may be included in this category, as would streams and rivers unaffected by human activity. Pristine waters are generally accepted to be the finest unspoiled natural water bodies or other waters with Class A qualities.

Recreational Trail - a corridor that is not paved and that is used for hiking, walking, bicycling, cross-country skiing, snowmobiling, all-terrain vehicle riding, horseback riding, and other similar recreational activity.

Regional Growth Area - As used in this plan, regional growth areas include the Regional Center, Town Centers, Village Settlements, Hamlet Areas, Designated Growth Centers, Designated Downtowns, and Designated Village Centers.

Regionally Significant Transportation Facilities - Any facility primarily designed to rapidly and efficiently transport goods and passengers between towns and/or regions.

Resilience - The ability of a system, community, region or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.

Riparian Buffer - A vegetated area (a "buffer strip") near a stream, usually forested, which helps shade and partially protect a stream from the impact of adjacent land uses. It plays a key role in increasing water quality in associated streams, rivers, and lakes, thus providing environmental benefits. With the decline of many aquatic ecosystems due to agricultural

production, riparian buffers have become a very common conservation practice aimed at increasing water quality and reducing pollution.

River Corridor - The land area adjacent to a river that is required to accommodate the dimensions, slope, planform, and buffer of the naturally stable channel, and necessary to maintain or restore fluvial equilibrium conditions and minimize fluvial erosion hazards, as delineated by the Agency of Natural Resources in accordance with river corridor protection procedure.

Secondary or Ancillary Retail – A business whose primary use is not retail sales, but contains a retail component that is clearly secondary to the primary use. Examples include (but are not limited to), eye doctor's offices, veterinarian's offices, small engine repair shop, manufacturer's with a small showroom, etc.

Service Business - Any establishment whose primary activity is the provision of assistance, as opposed to products, to individuals, business, industry, government, and other enterprises.

Smart Growth Principles - Growth that:

- a. maintains the historic development pattern of compact village and urban centers separated by rural countryside;
- b. develops compact mixed-use centers at a scale appropriate for the community and the region;
- c. enables choice in modes of transportation;
- d. protects the state's important environmental, natural and historic features, including natural areas, water quality, scenic resources, and historic sites and districts;
- e. serves to strengthen agricultural and forest industries and minimizes conflicts of development with these industries;
- f. balances growth with the availability of economic and efficient public utilities and services;
- g. supports a diversity of viable businesses in downtowns and villages;
- h. provides for housing that meets the needs of a diversity of social and income groups in each community;
- i. reflects a settlement pattern that, at full build-out, is not characterized by:
 - i. scattered development located outside of compact urban and village centers that is excessively land consumptive;
 - ii. development that limits transportation options, especially for pedestrians;
 - iii. the fragmentation of farm and forest land;
 - iv. development that is not serviced by municipal infrastructure or that requires the extension of municipal infrastructure across undeveloped lands in a manner that would extend service to lands located outside compact village and urban centers;

- v. linear development along well-traveled roads and highways that lacks depth, as measured from the highway.

Soils, Primary Agricultural – A farmland soils map unit that the Natural Resources Conservation Service of the U.S. Department of Agriculture (NRCS) has identified and determined to have a rating of prime or statewide significance. For the purpose of this Plan Prime Agricultural Land is synonymous with this definition.

Soils, Productive Forest – Those soils which are not primary agricultural soils but which have a reasonable potential for commercial forestry and which have not been developed. In order to qualify as productive forest soils, the land containing such soils shall be of a size and location, relative to adjoining land uses, natural condition, and ownership patterns so that those soils will be capable of supporting or contributing to a commercial forestry operation. Land use on those soils may include commercial timber harvesting and specialized forest uses such as maple sugar or Christmas tree production.

Source Protection Area (SPA) - The surface and subsurface area surrounding a public water source system, through which contaminants are likely to move toward and reach the water well or well-field during normal pumping activity. Synonymous with "Wellhead Protection Area" (WHPA). Most often delineated by the Vermont Department of Health.

Special Flood Hazard Area – The floodplain within a community subject to a one percent or greater chance of flooding in any given year. For purposes of these bylaws, the term “area of special flood hazard” is synonymous in meaning with the phrase “special flood hazard area”.

Sprawl - Dispersed auto-dependent development occurring outside of compact urban and village centers, along highways, and in rural countryside. Sprawl is typically characterized by:

- a. excessive land consumption;
- b. low densities in comparison with older centers;
- c. lack of choice in ways to travel;
- d. fragmented open space, wide gaps between development and a scattered appearance;
- e. lack of choice in housing types and prices;
- f. separation of uses into distinct areas;
- g. repetitive one-story development;
- h. commercial buildings surrounded by acres of parking;
- i. lack of public spaces and community centers.

Strip Development - Linear commercial development along an arterial highway leading from an urban or village center or connecting two centers. Strip development has many characteristics, not all of which need to occur for strip development to be present. The characteristics of strip development include, but are not limited to, the following:

- a. use of individual curb cuts for each project along the highway;
- b. lack of connections between the projects, except for the highway connection;

- c. one-story buildings containing a single type of use;
- d. little to no pedestrian circulation between projects on the strip;
- e. accessibility of individual projects primarily to automobiles;
- f. separation of projects by parking lots;
- g. individual project design, signage, lighting, parking, and landscaping; lack of coordination between projects concerning these items, causing cluttered appearance;
- h. narrow depth and broad street frontage of project parcels to take advantage of exposure on the arterial highway.

Substantial Regional Impact – A threshold for review under Act 250 and precedence of this Regional Plan as defined in Section XIV(A) of this Plan under the authority of V.S.A. Title 24, Chapter 117 §4345a(17).

Structure – An assembly of materials for occupancy or use.

Tax Increment Financing (TIF) - Provides authority for municipalities to bond for indebtedness due to infrastructure improvements within a TIF District.

Transit Development Plan (TDP) - A regionally developed transit plan approved by the Agency of Transportation which outlines passenger transportation needs and quality of service in the region. The TDP's goals are to be incorporated into the Transportation Elements of Regional Plans prepared by regional planning commissions.

Transportation Improvement Program (TIP) - A staged, multi-year, intermodal program of transportation projects, funded by the Federal Highway Administration or Federal Transit Administration, which are consistent with the Statewide Long Range Transportation Plan and its planning processes.

Traveler Services – Establishments whose primary purpose is to assist road travelers. These establishments would provide easy access to fuel, prepared food, restroom facilities, commuter parking, lodging or travel information. Establishments that fall under this definition do not include primary or principal retail establishments such as supermarkets, hardware stores, dry-goods stores, pharmacies or big box stores.

Universal Design - Universal design is the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.

Unnatural Conversion - Man-made successional changes in physical or biologic communities such as logging, development, mining, reduction of habitat continuity or composition or other actions altering the natural process of ecological change normally occurring in an area.

Wetland - Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Workforce Housing - Affordable housing that is in close proximity to employment centers, and is typically associated with members of the community who are gainfully employed in roles that may require advanced certification or degrees, including police officers, nurses and other medical staff, and school teachers.

DRAFT

1 I. ENERGY

2 A. Introduction

3 The Vermont Municipal and Regional Planning and Development Act (24 VSA Chapter 117)
4 stipulates that the Regional Plan shall have the purpose of guiding development in such a fashion
5 that it shall:

- 6 • Reduce wastes of energy which result from either excessive congestion or excessive
7 scattering of population;ⁱ
- 8 • Promote efficient and economic utilization of energy;ⁱⁱ
- 9 • Promote the conservation of the supply of energy;ⁱⁱⁱ
- 10 • Promote the reasonable use of energy resources.^{iv}

11 To accomplish this purpose, the Regional Plan must contain an energy element, which may
12 include an analysis of energy resources, needs, scarcities, costs and problems within the region
13 across all energy sectors, including electric, thermal, and transportation, a statement of policy on
14 the conservation of energy and the development of renewable energy resources, and a statement
15 of policy on patterns and densities of land use and control devices likely to result in conservation
16 of energy.

17
18 With the passage of Act 174 in 2016, the concept of “enhanced energy planning” was formally
19 included in statute. Regional Plans that meet standards set by the Department of Public Service
20 (DPS) for enhanced energy planning can seek a “Determination of Energy Compliance.” This
21 determination ensures that the Regional Plan will be given substantial deference in all
22 proceedings of the Public Service Board under §248. Additionally, with this determination,
23 regional planning commissions can grant determinations of energy compliance to communities
24 who meet the standards set by DPS. TRORC has developed a standalone Energy
25 Implementation Plan in order to meet the standards set by DPS. This Energy Implementation
26 Plan has been adopted by reference as part of this Plan.

27
28 The policies and programs in this chapter (and in the Energy Implementation Plan) are intended
29 ~~to act as a guide for~~ direct future development and to ~~serve as a tool to clearly outline~~ indicate
30 how energy development and generation ~~should~~ shall occur in this region. It is also intended to
31 ensure that the Two Rivers-Ottawquechee Region maintains a safe, efficient energy system which
32 encourages energy conservation and the generation of renewable resources in a manner that does
33 not negatively impact the rural nature of our communities.

34 B. Background

35 Concern about the sustainability of our nation’s dependence on foreign oil has grown greatly
36 since the oil crisis of the mid-1970s. In the mid-2000s the price of oil based fuels experienced a
37 dramatic rise, which highlighted the tenuous position that oil dependency has put the nation in.
38 ~~As prices of oil related fuels rise~~ Unpredictable fluctuations in the cost of fossil fuels can make
39 budgeting for everyday activities such as home heating and travel by car become increasingly

1 burdensome for our communities. While the Regional Commission recognizes that energy
2 supply and demand are directly influenced by economic forces at the state, federal, and
3 international levels, the manner in which our Region plans for future growth, how it consumes
4 energy, and where it chooses to get energy from, will have an important impact on global energy
5 resources.

6
7 Theories such as the Hubbert Peak Theory (a.k.a. Peak Oil), suggest that at some point – perhaps
8 sooner than later – the worldwide consumption of oil will outpace the existing supply. Although
9 new technologies may enable energy providers to extract oil from locations that were previously
10 impossible to reach, there is most likely a finite amount of oil available. Many of these more
11 extreme methods of energy extraction have the potential to create negative impacts on our
12 environment. Given the predictions of Peak Oil, the Two Rivers-Ottawaquechee Region, like the
13 rest of the world, should prepare for a very different future, one that focuses on sustainability.
14 Declining oil production and increasingly worrisome signs of climate change underscore the
15 need for good planning and active discussion about energy alternatives. It is in consideration of
16 this, that the Regional Commission supports the principles of energy conservation,
17 environmental stewardship, and energy independence.

18 **C. Statewide and Regional Energy Needs**

19 ~~According to the 2016 Vermont Comprehensive Energy Plan, energy demand grew at a 1.8% rate~~
20 ~~of growth from 1990 to 1999, but has been close to 0% for the past 10 years. The likely~~
21 ~~combination of state energy efficiency programs and the 2007–09 recession impacted energy~~
22 ~~demand across most end-use sectors. The 2010 American Community Survey indicates that the~~
23 ~~major heating fuels consumed in Vermont are oil (47%), electric (5%), wood (15%) and LPG~~
24 ~~and gas (30%).~~

25
26 Since 1970, total end-use energy consumption statewide has increased at an average rate of
27 around half a percent per year. Over the same period, Vermont’s population has grown at an
28 average rate of around 0.8% per year. This means that Vermont consumes about as much site
29 energy per capita today as it did in 1970. In more recent years, since around 2000, Vermont’s
30 overall demand for energy has moderated somewhat, even as the population and economy
31 continued to grow (albeit more slowly than in the decades before 2000). Total energy end use is
32 now 5% lower than it was 15 years ago, and per-capita site energy consumption now appears to
33 be on a slight downward trend, having decreased by around a half a percent per year on average
34 since 2000. This shift is mainly attributable to declining consumption of gasoline, electricity, and
35 distillates, the three largest components of Vermont’s total primary energy consumption.

In terms of per capita energy consumption for residential and transportation purposes, the North East is about the same as the rest of the U.S. In Vermont, almost 80% of residential energy is dedicated to space heating and domestic hot water, while approximately nearly 35% of the state's total energy usage goes toward transportation.

Of the energy dedicated to transportation, over 50% is used to fuel private cars for residents (as opposed to being used for public transit, road maintenance, or another public purpose). This reinforces the need for clear policy that guides land use in such a fashion that it does not continue to encourage auto-centric development.

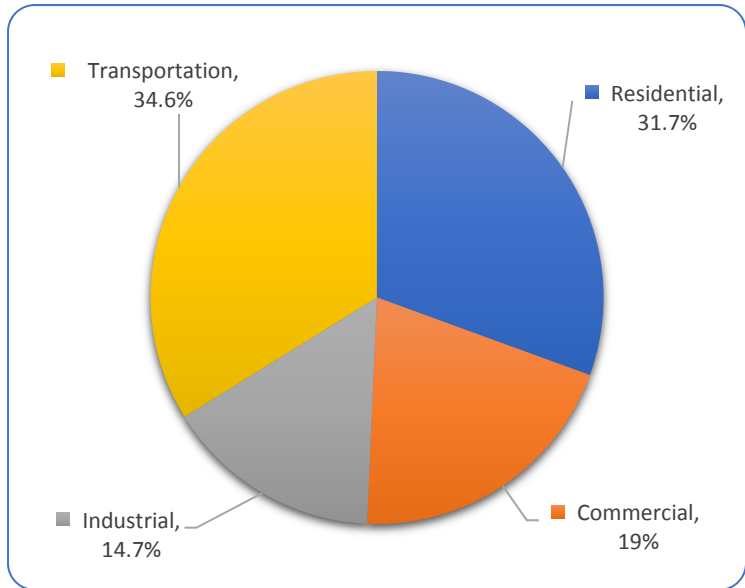


Figure 37: Vermont Energy Use by Sector, 2014
Source: U.S. Energy Information Administration

D. Current Energy Sources

Fossil Fuels

The Two Rivers-Ottawquechee Region, like Vermont, depends primarily on fossil fuels for energy production and transportation. As shown in the figure above, fossil fuels (most of which is used in transportation) account for more than 50% of all energy consumed in Vermont. Nearly 50% of the oil consumed in the U.S. is imported. Our economic system is so closely tied to the availability of fossil fuels that even modest price increases can lead to inflation, a slowdown in economic growth, and monetary instability. These instabilities have a much broader impact than just our economic system. Fluctuation in the price of fossil fuels can impact our communities at the municipal and residential level as well. Increasing fuel costs make it more

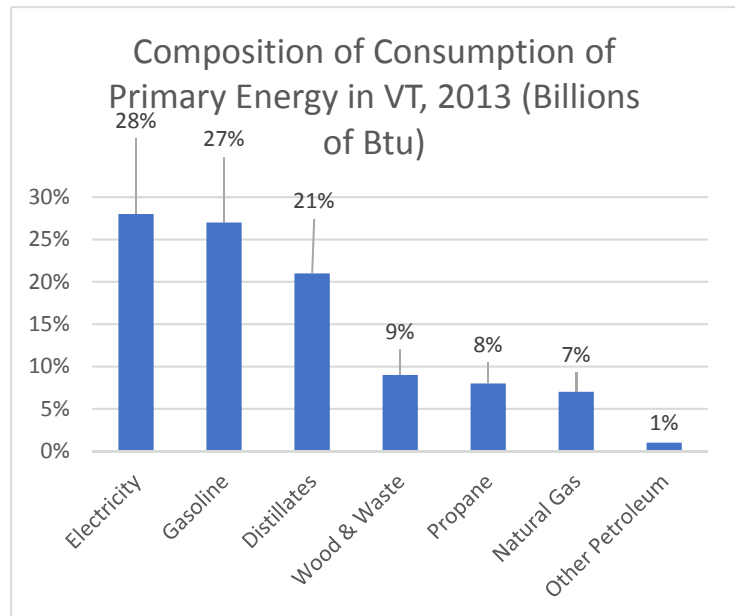


Figure 37: Primary Energy Consumption
Source: VT Department of Public Service

expensive for communities to provide services and maintain facilities. Rising costs can make it challenging for residents to heat their homes. The price and availability of food is also impacted by changes in fuel costs.

But these consequences of intensive fossil fuel use are only part of the story. The combustion of fossil fuels has been determined to be the largest contributor of atmospheric "greenhouse gases" (primarily carbon dioxide). There is consensus in the scientific community that continued accumulation of greenhouse gases within the earth's atmosphere ~~will~~ has lead to a warming of the atmosphere, or "greenhouse effect." Such warming causes severe coastal flooding and unpredictable climate shifts, threatening the viability of the earth's most significant urban and agricultural centers. Vermont has experienced an increase in the number of severe weather events¹. ~~In 2011 there were four federally declared disaster events, more than had ever occurred in a single year over the past twenty years, most notably Tropical Storm Irene in 2011.~~ If, indeed, climate instability and climate change are linked as many feel is the case, it is essential that we decrease our reliance on fossil fuels in an attempt to reverse or at least halt future damage to our atmosphere.

Nuclear Energy

~~Vermont Yankee Nuclear Power Station has been generating electricity since 1971. The age of the facility has begun to manifest itself in terms of plant instability. Between 2009-2010, the Vermont Department of Health identified several ground water monitoring wells at the facility that contained tritium. This finding indicated an unintended release of radioactive material, and it means that other radioisotopes may have contaminated the environment. At the same time, Vermont Yankee's license to operate was due to expire in March of 2012. This license extension request has been quite contentious, due in part to the previously mentioned tritium leaks, but also because the generation of electricity via nuclear fission remains controversial.~~

~~A properly maintained nuclear power facility can, to some extent, represent a cleaner form of energy production than fossil fuels. However, the mining, processing and disposal of nuclear material continues to raise questions. Nuclear generated electricity produces various long-lived radioactive wastes which are highly toxic and require extraordinary precautions for safe storage. Existing technology does not assure safe disposal. The industry has not completely resolved safety issues regarding the decommissioning of nuclear power plants.~~

Renewable Energy

Vermont can successfully claim that a substantial amount of the power used statewide comes from renewable sources when compared to other states. Although the majority of Vermont's renewable energy is generated through Hydro-Quebec (~~see below~~), some hydroelectric power is generated in Vermont. Additional sources of renewable energy include several utility owned commercial-scale wind and landfill methane projects and utility-scale solar facilities. For more information on renewable energy in the TRORC region and the siting of renewable energy generation facilities, see the TRORC Energy Implementation Plan.

¹ Based on disaster declarations for the State of Vermont as reported by the Federal Emergency Management Administration.

E. Electrical Generation

While Vermont is fortunate to have two large electricity generators that utilize fuels that are considered less harmful in terms of greenhouse gas emissions, the Regional Commission believes that we must continue to strive toward energy independence as a primary element of this energy plan. To do so we must consider a wide range of potential benefits and impacts on our region and utilize this analysis to create a plan for the future.

Regional Impacts of Energy Generation

Regional electrical generation has the potential to be a boon to our communities, through the generation of jobs as well as adding to the tax base. While larger scale facilities will generate more energy, and would have a more substantial impact on the economy, they would likewise have more potential negative impacts. Construction of new large capacity generators (such as combined cycle natural gas plants, nuclear generators, and coal generators) creates significant risks, due in part to large capital expenses necessary to begin construction, environmental impacts of large scale construction, and the likely need for significant upgrades to transmission facilities to efficiently move the power.

For the Two Rivers Ottauquechee Region, a smaller scale and more sustainable approach to electrical generation is more appropriate. Instead of large scale energy generation facilities, smaller scale systems, such as the combined cycle combustion turbines that used for district heating are more appropriate. These systems could offset otherwise needed transmission infrastructure upgrades, reduce reliance on oil for heating, and providing moderately priced energy to parts of Vermont. Small scale generation facilities may be more expensive to implement than larger systems due to scale, but they are lower impact, have lower emissions, offer long term affordability, and should provide our region with energy security and stability. Additionally, these facilities will provide direct employment opportunities to our region. While there are potential opportunities for gas powered small scale generation facilities, the Regional Commission believes that in order to reduce our reliance on fossil fuels, we must focus on energy generation that is sustainable. It is a priority of this plan that new energy generation facilities that are proposed within the Two Rivers Ottauquechee Region be renewable in nature. We believe that there are opportunities for generation through wind, solar and biomass, each of which has its own unique impact and potential.

Renewable energy generation in our region is generally encouraged by the plan. However, in order to protect our natural, scenic and historic resources while encouraging renewable energy development, a statewide inventory of areas that would be suitable for renewable energy generation should be developed. This inventory should consider which areas are considered too sensitive for this type of development.

Wind Energy Generation

As is indicated by the chart above, wind power generation has some potential in our region, as such, it is reasonable to assume that there will be proposals to site wind turbines in upland areas of this region. Wind turbines rely on wind speed and power density to generate energy. A site's wind power potential is expressed in classes, Class 1 being the lowest and Class 7 being the

highest. Areas rated as Class 4 or higher are suitable for utility scale power generation. Areas in the region that have areas of Class 4 wind power or higher exist in Barnard, Braintree, Bridgewater, Granville, Hancock, Pittsfield, Plymouth, Rochester and Stockbridge. For more information, see Potential Wind Development Area data (classes 1-7) at <http://www.vtenergyatlas.com>. Topography and wind patterns in the TRORC region is most suited for residential scale wind energy generation. These smaller facilities are suited to providing power to a few residences at most, but they have the advantage of having a fairly limited impact on the environment in which they are located.

Table 21: Total Acres of Land with Wind Energy Potential	
Residential (30 Meter)	256,989 Acres
Small-Commercial (50 Meter)	55,731 Acres
Large-Commercial (70 Meter)	21,599 Acres

Source: Vermont Energy Atlas, 2011

Most of the high elevation land (above 2,500 feet) which offers the best conditions for commercial wind energy generation in the region is public land, owned by the National Forest Service (Green Mountain National Forest) or apart of the Appalachian Trail. Federal land policies are not specific regarding wind generation facilities and do not provide policies on the placement of facilities on public lands. The development of site criteria to address environmental and community concerns is encouraged. Through a consensus building process, all stakeholders will have a better understanding of the issues surrounding these new land uses. This is particularly important to industry providers and regulatory agencies as it will make the process of getting a project underway more predictable.

In December of 2004, the Vermont Agency of Natural Resource (ANR) released its policy on the development of wind generation facilities on state owned lands. From the Wind Energy and Other Renewable Energy Development on ANR Lands policy: "While the development of such facilities at appropriate sites may well become a desirable and even necessary part of Vermont's energy future, the Agency believes that large scale renewable energy development on ANR lands such as commercial wind farms would be incompatible with the uses of and contrary to purposes for which ANR acquired these lands. Therefore, such uses are not allowed on ANR lands. Temporary wind measurement towers and other exploratory uses that are designed to evaluate the potential for future large scale renewable energy development on ANR lands are also not allowed."

While the benefits of wind power are substantial, the location of utility scaled wind energy turbines and associated facilities can adversely interfere with scenic, natural and historic resources. Past versions of this plan have focused primarily on the aesthetic impact of these facilities, but it is fair to say that in order to encourage the development of renewable energy, we may have to accept a reasonable amount of impact to the scenic quality of the region. That said, our primary concern with these facilities is the impact on our region's natural environment. Because much of the area in which even small utility scale systems would be built is currently undeveloped, careful consideration to the impact on natural and wildlife communities must be taken into consideration. Wind generation facilities need to be carefully sited so they don't destroy or significantly imperil necessary wildlife habitat blocks, migratory

bird patterns, or wildlife corridors. Wind turbines, power lines, access roads, and other components of a generating system have been known to disrupt the physical and ecological relationships of habitats. Approvals or permits for this use should not be awarded unless evidence clearly establishes that habitats will not experience an undue adverse impact.

Biomass and Biogas Energy Generation

The term ‘biomass’ refers to biologically based feedstocks (that is, algae, food or vegetable wastes, grass, wood, methane, and much more). Biomass can be converted into an energy source to fuel vehicles (e.g. biodiesel), heat homes, or even generate electricity. According to the 2011 Vermont Comprehensive Energy Plan, those using wood for primary heating consumed about 5.4 cords in 2007–08, while those using wood as a supplementary source used 2.25 cords. In that same year, Vermont households burned about 20,155 tons of wood pellets, with primary heat-source consumers burning 3.8 tons and supplementary heat-source consumers burning 1.2 tons for the season. There are a very limited number of biomass energy generation facilities in the TRORC region. Those that are in use generally supply heat to schools.

Commercial biomass energy generation facilities should be located close to available biofuels to reduce transportation impacts and costs. A biomass power plant would require a great deal of space to accommodate the various stages of collection and conversion of the mass into fuel before burning it to produce electricity. Water can also pose a problem as biomass facilities require large quantities to handle the recycling process of waste materials. Materials would have to be transported to and from the facility, so truck traffic should be a consideration in selecting a site. Additionally, before a biomass energy generation facility is located in the TRORC region, developers should prove that their proposed project will not negatively impact the rural character of the community or the local road system.

Agriculture has the potential to become a net generator of energy through biomass as well. Raising of crops for biofuels is one of the more productive and environmentally safe methods of agricultural energy generation. Methane digestion, where the methane from manure is used to power a turbine is another potential way farms can generate power. However, these facilities are generally only effective when utilized by a large scale farm.

Combined Heat and Power

Combined Heat and Power (also known as cogeneration) utilizes a heating system or energy generator to simultaneously generate both electricity and useful heat. Cogeneration was common during the industrial era before national scale power distribution when industries that generated their own power used exhaust steam for process heating. Large office and apartment buildings and stores commonly generated their own power and used waste steam for building heat.

The TRORC Region has no combined heat and power systems at present, but several communities have investigated the concept. CHP is generally most appropriate for larger communities with a substantial amount of municipal infrastructure and a cohesive downtown core, such as the villages of White River Junction and Randolph. The primary barrier to creating

1 CHP systems is financial as it is complex process to implement. The Regional Planning
2 Commission supports local efforts to develop combined heat and power energy systems.

3 **Hydro Energy Generation**

4 A substantial amount of Vermont's current energy system is generated through hydropower by
5 Hydro-Quebec, but it does have a number of smaller facilities. In the TRORC region there are
6 currently eleven operating hydropower facilities, which generate approximately 188,188 MWh
7 of power on a yearly basis. There are two main forms of hydropower: run-of-river which uses
8 the natural flow of water to generate power and facilities that store water behind an
9 impoundment. Run-of-river systems rely on seasonal rainfall and runoff to produce power,
10 resulting in periods of low production. Impounding water behind a dam allows for control of the
11 water flow, resulting in consistent electric production.

12
13 While most of the best sites for large-scale hydropower energy generation in Vermont have
14 already been developed, there are thirty three sites in the TRORC region that are considered "in-
15 service", meaning that they are not actively producing power, but have the basic infrastructure to
16 do so. Many of these sites are existing dams. Retrofitting these existing sites presents the most
17 effective means of adding potential hydropower while keeping environmental impacts low.
18 Hydroelectric development necessitates balancing priorities. While the benefits of generating
19 electricity from local renewable resources are evident, they are not without associated costs. The
20 power output from a given stream must be moderated by environmental considerations. A
21 minimum stream flow, adequate to support aquatic life forms, needs to be maintained and
22 impoundments need to be designed with water quality, land use, and recreation considerations in
23 mind.

24
25 Hydropower generating facilities are regulated by the Federal Energy Regulatory Commission
26 and stringent federal water quality standards. As a result, the regulatory process for hydro
27 facilities is extensive and time consuming. Further, streams are public trust resources and the
28 potential impacts of hydro projects warrant significant consideration. Any hydropower
29 development within the Two Rivers Ottauquechee Region must not result in an undue adverse
30 impact to riverine ecosystems and water quality.

31 **Solar Energy Generation**

32 Solar energy has potential for providing clean, reliable, and safe energy, even in Vermont's
33 climate. Most areas in Vermont have the potential for some solar energy production, at least at
34 the residential scale. In the TRORC region, if all potential opportunities to develop solar energy
35 production were taken advantage of, the region could generate roughly 41,366,479 kWh of
36 power.

37
38 **Passive Heating and Lighting**—Good building and site design are essential to taking advantage
39 of the sun's energy through passive methods. Communities that wish to encourage use of solar
40 in this fashion can utilize zoning bylaws and subdivision regulations to require the appropriate
41 placement of buildings, landscaping and building design.

1 **Water Heating**—Solar water heating is the most common form of residential scale solar use in
2 Vermont. Solar systems are not regulated at the state level (with the exception of historic
3 preservation review) and are subject to local regulations. State statute forbids the creation of
4 land use regulations that prohibit renewable energy generation, but towns should take care not to
5 implement regulations that make the utilization of solar water heating a challenge.
6

7 **Electricity Generation**—Decreasing costs of equipment have made solar electric generation
8 systems more prevalent. Solar systems are no longer utilized exclusively by “off grid”
9 buildings. The advent of net metering allows buildings to be connected to the grid while
10 utilizing renewable energy. Systems that are net metered are overseen by the Public Service
11 Board and are not required to get a local permit.
12

13 There have been several commercial scale solar electricity generation facilities proposed in the
14 TRORC region, although none have been built to date. Because of the nature of solar arrays,
15 they are in some ways more desirable than wind towers. This is primarily due to the fact that
16 they do not need to be located on high ground and are therefore less visually prominent. In
17 addition, these facilities can be located in areas that are less rural in nature, requiring fewer
18 access roads and reducing impact on wild lands. However, that is not to say that they do not also
19 have potential for negative environmental impacts. If not properly sited, large facilities can
20 impact soil and water resources as well as typical natural resources such as wildlife habitat and
21 corridors. Considerations also have to be given to public safety. Because photovoltaic collectors
22 are reflective, they have the potential to create harsh and blinding lights that could be a hazard to
23 nearby buildings or road traffic.
24

25 It should be noted that there is a growing movement to site commercial scale solar energy
26 generation facilities on farms. The “solar farm” has the advantage of producing its energy on
27 site, for a business that is by its very nature, energy intensive. It also provides the farm with an
28 additional stream of income (selling energy back to the energy provider). While this concept has
29 merit, any commercial scale solar energy facilities that are located on farms need to be sited so
30 as to maximize the availability of prime agricultural soils for continued agricultural use.
31 The Regional Plan is likely to be supportive of small commercial scale systems in the region if
32 they are sited in such a fashion that they avoid negative environmental impacts and ensure public
33 safety (particularly in relation to roads). We believe that there are existing locations, such as
34 former industrial sites and brownfields locations that would make excellent locations for solar
35 energy generation.

36 **F. Permitting Considerations**

37 Energy generation in Vermont is subject to a number of different permitting requirements, most
38 of which are limited to state level permitting. On the municipal level, state statute protects
39 residential renewable energy generation systems from regulations that will prohibit their
40 development.

Section 248 for Non-Renewable Generation Facilities, Transmission and Distribution Systems

Distributed power generation facilities, such as hydropower dams, fossil fuel plants as well as wind power or solar systems owned by utilities, are subject to review and approval by the Vermont Public Service Board (30 VSA §248). Under this law, prior to the construction of a generation facility, the Board must issue a Certificate of Public Good. A Section 248 review addresses environmental, economic, and social impacts associated with a particular project, similar to Act 250. In making its determination, the Board must give ~~due consideration~~ substantial deference to the recommendations of municipal and regional planning commissions and their respective plans if they have received a determination of energy compliance. Accordingly, it is appropriate that this Plan address these land uses and provide guidance to town officials, regulators, and utilities.

The Regional Planning Commission's criteria for renewable energy generation facilities are specifically addressed in the TRORC Regional Energy Implementation Plan (adopted by reference as part of this Plan). For non-renewable energy generation facilities, as well as transmission or distribution facilities, the following policies shall apply:

1. **Preferred Locations:** New non-renewable generation, ~~and~~ transmission, and distribution systems facilities shall be sited in locations that reinforce the region's traditional patterns of growth, of compact downtown and village centers surrounded by a rural countryside, including farm and forest land.
2. **Prohibited Locations:** Because of their distinctive natural, historic or scenic value, energy facility development shall be excluded from the following areas:
 - Floodways shown on FEMA Flood Insurance Rate Maps (except as required for hydro facilities);
 - Fluvial erosion hazard areas shown on Fluvial Erosion Hazard Area maps (except as required for hydro facilities);
 - Wetlands as indicated on Vermont State Wetlands Inventory maps or identified through site analysis;
 - Rare, threatened or endangered species habitat or communities.
3. **Significant Areas:** All new generation, transmission, and distribution facilities shall be sited and designed to avoid or, if no other reasonable alternative exists, to otherwise minimize and mitigate adverse impacts to the following:
 - Historic districts, landmarks, sites and structures listed, or eligible for listing, on state or national registers.
 - Public parks and recreation areas, including state and municipal parks, forests and trail networks.
 - State or federally designated scenic byways, and municipally designated scenic roads and viewsheds.

- Special flood hazard areas identified by National Flood Insurance Program maps (except as required for hydro facilities)
 - Public and private drinking water supplies, including mapped source protection areas.
 - Primary agricultural soils mapped by the U.S. Natural Resources Conservation Service.
 - Necessary wildlife habitat identified by the state or through analysis, including core habitat areas, migration and travel corridors.
4. **Natural Resource Protection:** New generation and transmission facilities must be sited to avoid the fragmentation of, and undue adverse impacts to the town's working landscape, including large tracts of undeveloped forestland and core forest habitat areas, open farm land, and primary agricultural soils mapped by the US Natural Resource Conservation Service.
5. **Protection of Wildlife:** Designers must gather information about natural and wildlife habitats that exist in the project area and take measures to avoid any undue adverse impact on the resource. Consideration shall be given to the effects of the project on: natural communities, wildlife residing in the area and their migratory routes; the impacts of human activities at or near habitat areas; and any loss of vegetative cover or food sources for critical habitats.
6. **Site Selection:** Site selection should not be limited to generation facilities alone; other elements of the facility need to be considered as well. These include access roads, site clearing, onsite power lines, substations, lighting, and off-site power lines. Development of these elements shall be done in such a way as to minimize any negative impacts. Unnecessary site clearing and highly visible roadways can have greater visual impacts than the energy generation facility itself. In planning for facilities, designers should take steps to mitigate their impact on natural, scenic and historic resources and improve the harmony with their surroundings.

Local Permitting

The Vermont Municipal and Regional Planning and Development Act (24 VSA Chapter 117) does not allow communities to impose land use regulation that prohibits or has the effect of prohibiting the installation of solar collectors or other renewable energy devices. It also prohibits communities from regulating the height of renewable energy systems such as windtowers provided that they are small in scale. However, statute does enable Vermont's municipalities to adopt regulatory bylaws to implementing the energy provisions contained in their town plan. Zoning bylaws and subdivision regulations are the most commonly used bylaws. Each affords the opportunity to promote energy efficient development at the local level.

Zoning bylaws control the type and density of development. It is imperative that communities recognize the connection between land use, transportation and energy and seek to create zoning ordinances and subdivision regulations that encourage energy efficiency and conservation. Encouraging high density and diverse uses in and around existing built-up areas will lead to more compact settlement patterns, thereby minimizing travel requirements. At the same time,

1 zoning bylaws must be flexible enough to recognize and allow for the emergence of
2 technological advancements which encourage decreased use of fossil fuels, such as increased use
3 of solar and wind power.

4
5 Local zoning bylaws may also permit the creation of planned unit developments (PUDs). PUDs
6 are a grouping of mixed use or residential structures, pre-planned and developed on a single
7 parcel of land. The setback frontage and density requirements of the zoning district may be
8 varied, to allow creative and energy efficient design (i.e. east-west orientation of roads to
9 encourage southern exposure of structures, solar access protection, use of land forms or
10 vegetation for wind breaks, and attached structures), and to encourage the construction of energy
11 efficient buildings.

12
13 Subdivision regulations are one of the most effective tools for encouraging energy efficiency and
14 conservation. Subdivision regulations, like PUDs, involve town review (through the Planning
15 Commission, Zoning Board of Adjustment or Development Review Board) in the design
16 process. Because subdivision regulations govern the creation of new building lots, as well as the
17 provision of access and other facilities and services to those lots, a community can impose
18 requirements that a developer site their building to maximize solar gain. Likewise, subdivision
19 can require that landscaping be utilized to reduce thermal loss.

20 **G. Energy Efficiency and Conservation**

21 Energy efficiency and conservation are the highest priorities of the TRORC Region. In general,
22 these elements are the most cost effective method of reducing energy use. It is always less
23 expensive to reduce consumption than to produce energy. But, there are barriers that prevent
24 home owners and businesses from making energy efficiency investments and participating in
25 existing programs. High upfront costs, split incentives, poor understanding of benefits, a lack of
26 information about efficiency and poorly timed home improvements all present challenges to
27 improving energy efficiency.

28
29 Improving existing structures and building new structures with a vision toward increased energy
30 efficiency is a critical way to promote energy conservation and lessen or postpone the need for
31 costly sources of additional energy. Enhanced energy efficiency in buildings and structures can
32 lessen the amount of income that our region spends on energy costs, decrease per capita
33 consumption of non-renewable sources of energy, and decrease the emission of both acid rain
34 precursors and greenhouse gases. Reducing the consumption of costly, imported forms of
35 energy and increasing the use of renewable emission-free energy can reduce reliance on global
36 markets, stimulating local economies.

37
38 Much of ~~Vermont's~~ the Region's building stock is old, and many of these buildings are
39 considered historic and are either listed on or eligible for listing on the State and National
40 Registers of Historic Places. ~~According to the 2011 Vermont Comprehensive Energy Plan, more~~
41 ~~than 40% of Vermonters live in historic buildings, of which there are more than 30,000 in~~
42 ~~Vermont. Approximately 76,800 homes (30% of the total number of homes in Vermont) were~~
43 ~~constructed before 1940.*~~ In Orange and Windsor Counties, 47% of homes were built before
44 1970.

1 There are a wide range of programs designed to reduce costs for home energy efficiency
2 improvements, many of which are organized by Efficiency Vermont. Efficiency Vermont is
3 Vermont's statewide energy efficiency utility, which is funded by an energy efficiency charge on
4 a consumer's electric bill; it is managed by the Vermont Energy Investment Corporation (VEIC),
5 an independent non-profit energy services organization that is under contract to the Vermont
6 Public Service Board. Efficiency Vermont helps Vermonters reduce energy costs by making
7 their homes and businesses energy-efficient. It provides technical assistance and financial
8 incentives to help Vermonters identify and pay for cost-effective approaches to energy-efficient
9 building design, construction, renovation, equipment, lighting and appliances. The Regional
10 Commission supports statewide, regional and local efforts to provide educational outreach to
11 communities to better educate homeowners as to what resources are available to them for energy
12 efficiency improvements.

13
14 New residential development in the State of Vermont is required to comply with Vermont
15 Residential Building Energy Standards (RBES). Commercial development is subject to similar
16 (but more effectively enforced) code regulations. Some examples of the types of development
17 the RBES applies to include:

- 18 • Detached one- and two-family dwellings.
- 19 • Multi-family and other residential buildings three stories or fewer in height.
- 20 • Additions, alterations, renovations and repairs.
- 21 • Factory-built modular homes (not including mobile homes)

22 In order to comply with the RBES, a home, as built, must meet all of the Basic Requirements and
23 the Performance Requirements for one of several possible compliance methods. If the home
24 meets the technical requirement of the RBES, a Vermont Residential Building Energy Standards
25 Certificate must be completed, filed with the Town Clerk of the community and posted in the
26 home. If a home required by law to meet the Residential Building Energy Standard does not
27 comply, a homeowner may seek damages in court. It includes heating and cooling systems as
28 well. Unfortunately, the program lacks a mechanism that enforces the proper filing of the
29 required certificate. Without having a way to penalize contractors who do not file these reports,
30 there is no way to ensure compliance with the RBES. Communities who wish to take a role in
31 guaranteeing compliance with this program can do so by requiring proof of filing as part of a
32 certificate of occupancy through their zoning ordinance.

33 **H. Municipal Energy Efficiency and Conservation**

34 Municipalities expend a substantial amount of their yearly budgets on energy related costs,
35 primarily for heating and transportation. When the price of fuel rises, costs rise, which forces the
36 community to either raise taxes or cut services. In the event that fuel costs were to double in the
37 future, municipalities could be dramatically impacted. Efficiency and conservation at the
38 municipal level can have a broad impact and will benefit the community as a whole. Some of
39 the opportunities for energy efficiency and conservation at the municipal level include:

- 40 • Tracking energy expenses by building.
- 41 • Conducting energy audits on municipal buildings.

- Creating municipal policies that reduce energy use (such as an energy efficient purchasing policy.)

State statute enables communities to form an Energy Committee, which is a volunteer board that focuses on energy issues. An Energy Committee can assist the Planning Commission with developing good energy policy. It can also be responsible for auditing and tracking energy expenses in order to recommend energy efficiency improvements for municipal buildings.

Capital Budget and Program

Given the potential expense of energy efficiency improvements, it is essential to wisely budget town funding to cover these costs. State statute enables communities to create a Capital Budget and Program for the purposes of planning and investing in long-range capital planning. Although most communities have some form of capital account where they save money, many do not have a true Capital Budget and Program. A capital budget outlines the capital projects that are to be undertaken in the coming fiscal years over a five-year period. It includes estimated costs and a proposed method of financing those costs. Also outlined in the Program is an indication of priority of need and the order in which these investments will be made. Any Capital Budget and Program must be consistent with the Town Plan and shall include an analysis of what effect capital investments might have on the operating costs of the community.

When planning for routine major facilities investments, such as roof replacements, foundation repairs, etc., it is important to also consider making energy efficiency improvements at the same time. The cost to replace or renovate a community facility will only be slightly higher if energy efficiency improvements are done at the same time, rather than on their own.

Municipal Incentives

Communities can also consider offering incentives to residents that encourage energy efficient improvements. Vermont enacted legislation in May 2009 (Act 45) that authorizes local governments to create Clean Energy Assessment districts. Once created, municipalities can offer financing to property owners for renewable energy and energy-efficiency projects. Eligible projects include the installation of solar water and space heating, photovoltaic panels (PV), and biomass heating, small wind, and micro-hydroelectric systems. Property-Assessed Clean Energy (PACE) financing effectively allows property owners to borrow money to pay for energy improvements. The amount borrowed is typically repaid via a special assessment on the property over a period of up to 20 years; if the property owner wishes to sell the parcel before fully repaying the obligation, then the obligation is transferred to the new property owner at the time of sale.

~~I. Energy and Land Use~~

~~There is a clear connection between the way we choose to develop land and how much energy is used. Our desire to maintain a rural landscape and to live within that landscape has the negative impact of requiring a greater need for transportation and for the extension of services in rural areas.~~

1 The first goal of Title 24, Chapter 117, §4302(c) is to “plan development so as to maintain the
2 historic settlement pattern of compact village and urban centers separated by rural countryside.”
3 This goal, if properly implemented should help us achieve greater energy efficiency and
4 conservation if we utilize the principles of Smart Growth in the creating of land use policy.
5 Denser development should be directed toward villages and downtowns, or into designated
6 growth areas immediately adjacent to them. Development within this core area should be mixed
7 use and multiple modes of transportation should be considered including pedestrian and bicycle.
8 The types of uses most appropriate for compact urban centers focus on high density residential,
9 commercial and civic uses. Governmental facilities, such as post offices, town offices, town
10 halls, etc. should be located within these compact urban centers, the only exception being
11 facilities such as town garages and landfills which are more appropriate in other locations.
12 In more rural areas, density should be more disperse and should take advantage of existing roads
13 whenever possible. Because transportation is such a substantial portion of local and regional
14 energy use, it is in the interest of communities to encourage any new developments that are
15 proposed to locate adjacent to existing roads. In particular, dense residential developments
16 should be located within or adjacent to existing village centers or within designated growth
17 areas. Commercial development that requires trucking and freight handling should only locate
18 on roads which can effectively handle the size of vehicle needed.

19 **J. Energy and Transportation**

20 It is important to recognize the clear connection between land use patterns, transportation and
21 energy use. Most communities encourage the development of residences in rural areas, and these
22 are in fact coveted locations to develop because of the aesthetics that make Vermont special.
23 However, this rural development requires most of our population to drive to reach schools, work
24 and services.

25
26 All land use planning and development should consider multi-modal transportation, including
27 pedestrian and bicycle travel. The location of large developments should be designed to
28 minimize transportation energy use through location adjacent to employment or housing,
29 downtowns or village centers or along transit lines.

30
31 Regional public transit in Vermont is a challenge due to the rural nature of our state, but the
32 TRORC region is fortunate to have several public transit providers (for more information see the
33 Regional Plan chapter on Transportation). The availability of public transit is a key element of
34 reducing our transportation energy use, and the Regional Commission remains very supportive
35 of our public transit providers.

36
37 The Regional Commission also supports Transportation Demand Management programs and
38 facilities, which reduce reliance on the single occupancy vehicles. These programs include ride
39 sharing, car pooling and greater use of transit service and bike and pedestrian options. In 2010
40 we conducted a regional park and ride needs assessment. Park and ride facilities, if located in
41 areas served by public transit, can increase public transit ridership. The region has eleven park
42 and ride lots, eight of which have public transit connections. It is estimated that in utilizing the
43 regional park and ride system, commuters will have annually reduced a total of 20,430,800 total
44 annual vehicles miles traveled, saving 3,630,800 pounds of CO₂ each year and saving an
45 estimated \$588,919 in annual commuting costs. Despite having eleven existing park and ride

1 facilities in our region, we believe it is important to continuously build upon and expand the
2 region's network, and continue to support efforts that work toward that goal.

3 **K. Energy Assurance Planning**

4 The dramatic rise in fuel costs in the late 2000's brought concerns about the stability of our
5 national energy system to the forefront. Dependence on foreign fuels puts the nation in a
6 position of weakness, unable to control prices and maintain fuel supplies. This lack of control
7 highlights the fragility of our dependence on foreign fuel, particularly petroleum. Because
8 Vermont has no refining capacity and no crude oil reserves, this creates distinct challenges in the
9 event of a petroleum emergency.

10
11 If the costs of petroleum were to, for example, double in cost, municipalities would be
12 challenged to continue to offer services and taxpayers would be forced to absorb those rising
13 costs. This, coupled with the impact such fuel cost price changes would have on the private
14 sector could spell disaster for any part of the United States. Additional concerns lie in our ability
15 to maintain our existing energy distribution systems in the event of a severe hazard event. The
16 State of Vermont has seen an increase in the number of declared disasters over the past decade.
17 In 2011, Tropical Storm Irene isolated a number of communities, keeping them from available
18 fuel sources.

19
20 Fuel disruptions can wreak havoc on our transportation systems, economies and the provision of
21 services. Municipalities should engage in comprehensive, integrated energy assurance planning
22 that is designed to mitigate and enable timely response to the consequences of energy supply
23 disruption whether through shortages created by cost or by hazard events. Municipal Hazard
24 Mitigation Plans should include an element that specifically addresses fuel shortages. To ensure
25 that there is a comprehensive approach to energy assurance planning, municipalities should
26 assess impacts to the local supply and distribution system in the event of a fuel shortage. This
27 plan should include a clear set of non-mandatory and mandatory fuel conservation measures.
28 These measures are designed to alleviate supply shortages or disruptions and potentially prevent
29 a more serious crisis. For more extreme events, communities should be prepared to implement a
30 fuel allocation program that ensures that any available fuel will be distributed to priority areas of
31 need, such as emergency response and health care providers.

32 **L. Goals, Policies and Recommendations**

33 **Goals**

- 34 1. Energy efficient homes and buildings are constructed to lessen or postpone the need for
35 costly sources of additional energy.
- 36 2. More public transportation facilities and opportunities exist to increase ridership in areas
37 already serviced by public transportation.
- 38 3. Educational efforts increase awareness and use of energy conservation practices.
- 39 4. Patterns of land use and development use energy most efficiently.

- 1 5. Renewable energy generation is sustainable and protects our natural and rural landscape.

2 **Policies**

- 3 1. Prior to the construction of additional or upgraded transmission or distribution lines or
4 related facilities, utilities must demonstrate that such public investments are justified to
5 improve efficiency and is not inconsistent with the goal to increase energy conservation
6 for the consumer. In the consideration of the public benefit resulting from such
7 investments, full consideration of the associated external costs must be reflected in any
8 decision. Prior to the acceptance or acknowledgment of any new energy source or
9 facility development affecting the region, full community and technical review is
10 required to enable objective analysis of the positive and negative economic, social,
11 aesthetic, and environmental impacts associated with the project.
- 12 2. Unless specifically prohibited within a land use area, New non-renewable generation
13 facilities, and transmission facilities and distribution systems, must be sited to avoid the
14 fragmentation of, and undue adverse impacts to the town's working landscape, including
15 large tracts of undeveloped forestland and core forest habitat areas, open farm land, and
16 primary agricultural soils mapped by the US Natural Resource Conservation Service.
- 17 3. Properly planned and constructed expansions and efficiency improvements to existing
18 hydropower generators and transmission facilities are required where such investments
19 clearly benefit the residents of the region and are in accord with goals and policies of this
20 Plan.
- 21 4. Where development and construction of electric power generation facilities (renewable
22 and non-renewable) are proposed for public use, design plans must consider placement of
23 such facilities in locations where environmental impact is minimal or reasonable
24 measures have been employed to mitigate adverse impacts.
- 25 5. The Regional Plan requires transportation practices that promote energy efficiency. This
26 includes the following initiatives:
- 27 i. Invest in bicycling and walking facilities within settlement and commercial
28 growth centers, and invest in bicycle and walking facilities that connect settlement
29 and commercial growth centers.
- 30 ii. Continue investment in public transportation and rideshare programs to reduce the
31 region's dependency on single-occupancy vehicle trips.
- 32 iii. Construct more park-and-ride commuter parking lots at Interstate interchanges
33 and within our settlement and commercial growth centers.
- 34 iv. Support transportation facility design enhancements that better accommodate
35 multimodalism on the region's existing roads and bridges.
- 36 v. Require large-scale private land use development to invest in transportation
37 infrastructure and services that promote multimodalism or provide the necessary
38 right-of-way to allow public investment in those facilities.
- 39 6. Capital investments of public utilities and services are encouraged within built-up centers
40 to support the high intensities of use.

- 1 7. Where it is demonstrated that the costs of providing energy services and facilities clearly
2 is outweighed by a public benefit to the areas or region and the land use settlement
3 patterns resulting from the development or subdivisions are in conformance with this
4 Plan and relevant local plans, such services and facilities should be permitted.
- 5 8. No new dams or major improvements to existing dams are supported without full
6 consideration of its social, economic, and environmental impacts, the appropriate local
7 plan, and this Regional Plan. Future hydroelectric power development must occur within
8 these guidelines:
 - 9 i. Run-of-the river projects are preferred over projects which require impoundments
10 with low or minimum flows;
 - 11 ii. Recreation and fisheries are top priorities for river uses and should not be
12 significantly diminished by hydropower development. Provisions should be made
13 for fish passage and canoe portages. Also, recreational opportunities at
14 hydropower facilities should be explored and developed where appropriate; and
 - 15 iii. Water quality and minimum flows must be maintained.
- 16 9. New developments that are proposed under Act 250 must include measures to reduce
17 energy consumption through site and building design, materials selection and the use of
18 energy-efficient lighting, heating, venting and air conditioning systems.
- 19 10. ~~The Regional Commission~~ TRORC supports the development and use of renewable
20 energy resources – including but not limited to wind, solar, biomass, micro hydro and
21 cogeneration – at a scale that is sustainable, that enhances energy system capacity and
22 security, that promotes cleaner, more affordable energy technologies, that increases the
23 energy options available locally, and that avoids undue adverse impacts of energy
24 development on the local community and environment.

25 **Recommendations for Action**

- 26 1. ~~The Regional Planning Commission should contribute to the creation of a statewide~~
27 ~~inventory of areas that would be suitable for renewable energy generation.~~
- 28 2. ~~The Regional Commission should work with state legislators to craft new language in~~
29 ~~Act 250 that will require Act 250 to consider greenhouse gas emissions as a waste that~~
30 ~~must be minimized, that private utility services be required to make reasonable efforts to~~
31 ~~incorporate onsite generation from renewable resources and that the location of~~
32 ~~development must also be determined to minimize transportation energy use through~~
33 ~~location adjacent to employment or housing, downtowns or village centers or along~~
34 ~~transit lines.~~
- 35 3. ~~The Regional Commission should continue to provide support and outreach to municipal~~
36 ~~energy committees.~~
- 37 4. ~~Local planning commissions, Selectboards, citizens, and members of the energy industry~~
38 ~~should work cooperatively to identify ways to reduce the cost of energy to consumers,~~
39 ~~and to promote efficiency in energy use and conservation.~~

- 1 5. ~~Local planning commissions should employ, as part of the review and approval process,~~
2 ~~all practical energy conservation measures to maximize energy efficiency in siting,~~
3 ~~design, and construction. Standards recommended by the Department of Public Service~~
4 ~~may serve as a basis for the development of such conservation measures.~~
- 5 6. ~~Continuing support should be given to wind and solar energy research and development~~
6 ~~in the region, as sustainable and emission free sources of energy.~~
- 7 1. Actively support partnerships, strategies, and state and federal legislation that will ensure
8 the affordable, reliable and sustainable production and delivery of electrical power to the
9 region, in conformance with regional and municipal goals and objectives.
- 10 2. The Regional Commission will participate in long-range utility planning and
11 development to ensure that local energy, resource conservation and development
12 objectives are identified and considered in future utility development.
- 13 3. Participate in the Public Service Board’s review of new and expanded generation and
14 transmission facilities to ensure that local energy, resource conservation and development
15 objectives are identified and considered in future utility development.
- 16 4. Work in cooperation with state and local agencies, emergency service providers, regional
17 suppliers and municipalities to develop local emergency contingency plans that ensure
18 access to critical energy supplies and measures to reduce nonessential energy
19 consumption in the event of an abrupt energy shortage.

ⁱ §4347(2)

ⁱⁱ §4347(3)

ⁱⁱⁱ §4347(4)

^{iv} §4347(5)

^v 2011 Vermont Comprehensive Energy Plan, p.162

Fostering Healthier Communities



VISION: Communities where healthy living is an easy part of everyday life for all.

The purpose of *Fostering Healthier Communities* is to facilitate and encourage municipalities to plan for and create vibrant, active places through their built environments that encourage healthy lifestyles.

How a community is designed has a direct effect on the health of its citizens. Land development patterns, zoning ordinances, and land use classifications impact walkability, access to services, and transportation options.

In many respects, the concepts for healthier communities are already prevalent in Vermont's land-use planning and; therefore, are already included throughout the TRORC Regional Plan. Many town plans in the region already include goals, policies, and recommendations that support

healthy places as well. For example, Woodstock's town plan includes a suggested action to reduce greenhouse gases by implementing an anti-idling policy for all vehicles.

The American Planning Association has determined; however, that including a specific chapter explicitly focused on public health ensures that a greater emphasis is placed on health throughout other plan elements.¹

Communities where residents feel connected to neighbors, have a sense of belonging, have safe options for walking and being active, and have easy access to services, healthy foods, the natural environment, and affordable housing are communities where people enjoy greater health and well-being.

Goal 1: The impact of our built environment on health is understood.

Goal 2: Communities are intentionally designed to promote physical and mental health.

COMMUNITY DESIGN, THE BUILT ENVIRONMENT, AND LAND USE

What does it all have to do with public health?

Community design can and should accommodate a range of lifestyles, age groups, and working conditions. Land use choices influence the underlying determinants of community and environmental health, such as obesity, heart disease, mental health, social isolation, nutrition, and air quality. Developing coherent strategies that integrate health considerations is critical.

A community's capacity to provide affordable and appropriate housing, supportive community features and services, and adequate mobility options for people of all ages and abilities is rooted in its local zoning codes and related land use policies. ~AARP

The built environment includes all of the physical parts of where we live and work (e.g., homes, buildings, streets, open spaces, and infrastructure). For

example, the built environment influences a person's level of physical activity: Inaccessible or nonexistent sidewalks and bicycle or walking paths contribute to sedentary habits.²

Healthy land use patterns can be achieved by encouraging infill; focusing mixed-use developments in established downtowns and village centers; avoiding sprawl and encouraging land use patterns that promote walking, bicycling, and transit use.

Note: This chapter does not include an inventory of health care facilities and services; however, some discussion of "Services for Vulnerable Populations" and area health care entities and availability of services can be found in Appendix ?.

Population Shifts

The proportion of Vermont's population that is 60 and older is growing more rapidly than other components of the population. The U.S. Census Bureau estimates that more than 29% of Vermont's population will be 60 and older by the year 2030, an increase of 40% from 2012.³

Orange and Windsor Counties are home to almost 85,000 people. Of these people, almost 36,000 (42%) are over age 50; more than 21,000 (24%) are over 60; almost 7,800 (9%) are over 70; and nearly 2,700 (3%) are over 80.⁴

Healthy lifestyles have a greater influence than genetic factors on avoiding age-related decline in physical and mental health and on the well-being of persons over 65. In addition, well-being can be promoted through sustainable ageing in place, which involves helping older residents remain in their community while also addressing the long-term economic, social, and health needs of both current and future generations at every age.⁵

gaining 30-34 year-olds & more

Great news! We're gaining in a much-needed age cohort, now let's give them healthy, happy, and affordable places to stay and raise their children.

On the flip-side, a closer look at age cohorts does reveal that our region is gaining residents, particularly in the 30-34 range. Since some of our schools are losing students at a fairly rapid rate, and employers are struggling to fill jobs, this is most certainly the age group we need to attract. While we continue to support our long time Vermonters who wish to stay here, we must also put those things in place that attract more families with young children: Great town centers, affordable housing, a great place to raise children,

and a place that makes families feel welcome and safe.⁶

“As chronic diseases such as arthritis, obesity, and diabetes increase in prevalence, the need becomes paramount for communities where elderly and disabled persons (and young persons with few resources) can function well and contribute to society without needing to own an automobile.” ~American Journal for Public Health

Growth in Obesity Rates

Obesity has reached epidemic proportions in Vermont and across the United States. In 2015, a quarter of Vermont adults (20 and older) reported being obese, while an additional 35% were overweight. The rate of obesity in Vermont is significantly lower than the U.S. overall (29%), while the rate of overweight is similar (35% vs. 36% U.S.). Among adults 20 and older in Vermont, the rates of overweight and obesity remain statistically unchanged since 2011.⁷

In 2015, 12% of students were obese and 14% were overweight—a significant decrease from 16% in 2013. One in 8 Vermont youth in grades 9 to 12 are considered obese. Additionally, 1 in 7 Vermont youth in grades 9 to 12 are overweight and at risk of becoming obese.⁸ While obesity affects people

from all backgrounds, lower income Vermonters are disproportionately affected.⁹

Obesity-related conditions cost billions of dollars each year and is the cause of an estimated 300,000 premature deaths in the United States. Some of the health effects associated with obesity include: high blood pressure, diabetes, heart disease and joint problems.¹⁰



WHAT MAKES A HEALTHY COMMUNITY?

Healthy Food Access

Research shows that one of the most effective ways to prevent obesity and improve outcomes for those who are overweight is to create opportunities for healthy eating for everyone in the community.

Lack of transportation to a grocery store presents a serious problem for

many people.¹¹ According to the U.S. Census, approximately 2% of households in Orange and Windsor Counties have no vehicle. While this percentage may seem low, when you look at the total population, one must consider that many households without cars are not necessarily close to needed services, including grocery stores. Public transit is also lacking in many of our towns.

In Vermont, one of the best ways to ensure young people have access to healthy food is for schools to participate in the Vermont Farm to School Network.

Relationship to the Built Environment:

- Access to transportation
- Location and type of food outlets

Positive Health Outcomes:

- Combats diseases
- Helps fight obesity
- Improves longevity
- Boosts energy
- Improves mood

“Food access is not simply a health issue but also a community development and equity issue. For this reason, access to healthy, affordable, and culturally appropriate food is a key component not only in a healthy, sustainable local food system, but also in a healthy, sustainable community.”

~American Planning Association

- May reduce health care costs

Policies:

1. Increase access to healthy foods.
2. Support the Vermont Farm to School Network.

Recommendations for Action:

1. Municipalities should connect with the Vermont Farm to Plate and Farm to School networks to see how they can best promote the consumption of locally grown foods to their residents.
2. TRORC and/or State should create mapping resources:
 - a. Locality of grocers, convenience stores, farmers' markets, farms, agricultural institutions, processing facilities, distributors, community gardens, food banks, and food pantries.
 - b. Identify transportation routes/types to food retail.
 - c. Location of low-income census tracts.
3. Municipalities should develop incentives for small or convenience store owners to stock healthy and local options.
4. Municipalities should promote and expand farmers markets and community gardens.
5. TRORC and municipalities should educate state and local policymakers on connections between food access and nutrition.
6. Municipalities should support the preservation of large, contiguous blocks of productive agricultural land.

7. Municipalities should work jointly with other jurisdictions to preserve agriculture land.

Healthy Homes

Housing is the best known predictor of health.¹² Lead exposure can lead to significant abnormalities in cognitive development; asbestos and radon exposure can increase the chance of developing lung cancer; uncontrolled moisture, mold, pests, and other triggers cause or exacerbate asthma and other respiratory dysfunction; inadequate heat can lead to use of inappropriate heating sources potentially resulting in fires or carbon monoxide poisoning; and poorly maintained stairwells and other structures can cause injuries. Not surprisingly, many health-related hazards are disproportionately found in low-income housing.

"In every community, property owners, advocates, code officials, public health leaders, and others are positioned to recognize and coordinate their shared missions of keeping people safe and healthy in the places they live."*

~National Center for Healthy

On average we spend 90% of our time indoors;¹³ therefore, existing homes offer significant opportunity to protect public health and reduce health disparities especially for those who are

particularly vulnerable and who spend more time in the home, such as children and the elderly.¹⁴

Health outcomes can be improved by making physical changes to a home. But creating a healthy home only goes so far to promote health and health equity. Homes must also be affordable.

Housing affordability is addressed in detail in the “Housing Resources” chapter; but it bears repeating here: for the health of our schools, towns, and our economy as a whole, we must put policies in place that encourage young families and the elderly to live and thrive here. Affordable housing provides low-income residents the opportunity to redirect some of their resources to healthy food and health care.¹⁵

The addition of housing units to existing neighborhoods—through attached housing, accessory units, or conversion to multifamily dwellings—creates opportunities for communities to slowly increase density on land served by existing infrastructure without radically changing the landscape, while providing needed housing for a variety of residents.¹⁶

Relationship to the Built Environment:

- Healthy construction practices
- Healthy building materials
- Good maintenance practices
- Sufficient air ventilation
- Quality affordable housing
- Quality public housing

Positive Health Outcomes:

- Better indoor air quality lessens the following:
 - Communicable disease

- Lead poisoning
- Respiratory illness
- Skin disease
- Alleviates stress
- Positive health and emotional benefits¹⁷
- May reduce health care costs

Policy:

1. Prioritize the development and maintenance of high-quality affordable housing.

Recommendations for Action:

1. The Vermont Department of health should provide community assessment, testing sites and remediation programs for housing-related illnesses (blood lead levels, respiratory health, and skin disease).
2. The Vermont State Housing Authority and other housing entities should educate policymakers on the relationship of poor housing conditions to health outcomes.
3. TRORC should advocate for project approval processes that reflect the Housing Resources chapter’s housing-needs allocation for all income levels.
4. TRORC and municipalities should participate in health impact assessments of proposed housing developments.
5. Municipalities should support efforts to structure community design, housing and healthcare to meet the needs of seniors and those with disabilities.¹⁸
6. Municipalities should work with local housing authorities to

- create a variety of housing types and maintenance options.
- 7. The state and housing organizations should promote healthy home renovation and construction.

Environmental Quality

Safe air, land, and water are fundamental to a healthy community environment. An environment free of hazards, such as secondhand smoke, carbon monoxide, allergens, lead, and toxic chemicals, helps prevent disease and other health problems. Implementing and enforcing environmental standards and regulations, monitoring pollution levels and human exposures, building environments that support healthy lifestyles, and considering the risks of pollution in decision-making can improve health and quality of life.¹⁹



Relationship to the Built Environment:

- Public transportation
- Proximity of services to one another and housing

- Building construction methods
 - Healthy homes
 - Indoor air quality
- Potable water quality
- Brownfield restoration
- Reduces health care costs

Positive Health Outcomes:

- Lower incidence of chronic diseases
- Better quality of life
- Clean air
- Clean water
- May reduce health care costs

Note: While this section offers specific recommendations to improve environmental quality, TRORC believes that most recommendations throughout the “Fostering Healthier Communities” chapter have the ability to improve our overall environmental quality.

Policies:

1. Minimize the risks to human health and the environment posed by hazardous sites.
2. Improve air and water quality and reduce air and water pollution.
3. Promote compact, mixed-use development.

Recommendations for Action:

1. TRORC should advocate for implementation of the state’s greenhouse gas reduction plans.
2. TRORC and municipalities should participate in the review of environmental impact reports.
3. TRORC and municipalities should advocate for and participate in health impact assessments.

4. Municipalities should prioritize the reuse and remediation of brownfields.
5. Municipalities should require new development and significant additions to existing development to provide adequate tree canopy to improve or maintain environmental health.
6. TRORC and municipalities should continue to advocate for plentiful, high-quality drinking water.
7. The State and municipalities should protect water quality of rivers, streams, lakes, and wetlands.

Active Living & Active Transportation

As the built environment has become increasingly car-centric, levels of physical activity have correspondingly declined. Reduced physical activity has resulted in population weight gains. To counter these trends, it is necessary to make communities more conducive to physical activity once again, particularly walking and cycling.²⁰

Designing our communities to be safe and walkable and in a way that provides access to essential goods and services is extremely important for all ages, as well as the environment.

Locating services near housing and transportation options allows seniors, and those without reliable transportation, to live more independently. Sprawling, dispersed services and shopping not only are costly to governments and residents,

but they also detract from residents' quality of life. As communities are redesigned to allow seniors to age in place, it is important to ensure that drop-off and pick-up locations are safe: from providing adequate lighting around neighborhoods, to maintaining or installing sidewalks, to installing ramps and handrails where previously there were only stairs.

Parks and recreation facilities provide opportunities for physical activity and can help people of all ages lead a more active lifestyle. Some lower-income communities tend to have less access to quality parks and recreation facilities. Making recreational facilities accessible in all communities is a critical strategy for increasing physical activity and preventing obesity.²¹

People who live in walkable, mixed-used communities are more than twice as likely to be physically active 30 minutes or more each day, compared to those who live in communities oriented to motor vehicles.

~ChanaeLah Solutions

Active Transportation:

Active transportation refers to any form of human-powered transportation – walking, cycling, using a wheelchair, in-line skating or skateboarding. There are many ways to engage in active transportation, whether it is walking to the bus stop, or cycling to school/work.

Increasing transit access is a key strategy to creating healthy communities. It promotes physical activity through daily exercise, reduces air pollution by encouraging alternatives to automobile use, and connects residents to needed services such as jobs, housing, education, healthy food, recreational opportunities, and medical facilities.

By encouraging active transportation, a community can reduce the number of collisions by providing safe conditions for pedestrians and cyclists.²² Communities can ensure that all residents have the opportunity for safe, active transportation by supporting and implementing the Complete Streets law that was passed by the Vermont Legislature in 2011. See the Transportation chapter for more details.



“A complete street in a rural area will look quite different from a Complete Street in a highly urban area, but both are designed to balance safety and convenience for everyone using the road.”²³

~Smart Growth America

The implementation of bicycle and pedestrian trails has been demonstrated to promote a healthy

lifestyle.²⁴ Biking and hiking trails can promote increased activity, and can be created with smaller amounts of land than large parks. They can often be created from “leftover” or unwanted land.

When designing for active living, older people and those with disabilities must be involved in assessing a community’s strengths and deficiencies. They should play a role in suggesting changes and in implementing and monitoring improvements, these residents can speak to their own experience of the communities’ positive characteristics and barriers.²⁵

Relation to the Built Environment:

- Easy access to parks or open space
- School land available for recreation after school hours
- Less time commuting
- Available, efficient, cost-effective public transit
- Maintained bicycle lanes, bicycle parking, sidewalks and lower speeds—where appropriate—allow for safe pedestrian options and lessen noise and air pollution
- Maintained pedestrian, wheelchair, and stroller amenities such as walkways, crosswalks, and islands
- Buffer separating cars from pedestrians, wheelchairs, strollers, and bicyclists.

Positive Health Outcomes:

- Leads to increased physical activity

- Provides connection to nature
- Offers the opportunity for connection to neighbors and community
- Helps reduce obesity and incidence of chronic diseases
- Alleviates stress
- May reduce health care costs

- 6. Municipalities should promote joint use of park and recreation facilities between communities.
- 7. Municipalities should promote existing trails.

Policies:

1. Create a balanced and equitable transportation system that provides for the safety and mobility of pedestrians, bicyclists, strollers, and wheelchairs.
2. Incorporate active transportation design features into new development projects.

Recommendations for Action:

1. The State and/or TRORC should map neighborhoods and advocate for connectivity to essential services, walkable routes, recreations opportunities, and transportation options.
2. Municipalities should conduct walkability and bikability assessments.
3. The State and TRORC should work with local jurisdictions to adopt bike and pedestrian master plans.
4. The State and TRORC should educate decision makers on links between safe streets and health.
5. TRORC should collaborate with local agencies and communities to implement Safe Routes to Schools programs and Vermont's Complete Streets program.

Social Inclusion

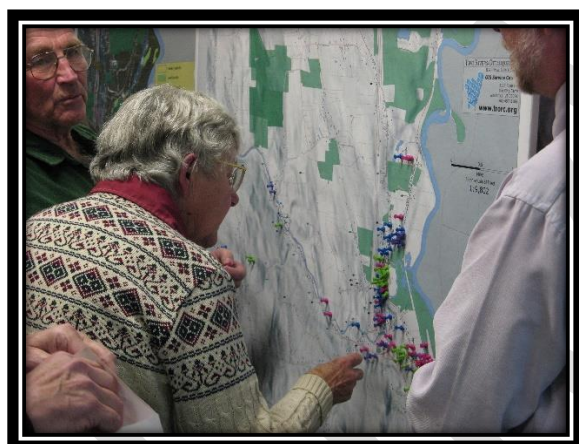
Social inclusion represents a vision for a “society for all” in which every individual has rights, responsibilities and an active role to play.²⁶ Creating spaces for people young, old and with varying degrees of abilities is imperative to helping create healthy communities.

Opportunities to participate in, and make a positive contribution to community and society—no matter a person's age or abilities—are integral to dignity. Maintaining contact with family and friends, participating in cultural and community activities and using skills all contribute to social inclusion.²⁷ Involving people of all ages at all levels of service planning and delivery benefits the individuals involved, as well as the community as a whole.

Age discrimination, sometimes alongside other forms of discrimination, can contribute to the social isolation of older people. The risk is greater for people living alone and the very elderly, and can be increased by bereavement, loss of work or poor health. Such isolation can contribute to the incidence of mental illness, particularly depression.

Many people with disabilities* unnecessarily experience life quite differently. They may not have a sense of place or belonging in the community and may not have access to activities they prefer or desire. In 2015, about a quarter (23%) of Vermont adults reported that they are disabled, similar to the 22% among U.S. adults overall. Disability increases as age increases.²⁸

Social inclusion may also go a long way toward attracting and keeping a younger population who feel that they are welcome and heard.



Relation to the Built Environment:

- Access to public gathering spaces
- Access to goods and services
- Access to public transit
- Housing stability

Positive Health Outcomes:

- Positive attitudes
- Sense of belonging and well-being

- Increased self-esteem

Policies:

1. Promote increased, accessible use of public space, walkable and accessible neighborhoods, and mixed-use development.
2. Increase affordable and reliable transit options to essential services.
3. Improve parks, recreation facilities and open spaces for accessibility and community mingling.

Recommendations for Action:

1. The municipality should map public gathering spaces and indicate level of accessibility.
2. Public health professionals should educate decision makers on the link between social support and health.
3. Municipalities should consider accessibility when developing public spaces and or recreational opportunities.
4. The State and TRORC will provide training for neighborhood residents to participate in boards and commissions.

Age-Friendly Environment

Age-friendly environments cultivate well-being and the participation of people as they age.²⁹ They provide services and support that enable recovery or that compensate for the loss

* Disability is defined as activity limitations due to physical, emotional, developmental, or mental problems OR any health problem that requires use of special equipment (e.g. wheelchair or special phone).

of function with the goal that individuals can keep on doing the things that are essential to them.

Many of the policies and recommendations within this chapter would allow residents a level of independence and an opportunity to engage in community life. However, for persons of all ages, particularly the elderly, access to appropriate housing, mobility, and essential goods and services is extremely important.

The State of Vermont has placed an emphasis on independent living for both seniors and the disabled. Creating a support network which allows seniors to age in place rather than enter into institutional facilities will allow the region to cope with its rapidly expanding senior population. Independent living is a more attractive option for seniors and the disabled, and it is also more cost effective than institutionalizing people within the medical system.

Many towns within the TRO region are rural and do not have the appropriate infrastructure or an adequate range of available services to support aging in place. Many seniors over the age of 65 have some form of functional limitation.^{†30} Additionally, elders who age in place are often isolated in their homes.

One concept in particular that has been gaining traction across the nation, as

well as in our Region is the “Community Health Care Coordinator.”

“Many services are available for meeting all kinds of health care needs. Some services are managed and funded locally; some regionally; some statewide and others nationally. However, individuals needing care sometimes don’t get that care because they don’t know it exists or because it is challenging to deal with all the agencies providing the services.” ~Carol Langstaff, Sharon Resident

As a care coordinator, community health workers (CHW) help individuals with health conditions to navigate the healthcare system. They liaise between the target population and a variety of health, human, and social services organizations. They may support individuals by providing information on health and community resources, coordinating transportation, and making appointments and delivering appointment reminders.

Additionally, they may work with individuals to develop a care management plan and use other tools to track their progress over time (e.g., food and exercise logs). Interventions

[†] Functional limitation is any restriction in the performance of activities resulting from disease, injury or environmental restrictions.

such as this, help save costs and may prevent more serious health problems.

Towns in the region that currently have some level of a Community Health Coordinator (or Community Nurse) are Sharon, Thetford, Hartland, Bradford and the greater Woodstock area (via the Ottawaquechee Health Foundation/Mt. Ascutney Hospital).

Housing designed to accommodate a range of functional ability over time (universal design) is another important way housing can assist in keeping the elderly and disabled in their own homes.

Relationship to the Built Environment:

- Transportation access and availability
- Homes designed for a variety of ages and abilities

Positive Health Outcomes:

- “Aging in Place” may yield cost savings for families, government, and health systems³¹
- Reduces stress

Policies:

1. Promote the concept of health care coordinators in all towns.
2. Promote the concepts of universal design.

Recommendations:

1. Municipalities should support “aging in place” programs to ensure access to housing and services for residents of all ages and economic means.
2. The State and TRORC must continue to educate residents

about Accessory Dwelling Units (ADUs).

3. Municipalities should allow staff to review and administer permitting for ADUs.
4. Housing organizations should work with communities to coordinate healthcare and supportive services with housing.
5. Municipalities should allow senior housing to be built in traditionally single-family neighborhoods.
6. Municipalities should create and invest in health care coordinator programs (i.e., community nurse, community healthcare coordinator).
7. The State and/or TRORC, respecting privacy, should use Geographic Information System (GIS) technology to map seniors and disabled citizens’ location, housing, health facilities, and other needed and available services.

Substance Abuse Prevention

Preventing substance use disorders and related problems (e.g., mental illness) in children, adolescents, and young adults is critical to Americans’ behavioral and physical health. Behaviors and symptoms that signal the development of a behavioral disorder often manifest two to four years before a disorder is present.

According to the 2014 SAMHSA’s (Substance Abuse and Mental Health Services Administration) National Survey on Drug Use and Health, an

estimated 25.2% (66.9 million) of Americans aged 12 or older were current users of a tobacco product. About two-thirds (66.6%) of people aged 12 or older reported that they drank alcohol in the past 12 months, with 6.4% meeting criteria for an alcohol use disorder. Also among Americans aged 12 or older, the use of illicit drugs has increased over the last decade from 8.3% of the population using illicit drugs in the past month in 2002 to 10.2% (27 million people) in 2014. Of those, 7.1 million people met criteria for an illicit drug use disorder in the past year. The misuse of prescription drugs is second only to marijuana as the nation's most common drug problem after alcohol and tobacco, leading to troubling increases in opioid overdoses in the past decade.³²

What has proven most effective in reducing rates of underage drinking and tobacco use in the last 20 years are using approaches that address the availability of substances and the cultural norms that surround them. Universal prevention approaches include the use of “environmental prevention strategies,”[‡] which are tailored to local community characteristics and address the root causes of risky behaviors by creating environments that make it easier to act in healthy ways.³³ These strategies are also more universal in nature, meaning that they don't target specific groups of at-risk youth and thus can benefit everyone—including people who are in recovery from misusing substances.

Some of these strategies include working with law enforcement to enforce existing underage drinking laws, parent education to promote clear expectations around substance use for children, and limiting where and when tobacco and other adult-only products can be used, sold, and advertised.

Another important component for the decreased likelihood of initiating drug and alcohol use are youth mentoring programs. The supportive, healthy relationships formed between mentors and mentees are both immediate and long-term and contribute to a host of benefits for mentors and mentees.³⁴



All of these approaches lead to a community where the norm is for a healthy behavior and makes this choice easier for all members of the community, especially young people. Successful implementation of these strategies involve many sectors of the community including law enforcement, local officials including town-planners, businesses, faith-based organizations, schools, and residents including parents and youth.³⁵

[‡] *Environmental prevention strategies address the environment that surrounds people living in communities.*

6. Municipalities should provide plenty of recreational and healthy opportunities for youth and overall community participation.

Relation to the Built Environment:

- Access to active parks and recreation
- Access to transit
- Location and type businesses

*Positive Health Outcomes:*³⁶

- Helps fight addiction
- Reduces family and community stress
- Helps fight crime and injury
- Promotes community problem-solving
- May reduce health care costs

Policies:

1. Reduce concentrated exposure to alcohol, drugs, and tobacco.
2. Provide opportunities for recreation and community involvement.

Recommendations for Action:

1. With the help of public health professionals, municipalities should assess the type of problem within the community.³⁷
2. Municipalities should raise awareness of the nature and seriousness of the problem.
3. Municipalities should assess the community's readiness for prevention.
4. Municipalities should review current programs already in place.
5. Municipalities should convene community organizations who serve youth and local leaders to capture ideas and resources to help implement and sustain research-based programs.

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HISTORY AND DEVELOPMENT

A. Background

This chapter provides an historic perspective on demographic, social, and economic factors influencing change within the region. The data presented are intended to provide the framework necessary for analysis of future development goals. The principal sources used include data from the State of Vermont; U.S. Department of Commerce; U.S. Census Bureau, American Community Survey (ACS); TRORC; and municipalities.



Royalton, 1915 | Source: Royalton Historical Society
South Royalton, 2015 | Source: First Light Studios

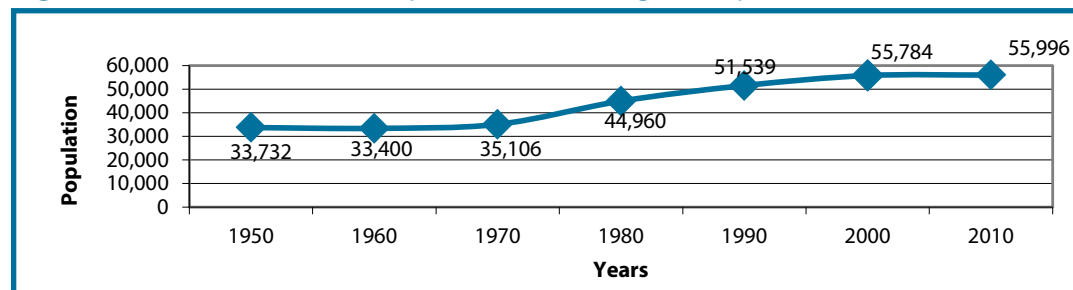
B. Population

Population and the rate of growth are major influences on overall development. Increases or decreases in population relate directly to the design and capacity of infrastructure. The density and overall distribution pattern of population, and population movements, affect the type of public facilities necessary to provide an adequate level of service. Public investments can be more effectively prioritized and implemented when population characteristics and trends are understood.

The population of the region in 2010 was 55,996, and in 2000 it was 55,784 (see

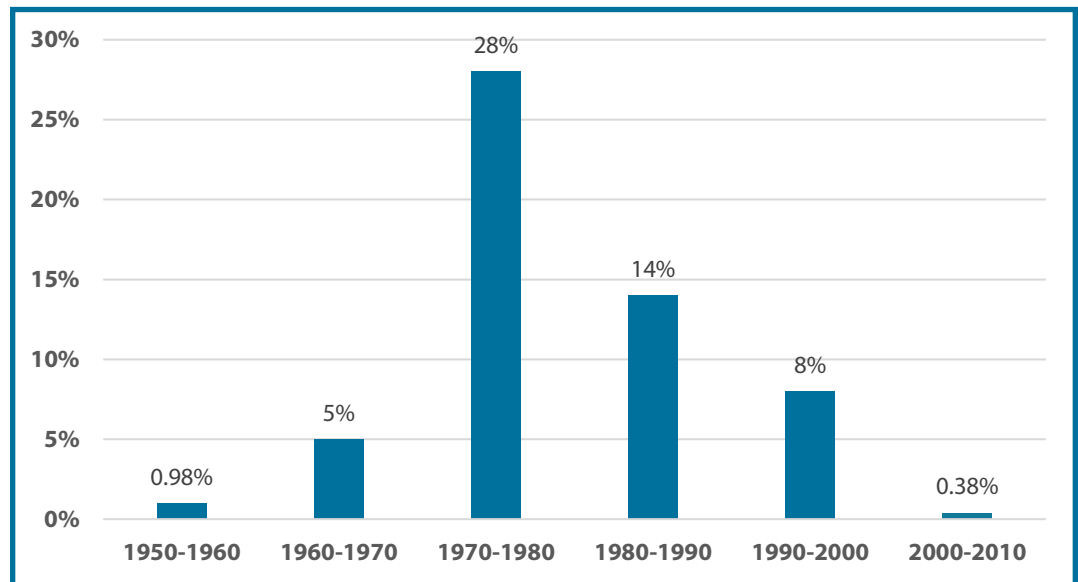
Figure 2-1); this means the region grew by 0.38% or 212 people between 2000 and 2010. However, this is at a much slower growth rate than in decades past (see Figure 2-2). While half of the region's towns saw a population increase, the other half saw population decreases (see Figure 2-3). Vermont's overall population increased by 2.6%, or by 16,123 people, to a total of 625,741. The towns experiencing the highest growth in the region were not the towns nearest the economic and employment centers (White River Junction, VT and Hanover and Lebanon, NH), as one would expect, but were some of the smaller outlying towns around them.

Figure 2-1: Two Rivers-Ottawquechee (TRO) Region Population, 1950-2000



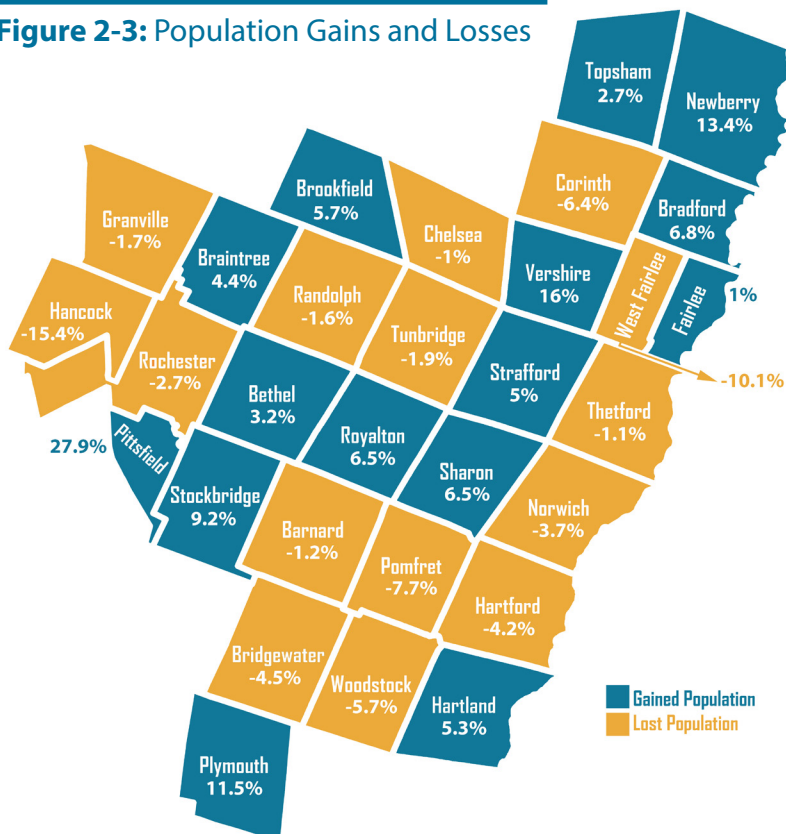
Source: U.S. Census

Figure 2-2: Population Change in TRO Region



Source: U.S. Census

Figure 2-3: Population Gains and Losses



This may indicate that cost of land and housing affordability is pushing workers further from the traditional centers of population and commerce to towns where affordable housing and land are available. Some of the communities that experienced increases in population are close to major roads (Bethel, Royalton, Sharon, Stockbridge, Bradford, and Newbury).

The second-home market influences regional growth as well: access to interstates, a beautiful working landscape, and a variety of natural and recreational assets is attractive as a destination for second-home development. Other factors influencing rates of population growth are the perceived quality of school systems, the relative property tax burden for comparable housing, land values in outlying towns, and the market value for single-family housing.

Source: U.S. Census

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Table 2-1: Population Change by Town 1950 - 2010

	1950	1960	1970	1980	1990	2000	2010	Actual Change '50 - '10	Percentage of Change '50 - '10
Barnard	439	435	569	790	872	958	947	508	115.72%
Bethel	1,534	1,356	1,347	1,715	1,866	1,968	2,030	496	32.33%
Bradford	1,551	1,619	1,627	2,191	2,522	2,619	2,797	1,246	80.34%
Braintree	626	536	751	1,065	1,174	1,194	1,246	620	99.04%
Bridgewater	903	776	783	867	895	980	936	33	3.65%
Brookfield	792	597	606	959	1,089	1,222	1,292	500	63.13%
Chelsea	1,025	957	983	1,091	1,166	1,250	1,238	213	20.78%
Corinth	786	775	683	904	1,244	1,461	1,367	581	73.92%
Fairlee	571	569	604	770	883	967	977	406	71.10%
Granville	213	215	255	288	309	303	298	85	39.91%
Hancock	391	323	283	334	340	382	323	-68	-17.39%
Hartford	5,827	6,355	6,477	7,963	9,404	10,385	9,952	4,125	70.79%
Hartland	1,559	1,592	1,806	2,396	2,988	3,223	3,393	1,834	117.64%
Newbury	1,667	1,452	1,440	1,699	1,985	1,955	2,216	549	32.93%
Norwich	1,532	1,790	1,966	2,398	3,093	3,544	3,414	1,882	122.85%
Pittsfield	225	254	249	396	389	427	546	321	142.67%
Plymouth	348	308	283	405	440	555	619	271	77.87%
Pomfret	586	600	620	856	874	979	904	318	54.27%
Randolph	3,499	3,414	3,882	4,689	4,764	4,853	4,778	1,279	36.55%
Rochester	937	879	884	1,054	1,181	1,171	1,139	202	21.56%
Royalton	1,331	1,388	1,399	2,100	2,389	2,603	2,773	1,442	108.34%
Sharon	470	485	541	828	1,211	1,411	1,502	1,032	219.57%
Stockbridge	427	392	389	508	618	674	736	309	72.37%
Strafford	680	548	536	731	902	1,045	1,098	418	61.47%
Thetford	1,046	1,049	1,422	2,188	2,438	2,617	2,588	1,542	147.42%
Topsham	733	638	686	767	944	1,142	1,173	440	60.03%
Tunbridge	774	743	791	925	1,154	1,309	1,284	510	65.89%
Vershire	284	236	299	442	560	629	730	446	157.04%
W. Fairlee	363	333	337	427	633	726	652	289	79.61%
Woodstock	2,613	2,786	2,608	3,214	3,212	3,232	3,048	435	16.65%
Region	33,732	33,400	35,106	44,960	51,539	55,784	55,996	22,264	66.00%

Source: U.S. Census

Poverty Status of Population

The U.S. Census Bureau uses a set of money income thresholds that vary by family size and composition to determine who is in poverty (see Table 2-2). If a family's total income is less than the family's threshold, then that family and every individual in it is considered in poverty. The poverty threshold, or poverty line, is the minimum level of cash resources (income, Social Security Benefits, interest, dividends, pension or other retirement income) that are adequate to meet basic needs. The official measure uses three times the cost of minimum food diet in 1963 in today's prices. The official poverty thresholds do not vary geographically, but they are updated for inflation using the Consumer Price Index (CPI-U).

The percent of people living in poverty in the region are similar to the poverty numbers for the State of Vermont, but there are towns where the poverty numbers exceed the regional or statewide averages (see Table 2-3). The Town of Bethel's poverty rates exceeded the state and regional numbers. The Town of Bradford's poverty rates exceeded the state and regional numbers in every category. The Town of Strafford's numbers are just the opposite, Strafford has low poverty rates for all groups. The towns of Corinth, West Fairlee, Vershire, Royalton, and Rochester have the region's highest rates of poverty among persons aged 65 years old or older.

The towns of Vershire, Topsham, Chelsea, Barnard, West Fairlee and Newbury have the region's highest rates of poverty

Table 2-2: Poverty Thresholds in 2015 by Size of Family and Number of Related Children Under 18

Size of family unit	Weighted average poverty thresholds	Related children under 18 years								
		None	One	Two	Three	Four	Five	Six	Seven	Eight or more
One person (unrelated individual)	12,082									
Under 65 years	12,331	12,331								
65 years and over	11,367	11,367								
Two people	15,391									
Householder under 65 years	15,952	15,871	16,337							
Householder 65 years and over	14,342	14,326	16,275							
Three people	18,871	18,540	19,078	19,096						
Four people	24,257	24,447	24,847	24,036	24,120					
Five people	28,741	29,482	29,911	28,995	28,286	27,853				
Six people	32,542	33,909	34,044	33,342	32,670	31,670	31,078			
Seven people	36,998	39,017	39,260	38,421	37,835	36,745	35,473	34,077		
Eight people	41,029	43,637	44,023	43,230	42,536	41,551	40,300	38,999	38,668	
Nine people or more	49,177	52,493	52,747	52,046	51,457	50,490	49,159	47,956	47,658	45,822

Source: U.S. Census

Table 2-3: Poverty Status by Town - 2015

	% of Families with Children Living in Poverty	% of Female Householders Living in Poverty	% of Individuals Living in Poverty	% of Elderly Living in Poverty (65 years old & over)
Barnard	26.2%	14.3%	10.2%	3.9%
Bethel	17.5%	18.1%	13.9%	8.6%
Bradford	17.6%	37.0%	15.7%	9.3%
Braintree	9.2%	17.9%	9.6%	9.8%
Bridgewater	17.5%	0.0%	11.3%	8.6%
Brookfield	8.8%	41.7%	8.1%	7.0%
Chelsea	30.0%	27.4%	17.2%	9.8%
Corinth	17.3%	12.5%	16.7%	14.2%
Fairlee	13.1%	15.7%	10.8%	3.4%
Granville	18.2%	0.0%	14.8%	3.0%
Hancock	10.2%	25.0%	13.7%	6.6%
Hartford	9.7%	25.0%	8.9%	12.1%
Hartland	0.0%	0.0%	3.2%	10.2%
Newbury	30.7%	41.6%	19.7%	6.9%
Norwich	20.0%	80.0%	6.1%	5.8%
Pittsfield	16.0%	36.6%	7.8%	8.7%
Plymouth	8.8%	0.0%	10.9%	1.5%
Pomfret	0.0%	0.0%	2.9%	0.0%
Randolph	22.7%	35.9%	13.1%	7.5%
Rochester	0.0%	0.0%	9.3%	13.2%
Royalton	8.9%	26.4%	23.9%	13.8%
Sharon	13.2%	15.4%	10.3%	3.0%
Stockbridge	15.4%	41.7%	12.0%	10.3%
Strafford	0.0%	0.0%	3.0%	1.4%
Thetford	12.2%	16.4%	9.0%	5.5%
Topsham	21.9%	40.7%	12.3%	12.3%
Tunbridge	1.6%	6.9%	5.8%	8.2%
Vershire	20.5%	77.8%	14.7%	13.6%
West Fairlee	20.2%	50.0%	19.0%	13.0%
Woodstock	6.2%	11.3%	4.6%	4.3%
Region	13.8%	23.8%	11.3%	7.9%
Vermont	13.2%	28.6%	11.5%	7.2%

Source: U.S. Census, 2011-2015 American Community Survey 5-Year Estimates

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among families with children. The towns of Norwich, Vershire, West Fairlee, Topsham, Stockbridge, and Newbury have the region's highest rates of poverty among female householders, with "no husband present" as the ACS specifies. With state and regional female householder poverty rates at 28.6% and 23.8% respectively, these six towns have exceptionally high rates of poverty among single, female parents of children.

Poverty rates for "individuals" gives an overall view of poverty in a town, the highs or lows of selected groups' poverty rates are combined into one general measure of poverty. The poverty rate for individuals in Vermont was 11.5%, the region's poverty rate for individuals was 11.3%. Towns with the highest poverty rates for individuals were: Chelsea, Royalton, Bradford, Newbury, and West Fairlee.

The following towns have elevated proportions of people living in poverty for at least one of the four selected groups: Bethel, Bradford, Bridgewater, Chelsea, Fairlee, Granville, Newbury, Plymouth, Royalton, Strafford, Topsham, and Vershire. The towns of Bradford and Vershire had high poverty rates for three of the four groups, and Bridgewater and Topsham had highs for two of the four groups.

Many of the towns with the highest poverty rates also have the highest percentages of household that pay more than 30% of their income on housing, which is considered unaffordable by HUD standards.

Income of Population

The region's median household income ranged from a high of \$99,663 in Norwich, to a low of \$34,882 in Royalton. From 2010 to 2015 (see Table 2-4), Vermont's median household income grew by 6.4% while the region's median household income grew by 42.8%; however, in terms of real dollars, the region's median family income was still \$9,007 lower than that of the State.

Age of Population

Between 2000 and 2010 the region's population grew at 0.38% and the State grew at a rate of 2.6%. The State saw a slight increase in the size of the child-aged population over the decade, but the region saw a slight decrease. In 2010, the population of persons aged 19 years and younger constituted roughly 20.7% of the State and regional populations, but the region had a lower population of young adults (aged 20 to 24) than did the State, 5% for the region and 7% for the state. The region had a larger proportion of elderly persons (aged 65 years and over) than did the State, 16% for the region and 15% for the State. The region's growth was most driven by the in migration of people aged forty-five through seventy.

Future Population Projections

Future population projections are functions of two components; an estimate of natural changes in population that considers births and deaths, and estimates of migration. In 2013, the Vermont Department of Aging and Independent Living contracted with Vermont Agency of

Table 2-4: Median Household Income by Town

	2010	2015
Barnard	\$69,063	\$57,969
Bethel	\$47,853	\$54,500
Bradford	\$46,029	\$48,598
Braintree	\$42,667	\$49,375
Bridgewater	\$42,045	\$65,655
Brookfield	\$35,592	\$56,339
Chelsea	\$41,957	\$52,841
Corinth	\$51,667	\$56,042
Fairlee	\$54,628	\$65,885
Granville	\$53,000	\$50,417
Hancock	\$32,500	\$47,679
Hartland	\$34,877	\$57,383
Hartford	\$50,417	\$56,927
Newbury	\$62,212	\$45,428
Norwich	\$86,458	\$99,663
Pittsfield	\$63,000	\$66,250
Plymouth	\$58,333	\$51,500
Pomfret	\$63,750	\$74,474
Randolph	\$49,226	\$51,612
Rochester	\$43,631	\$50,577
Royalton	\$34,968	\$34,882
Sharon	\$49,000	\$60,109
Stockbridge	\$47,404	\$46,875
Strafford	\$53,152	\$71,250
Thetford	\$69,667	\$69,815
Topsham	\$46,111	\$54,063
Tunbridge	\$53,393	\$55,625
Vershire	\$47,045	\$50,735
West Fairlee	\$50,227	\$50,054
Woodstock	\$75,000	\$75,188
Region	\$32,340	\$46,169
Vermont	\$51,841	\$55,176

Source: U.S. Census, 2006-2010 and 2011-2015 American Community Survey 5-Year Estimates

Commerce and Community Development to produce population projections in Vermont for the state, counties, and municipalities that were based on the 2010 Census and would project growth to 2030 (see Table 2-5). Projections were based on the assumption that economic conditions throughout Vermont would remain stable.

Sharon, Vershire and Thetford had the three highest rates of growth over the past sixty years (see Table 2-1) and they are also projected to continue experiencing high growth rates in 2030.

Looking at the towns that experienced moderate or slow growth over the past sixty years, the town of Stockbridge is projected to be the fastest growing town from 2020 - 2030. Vershire, Bethel, Plymouth, Pittsfield Royalton, and Sharon are projected to grow faster than the regional, county and state averages; the remaining towns will experience growth near the regional and state averages. Finally, the projections indicate that nine towns: Chelsea, Corinth, Granville, Hancock, Randolph, Thetford, Tunbridge, West Fairlee, and Woodstock will lose population as they approach 2030.

Planning Implications

Despite the fact that local incomes don't keep pace with escalating real estate costs, people are still drawn to this region of Vermont for its rural landscape, the varying seasons, superior environment and independent character. Towns that offer affordable housing and easy access to major roads and public transit will continue to gain population.

Table 2-5: Population Projections 2010 - 2030

Town	Census 2010	% Change			
		2020	2030	2010-20	2020-30
Barnard	947	994	1,018	5.0	2.4
Bethel	2,030	2,151	2,223	6.0	3.3
Bradford	2,797	2,907	2,950	3.9	1.5
Braintree	1,246	1,273	1,277	2.2	0.3
Bridgewater	936	965	977	3.1	1.2
Brookfield	1,292	1,363	1,395	5.5	2.3
Chelsea	1,238	1,252	1,245	1.1	-0.6
Corinth	1,367	1,377	1,363	0.7	-1.0
Fairlee	977	1,001	1,005	2.5	0.4
Granville	298	286	273	-4.0	-4.5
Hancock	323	300	279	-7.1	-7.0
Hartford	9,952	10,302	10,457	3.5	1.5
Hartland	3,393	3,653	3,815	7.7	4.4
Newbury	2,216	2,342	2,408	5.7	2.8
Norwich	3,414	3,579	3,661	4.8	2.3
Pittsfield	546	630	677	15.4	7.5
Plymouth	619	715	782	15.5	9.4
Pomfret	904	923	928	2.1	0.5
Randolph	4,778	4,745	4,666	-0.7	-1.7
Rochester	1,139	1,155	1,158	1.4	0.3
Royalton	2,773	3,011	3,163	8.6	5.0
Sharon	1,502	1,659	1,761	10.5	6.1
Stockbridge	736	809	958	9.9	18.4
Strafford	1,098	1,164	1,195	6.0	2.7
Thetford	2,588	2,611	2,592	0.9	-0.7
Topsham	1,173	1,245	1,277	6.1	2.6
Tunbridge	1,284	1,309	1,308	1.9	-0.1
Vershire	730	807	855	10.5	5.9
West Fairlee	652	640	623	-1.8	-2.7
Woodstock	3,048	3,055	3,040	0.2	-0.5
Region	55,996	58,223	59,329	4.0	1.9
Orange County	28,936	29,813	30,056	3.0	0.8
Windsor County	56,670	59,057	60,328	4.2	2.2
Vermont	625,741	653,575	670,073	4.4	2.5

Source: VT Department of Aging and Independent Living; analysis by VT Agency of Commerce and Community Development, 2013

Towns within thirty minutes of the primary service and employment centers (e.g. Rutland, Montpelier/Barre, and White River Junction/Hanover/Lebanon) may experience higher growth than towns that are beyond that commuting distance, or towns that are closer to the employment centers but have prohibitive costs of living. Accordingly, the transportation facilities connecting new growth areas to service and employment centers will carry higher volumes of traffic.

C. Economy

Current Economy and Jobs

The ACS indicates that 42.7% of the regional workforce, (people who live in the region but may or may not work in it), were employed in occupations classified as “Management, Professional, or Related Occupations” (see Table 2-6). Growth was also seen in “Production, Transportation, and Material Moving Occupations.” “Service Occupations,” “Sales and Office Occupations,” and “Natural resources, Construction & Maintenance Occupations saw job losses between 2010 and 2015. The occupational profiles of the region and state are nearly identical.

Salary Classification and Work Patterns

The proportions of employment in private sector, public sector, and self-employed endeavors in the Region is nearly identical from 2010 to 2015, with a drop in unpaid family workers in 2015 (see Table 2-7). The State has a higher percentage of private sector employment (78%) than the region; the region has a higher proportion of self-employment than does the state (11.4%).

Table 2-6: Regional Occupations, 2010 and 2015

	Management, Professional and Related Occupations	Service Occupations	Sales and Office Occupations	Natural resources, Construction, & Maintenance Occupations	Production, Transportation & Material Moving Occupations
2015	42.7%	15.4%	20.1%	11.6%	10.2%
2010	41.7%	15.8%	22.4%	11.5%	8.6%

Source: U.S. Census, 2006-2010 and 2011-2015 American Community Survey 5-Year Estimates

Table 2-7: Regional Salary Classification 2015

	Private Wage and Salary Workers	Government Workers	Self-employed workers in their own business, not incorporated	Unpaid Family Workers
2015	75.3%	13.9%	11.4%	0.2%
2010	73.2%	13.3%	13.1%	0.4%

Source: U.S. Census, 2006-2010 and 2011-2015 American Community Survey 5-Year Estimates

Some portion of the jobs in the region are held by people who don't live within it. This region houses the employees of other regions' businesses as well. For instance, the region's top two major employers (see Table 2-9), Dartmouth College and Dartmouth Hitchcock Medical Center, are located outside the region. Randolph is home to at least five of the region's major employers.

Gender and the Labor Force

Women in the region constituted 49% of the workforce in 2015, the same as Vermont. Norwich has the highest percentage of women in the work force, while Plymouth has the lowest.

Mode of Travel and Travel Time to Work

Seventy-five percent of the region's workforce drives a single-occupancy vehicle to work (see Table 2-8). This is the same as the statewide percentage. The region has a longer, average commuting-time than the State. The mean travel-time-to-work for the State was 22.5 minutes; it was 26.8 minutes for the region. The longest commutes occurred in the towns that grew the fastest over the past five years. The region's travel times may be comparable to those of the state or nation, but they are increasing at a faster rate than those of the state or nation.

Table 2-8: 2015 Commuting to Work - Mode of Transportation by Town

	Workers 16 years and over	Car, Truck, Van (drove alone)	Car, Truck, Van (car- pooled)	Public Transport (and taxis)	Walked	Other Means of Transport	Worked at Home	Mean Travel Time to Work (minutes)
Barnard	387	301	10	0	23	18	35	32.6
Bethel	1,069	757	160	19	35	0	98	25.7
Bradford	1,249	842	186	8	98	51	64	24.9
Braintree	661	468	72	17	18	21	65	24.8
Bridgewater	461	352	43	0	14	4	48	29.9
Brookfield	662	489	74	4	26	22	47	31.7
Chelsea	624	470	50	0	36	0	68	28
Corinth	664	538	45	3	17	8	53	40.7
Fairlee	599	457	41	0	41	2	58	22.9
Granville	169	135	12	0	3	1	18	30.4
Hancock	168	116	31	0	7	1	13	29.7
Hartford	5,152	3,946	711	54	76	35	330	17.6
Hartland	1,779	1,408	231	0	10	0	130	22.8
Newbury	971	783	59	14	37	8	70	27
Norwich	1,717	1,253	134	43	63	60	164	19.7
Pittsfield	302	275	9	0	18	0	0	23.4
Plymouth	233	169	26	0	6	0	32	22.2
Pomfret	474	372	38	3	21	4	36	23.3
Randolph	2,384	1,741	213	29	217	40	144	23.8
Rochester	533	396	53	6	33	17	28	26.7
Royalton	1,165	874	129	6	124	0	32	25.7
Sharon	766	614	69	7	33	4	39	25.9
Stockbridge	366	315	17	0	2	2	30	24.1
Strafford	604	473	62	0	9	4	56	27.1
Thetford	1,496	1,158	122	0	16	12	188	24.2
Topsham	612	491	79	0	3	7	32	31.8
Tunbridge	714	578	85	0	7	3	41	35.4
Vershire	348	239	45	8	32	2	22	30.8
West Fairlee	373	289	23	0	18	0	43	29.6
Woodstock	1,645	1,180	62	0	163	11	229	22.9
Regional Totals	28,347	21,479	2,891	221	1,206	337	2,213	26.8
Regional Percent		75.3%	10.1%	0.8%	4.2%	1.2%	7.8%	26.8
Vermont Percent		75.3%	9.4%	1.2%	5.8%	1.6%	6.7%	22.5

Source: U.S. Census, 2011-2015 American Community Survey 5-Year Estimates

Planning Implications

If population projections for the region hold true, the number of people entering the work force will increase. The number of jobs available above the natural growth of the work force will affect future population of the area and housing. If few jobs are created, workers will be forced to migrate elsewhere. Rapid job formation, exceeding natural growth in the Upper Valley Area will result in a net in-migration of people into the region. This area is generally defined as communities drawing primarily on Lebanon, White River Junction, and Hanover for primary services.

Cooperation and coordination among neighboring employment centers is essential to secure the proper balance between population and employment. Evaluation of and improvements to transportation systems and facilities should be a part of this inter-regional effort. As noted earlier, a sizable portion of the resident work force commutes to communities outside of the region.

The natural work force changes (job entries versus attrition rates) can more than likely be accommodated in the future without undue hardship on public services as the rate of change would be relatively slow. However, the advent of new industries, service facilities, or business expansions located in area employment centers could place growth pressures on surrounding towns and the State to provide services. Demands for rehabilitation or improvements to public infrastructure necessary to accommodate or plan for increased economic activity are likely to be

the result. The adequacy or sufficiency of existing transportation facilities could be impacted.

Vermont, hence the region, is not an isolated economy. It competes with neighboring states, the rest of the nation, and, increasingly, with the world. This competition will have an impact upon the region's competitive position. The creation of new jobs will, for example, be driven by the quality of the work force and the relative position of industry and commerce in compensation and benefit packages.

The type and rate of growth will be affected by economic policies and programs enacted by the State and its comparative advantages/disadvantages with other areas. Factors likely to influence economic change are:

1. Competitive tax structures and the overall tax climate for businesses and corporations;
2. Advancement of a statewide



Oxen on Chelsea Street in South Royalton 1915
| Source: Royalton Historical Society

Table 2-9: Major Employers Located In or Near the Region**Employers with 1,000 or more employees:**

Dartmouth College	Hanover, NH
Dartmouth Hitchcock Medical Center	Lebanon, NH
Hypertherm	Lebanon, NH

Employers with 500-999 employees:

Killington/Pico Mountaint Resort	Killington, VT
Veterans Administration Hospital	Hartford, VT

Employers with 250 - 499 employees:

G.W. Plastics, Inc.	Bethel, VT
Hartford School District	Hartford, VT
Simon Pearce (US), Inc.	Quechee, VT
King Arthur Flour Company	Norwich & Hartford, VT
State of Vermont	throughout Region
Vermont Castings, Inc.	Bethel, VT
Woodstock Resort Corp	Woodstock, VT
Mt. Ascutney Hospital & Health Center	Windsor, VT
Gifford Medical Center	Randolph, VT
Vermont Technical College	Randolph, VT

Employers with 100 - 249 employees:

Copeland Furniture	Bradford, VT
DuBois & King, Inc.	Randolph, VT
Town of Hartford	Hartford, VT
Mascoma Savings Bank	throughout Region
Oxbow Union High School District #30	Bradford, VT
Pompanoosuc Mills Corporation	Thetford, VT
Randolph Town School District	Randolph, VT
Quechee Lakes Landowners Association	Queechee, VT
U.S. 1st & 2nd Class Post Offices	throughout Region
Vermont Law School	Royalton, VT
Visiting Nurses Alliance of VT & NH	throughout Region
Woodstock Union High School District	Woodstock, VT

Source: Vermont Business Magazine, November 2016, King Arthur Flour Company, and TRORC Board and Staff

transportation system based upon solid planning and implementation;

3. Competitive energy costs and availability to accommodate economic development expansion;
4. Strength of marketing the benefits of job creation and private sector investment in the region or the state;
5. Comparative costs stringency and predictability of the regulatory permit process;
6. Extent of investment into telecommunication systems to bring rural areas of the region into the electronic workplace making it possible to access worldwide data and markets; and
7. Work force competency and education.

Travel and tourism is an increasing business enterprise in Vermont and as well as the region. There are numerous reasons for this, including the region's close proximity to major population centers in the Northeast, the wide and diverse range of amenities and interests available to satisfy the tourist, and the area's varied and unique historic, cultural and natural resources. The sensitivity of planners toward innovative transportation and implementation programs to retain these special values will positively impact the long-term quality of the tourism and the recreation industry.

D. Cultural Traditions, Land Use and Transportation: 1760 to the Present

In most environments, land has been put to use in a succession of stages, depending upon its resources and location. Each of these changes has connected the region to the state more extensively, as well as to the larger New England region.

The settlement of the region, which has become the dominant land use pattern we experience today, began after the 1760s, following the end of the French and Indian War. Immigration into the region came largely from southern New England and continued into the early 1800s. With the opening of private turnpikes, military roads, and bridges, young people seeking new opportunities in farming fled to the Connecticut River Valley towns. In the early 1800s, the region's population reached an all-time high.

While transportation improvements were being advanced in the region, others were being made outside the region. The result was a transportation system that had an economic impact. It enabled locally grown produce and raw materials to reach outside markets. This pattern continues to this day.

With the improvements to transportation to the west, including the famous Erie Canal, Vermont's farmers lost some of their goods market to New York and Ohio. Additionally, improved access to other areas set the stage for westward migration out of the region, a movement that continued into the early part of the

20th century. Much has been written about the drift of the region's farmers to the west. Not all of the region's residents chose to leave the area however. Many sought an enterprise in sheep farming, putting to use the rocky uplands. The sheep industry flourished with Orange and Windsor counties being one of the leading production areas in the 1850s.

Like the earlier years, transportation improvements were major factors setting off the decline in the sheep industry. Improved access to growing competition in the west, combined with comparatively higher annual costs for sheep farming in the region, made Vermont less competitive. The sheep era did, however, bring in the woolen industry. This was the first major move of employment toward non-agricultural pursuits. The number of mills increased dramatically. Factories began to emerge, as most towns in the region give evidence to today, with dams and mills situated on major rivers.

The sheep industry flourished with Orange and Windsor counties being one of the leading production areas in the 1850s.

Concurrently came the emergence of the railroad as an attractive alternative to the fragmented system of roads and trails. Low population and few industries along the rail lines limited the ability of the railroads to operate successfully at first. To be successful, railroads had to rely on additional traffic from out of state. Formed in the 1840s, the Central Vermont Railroad extended lines through the White River Valley to be followed shortly thereafter by

the Connecticut and Passumpsic River line (currently the Boston and Maine) along the eastern side of the region. Following the development of these and other main lines throughout the region and Vermont during the late 1870s, a number of short rail lines emerged. These included the White River Railroad, a twenty mile line extending from Bethel to Rochester, the Woodstock Railroad, a fifteen mile line extending from White River Junction to Woodstock, and the Montpelier and Wells River Railroad, extending from Wells River and New Hampshire to Montpelier. All of these lines reflected the need to transport goods, raw materials and people to and from some of the interior communities located away from major rail centers and lines. By the middle of this century these lines fell into financial decline, and were eventually discontinued and liquidated.

Railroads need to be recognized as key factors for the development and maturity of the State's tourism and recreation business today, a vital and growing part of the region's economy.

Railroads can be credited as a contributor to the economic development of the region. Railroads need to be recognized as key factors for the development and maturity of the State's tourism and recreation business today, a vital and growing part of the region's economy. The implications resulting from rail line development heavily influence the land use patterns and cultural values of our villages and countryside today. Also, it should come as no revelation that most of the region's

primary highways follow closely the course of existing or former railroad lines.

During the 1960s and 1970s, the region entered into an evolution of yet another transportation network imposed upon the landscape - the superhighway. Interstates 91 and 89 were completed throughout the region and Vermont. The interstate system can be credited as the first national highway system planned by the federal government.

The four lane interstate system bypassed most of the region's villages and tended to siphon off traffic from the older parallel truck roads such as Routes 5, 12, and 14, spelling economic hardships for some of the so-called business routes. Some gas stations closed and motor courts lost the traffic necessary to keep operating. Ownership changes and replacements for older uses resulted.

The region has thirteen interchange areas on I-91 and I-89. Some of these interchange areas have proven to be prime targets for roadside commercial development. Since land access to other points along the Interstates has been prohibited, land around the interchanges has become sought after and highly valuable. Oil companies, national franchised restaurants, and motels have begun to emerge on the landscape around these areas. While not yet prevalent within this region, the interchange area throughout Vermont is becoming somewhat a center for certain uses historically held to be within the town center. These include retail shops in large

complexes, such as shopping centers, automobile service and sales, trucking terminals, and other non-residential vehicular oriented uses. For the region, the core of the retail marketplace still remains within village centers and along roads leading to and from them. In some cases, such as in Bethel, Randolph, and Bradford, some downtown area merchants have felt that they have become an economic casualty of major road building and the development that has followed. Now the same source of funding that built or rebuilt major highways (the federal government), is being used to resuscitate life into these areas, (i.e., sidewalks, bikeways, road improvements, historic preservation, and parking areas).

The identity of the region today is a composite of its landscape, people, institutions, and history. All these factors contribute to its character. The case has been made in numerous forums that Vermont, hence the region, exhibits some of the finest landscapes and environments in the United States and elsewhere. The region's rural character and traditions are heavily influenced by its pattern of development and the sense of community that comes from people living and working here. When looked at over time, this pattern of settlement and its scale have worked for the sociological, psychological, and aesthetic benefit of the region.

Economic Development					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
TRORC will provide grant management, Act 250 support, and local regulatory reform assistance to further the development of job growth and workforce housing in areas close to employment and service opportunities.	TRORC	Low-Moderate	Ongoing	High	Various
TRORC will assist towns with village and downtown designation in order to provide incentives in these areas.	TRORC	Low	Ongoing	High	Various
TRORC will work with the Vermont state agencies, regional and local development groups, trade associations, Chambers of Commerce, planning commissions and other groups to integrate land use planning with economic planning and development programs based on our Region's assets.	TRORC, State, Towns, Non-profits	N/A	ASAP	High	N/A
TRORC will review and recommend revisions to zoning bylaws and other land-use guidelines to ensure they actively support vitality in town centers, including infill, adaptive reuse of structures, increased height limits, and density bonuses.	TRORC	Low	Short-term	High	ACCD
TRORC will offer assistance to towns in asset management, capital budgeting, and shared services/purchasing in order to lower costs and stabilize taxes.	TRORC	Low	Ongoing	High	ACCD
TRORC will assist towns to apply for and manage grants and loans for infrastructure repairs and/or upgrades that bolster the livability of core areas.	TRORC	Low	Ongoing	High	Various

Economic Development					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
State, regional, and local economic development agencies should develop stronger financing/funding mechanisms for business expansion and entrepreneurship.	State, Non-profits	N/A	Mid-term	High	N/A
TRORC will participate in discussions to improve the regulatory system at the state level and improve permitting coordination between local and state levels of government.	TRORC	N/A	Ongoing	Medium	N/A
TRORC will work in concert with towns and development organizations to provide technical support (such as support with permitting, funding, brownfield assistance, etc.) to businesses wishing to stay in or relocate to core areas.	TRORC, Non-profits	Low	Ongoing	Medium	Various
Public agencies, schools, and private businesses must expand workforce training and education that aligns with the strategic needs of our Region's current and future employers; and expand linkages that allow the Region's youth to learn about local career opportunities and gain exposure to the workplace.	State, Towns, School Boards, Businesses	N/A	Short-term	Medium	N/A
The Small Business Development Center, Chambers of Commerce and development corporations should develop a coordinated network of resources for businesses—including business coaching, financing, permitting assistance, and peer-to-peer networking—to equip current and would-be business owners with the skills needed to brand, promote, and effectively operate businesses.	Non-profits, Businesses	N/A	Mid-term	Medium	N/A

Economic Development					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
TRORC will work with towns and development organizations in the Region to identify and inventory vacant and under-utilized sites/buildings most suitable for near-term commercial and residential development in existing downtowns and villages where water, sewer, power, internet, and roadways have capacity.	TRORC, Towns, Non- profits	Low-Moderate	Short-term	Medium	Various
TRORC should work with local producers, development corporations, educational programs, the Vermont Agency of Agriculture and other organizations to identify and create needed processing, storage, and distribution capacity for locally-made food and forestry products.	TRORC, State, Non-profits, Businesses	Low-Moderate	Short-term	Medium	Various
TRORC should work with land trusts and local conservation commissions to inventory farm and forest lands to understand where parcels are available that could provide opportunities for new farm and forest businesses, and assist towns in crafting regulations to reduce fragmentation and leave land available for farming, forestry, and other land-based businesses.	TRORC, Non- profits	Low-Moderate	Short-term	Medium	Various
Towns, the state, telecommunications providers, and TRORC should map existing cellular and broadband services in the Region, identify gaps, and work to provide coverage in those gap areas, ensuring that all areas have particularly good service that supports both current and future businesses and residents.	TRORC, State, Towns, Utilities	Low-Moderate	Short-term	Low	Various

Economic Development					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
TRORC will support efforts to recognize businesses for excellence in creating better downtowns and villages, exemplary buildings, energy efficiency, and other activities that further regional goals.	TRORC, Businesses	N/A	Mid-term	Low	N/A
TRORC should support and assist efforts that focus on how best to utilize our rivers as economic drivers while improving water quality and protecting the rivers' natural beauty, native animal and plant species, health, and unique character.	TRORC/ Watershed Groups	N/A	Ongoing	Low	N/A
TRORC and child care providers must work with member towns to address identified needs for child care facilities or services, including identifying publicly-owned buildings throughout the Region suitable to serve as child care facilities.	TRORC, Towns, Businesses	Low-Moderate	Short-term		Various

Education					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
Ensure towns assess and incorporate the needs of disabled children into educational facility and budgetary planning efforts to ensure the provision of free and appropriate education for all children.	TRORC, Towns	N/A	Ongoing	High	N/A
Support local efforts to assess capacity issues in our Region's schools, and, conversely, that explore opportunities to consolidate where appropriate. This is of particular importance with respect to facilities that currently do—or in the future may—serve multiple jurisdictions, due to inherent land use implications of such decisions.	TRORC	Moderate	Ongoing	Medium	Various
In assisting towns with capital plan and budget formulation, ensure that member towns anticipate and plan for improvements to public school facilities.	TRORC	Low	Ongoing	Medium	MPG
Encourage the development of school-business partnerships that promote valuable and sustainable employment opportunities in the Region through vocational and workforce training experiential learning.	TRORC, Businesses, SU's	N/A	Ongoing	Medium	N/A
Facilitate coordination between town and school authorities to create and maintain safe pedestrian access and transit opportunities to educational facilities, in line with Safe Routes to School efforts.	TRORC, Towns, SU's	Low	Ongoing	Medium	Vtrans
Coordinate with the supervisory unions and the Agency of Education to create a regional approach to planning that considers the need for new school facilities and programs.	TRORC, State, SU's	Low	Ongoing	Low	Various

Education					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
Work with local communities to determine which locations are most desirable for and best suited to the growth of new or relocated educational facilities throughout the region.	TRORC/Towns	Low- Moderate	Ongoing	Low	Various

Emergency Management					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
State and Federal government must continue funding and operation of warning systems, including the National Weather Service's Emergency Alert System, NOAA weather radio and USGS river and precipitation gages.	State/Federal	Moderate	Ongoing	High	State/Federal
Individuals should have disaster kits ready in their homes and vehicles. They should have a plan as to what to do and where to go during foreseeable emergencies and know their local emergency shelter.	Individuals	Low	Ongoing	High	Private
Towns should pursue the use of capital programs and reserve accounts to properly budget for emergency vehicles and other large capital costs, as well as coordinate and share services to achieve overall efficiencies.	Towns/TRORC	Low	Ongoing	High	Towns
TRORC will work with all communities to annually update Local Emergency Operations Plans, ensuring that these plans take into account the Various needs of people with disabilities, pets, and those without access to transportation.	TRORC/Towns	Moderate	Ongoing	High	DHS/VT DEMAS
TRORC will continue to work with all communities on hazard mitigation planning efforts.	TRORC/Towns	Low	Ongoing	High	FEMA

Emergency Management					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
TRORC Will continue to work cooperatively with local emergency response organizations, DEHMS, LEPC #12, social service agencies, long term recovery organizations, community resilience organizations, and others to help improve emergency planning response and recovery.	TRORC/ DEHMS/Towns	Low	Ongoing	High	DEHMS
The federal and state governments should increase funding for preparedness and mitigation planning and actions at the local level in order to reduce escalating response and recovery costs.	DEMHS/ Federal	Moderate	ASAP	High	Federal
FEMA must modernize flood maps, especially in Orange County, and incorporate newer flood frequency predictions into new maps.	FEMA	High	ASAP	High	FEMA
TRORC will assist towns and ANR in refining river corridor maps, within budgetary constraints.	TRORC/ANR	Low	Mid-term	High	Various
TRORC will work to ensure that new hazard assessment data from the state and federal levels is disseminated to the public and local officials so that capacity is risk-based.	TRORC	Low	Ongoing	High	Various
TRORC will work with towns and other organizations to coordinate land use, transportation and energy policies and actions to result in more resilient communities.	TRORC	Low	Ongoing	High	Various
TRORC will assist towns in response and recovery stages through damage documentation assistance and navigating federal and state grants.	Towns	High	Ongoing	High	FEMA

Emergency Management					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
Communities should work to ensure that important local facilities that provide emergency services, water, food, gas or act as an emergency shelter are able to function in power outages.	Towns	Moderate	Ongoing	Medium	Various
Towns should encourage sprinkling in residential structures to reduce life and property loss from fire.	Towns	N/A	Ongoing	Low	N/A

Energy					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
Actively support partnerships, strategies, and state and federal legislation that will ensure the affordable, reliable and sustainable production and delivery of electrical power to the region, in conformance with regional and municipal goals and objectives.	TRORC	N/A	Ongoing	High	PSB/Various
Participate in the Public Service Board's review of new and expanded generation and transmission facilities to ensure that local energy, resource conservation and development objectives are identified and considered in future utility development.	TRORC	Low	Ongoing	High	ACCD
The Regional Commission will participate in long-range utility planning and development to ensure that local energy, resource conservation and development objectives are identified and considered in future utility development.	TRORC	Low	Ongoing	Medium	ACCD
Work in cooperation with state and local agencies, emergency service providers, regional suppliers and municipalities to develop local emergency contingency plans that ensure access to critical energy supplies and measures to reduce nonessential energy consumption in the event of an abrupt energy shortage.	TRORC	Low	Ongoing	Medium	DEMHS

Flood Resilience					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
The Regional Commission should work with towns to strengthen their Flood Hazard Bylaws in order to mitigate risks to public safety, critical infrastructure, historic structures and municipal investments from inundation and erosion.	TRORC/ANR	Low	ASAP	High	ANR/DEHMS
TRORC should work with VTrans on advocating for and improving the flood capabilities of state or town-owned transportation infrastructure.	TRORC/Vtrans	N/A	ASAP	High	DEMHS
TRORC should continue working with the Emergency Coordinators and Selectboards from each town to develop mitigation plans, and emergency preparedness and recovery procedures from flooding.	TRORC/Towns	Low	Ongoing	High	DEMHS
TRORC will work with towns to understand the impact stormwater runoff has on the region and on specific towns, and then work to address impacts from impervious surfaces through increased retention and infiltration.	TRORC/ANR	Moderate	Ongoing	High	Various
Existing homes and businesses at serious risk of flood damage should be identified and prioritized by towns in concert with the ANR River Management Section and the Regional Commission for mitigation actions such as elevation/relocation or purchase and demolition.	TRORC/Towns /ANR	High	ASAP	Medium	HMGP

Flood Resilience					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
Watershed-level planning should be done by towns with assistance from the Regional Commission to evaluate natural and constructed flood storage options upstream of existing areas of concentrated development that are at risk of flooding.	TRORC/Towns	Moderate	Mid-term	Medium	ANR
TRORC will work with the Granville, Stockbridge, Hancock, Rochester, and the U.S. Forest Service to address flooding on a watershed basis for the Hancock Branch, Upper White, West Branch and Tweed River.	TRORC/USFS	Moderate	Mid-term	Medium	ANR
TRORC will work with ANR, towns and landowners to lessen flood risk by restoring natural channel functions through berm or dam removal or intentional lowering of streambanks.	TRORC	High	Ongoing	Medium	ANR/Various
TRORC encourages more consistent, accurate and thorough identification of wetlands areas through the use of best available data and the adoption of local wetlands regulations and updated maps by the municipalities in the region.	TRORC	N/A	Ongoing	Medium	N/A
Areas not designated in either FEMA's maps or in VT ANR's maps, but which are flooded during a weather event should be added to local flood regulations.	Towns/FEMA	High	Mid-term	Low	FEMA

Land Use					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
Within five years of adoption, the Regional Commission will, in consultation with member municipalities, neighboring regional commissions, the State of Vermont, public interest groups and property owners, re-evaluate the Land Use section of this Plan. The Regional Commission should give consideration to existing land use settlement patterns, municipal plan goals and policies, agency plans, and projected trends and needs for the region's citizens and businesses. Following completion of the study, the Regional Commission should offer amendments to this section for adoption.	TRORC	Medium	Mid-term	High	Various
The Regional Commission should continue its efforts to provide professional planning services to its member municipalities and advise public officials on the various options available to manage growth and development at the local level.	TRORC	Low	Ongoing	High	ACCD/Municipal Dues
The Regional Commission will work with member towns to determine appropriate location and size for growth centers within the region.	TRORC	Low	Mid-term	High	Various
The Regional Commission should work with the Agency of Natural Resources and with towns to identify and map aquifers and aquifer protection areas.	TRORC/ANR	Medium	Mid-term	Medium	Various

TRORC Implementation Matrix

Towns are encouraged to develop Source Protection Plans for public water supplies or aquifers that have been identified. Such programs may include limiting or prohibiting development and other land uses within Wellhead or Aquifer Protection Areas.	Towns	\$5,000- \$15,000 Per SPA Plan	Mid-term	Low	State/Municipal
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Healthy Communities					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
The Vermont Department of health should provide community assessment, testing sites and remediation programs for housing-related illnesses (blood lead levels, respiratory health, and skin disease).	State	High	Long-Term	High	Various
Municipalities should work with local housing authorities to create a variety of housing types and maintenance options.	Municipalities	Low	Ongoing	High	Various
The state and housing organizations should promote healthy home renovation and construction.	State/Other	High	Ongoing	High	State/Private
TRORC should advocate for implementation of the state's greenhouse gas reduction plans.	TRORC	Low	Ongoing	High	Various
Municipalities should prioritize the reuse and remediation of brownfields.	Municipalities	N/A	Ongoing	High	N/A
The State and municipalities should protect water quality of rivers, streams, lakes, and wetlands.	TRORC/State	Moderate	Ongoing	High	State
TRORC should collaborate with local agencies and communities to implement Safe Routes to Schools programs and Vermont's Complete Streets program.	TRORC/State Municipalities	Moderate	Ongoing	High	Vtrans
The State and TRORC will provide training for neighborhood residents to participate in boards and commissions.	TRORC/State	Low	Near-Term	High	Various

Healthy Communities					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
Municipalities should support “aging in place” programs to ensure access to housing and services for residents of all ages and economic means.	Municipalities	N/A	Ongoing	High	N/A
Housing organizations should work with communities to coordinate healthcare and supportive services with housing.	Other	N/A	Ongoing	High	N/A
Municipalities should provide plenty of recreational and healthy opportunities for youth and overall community participation.	Municipalities	N/A	Near-Term	High	N/A
Municipalities should connect with the Vermont Farm to Plate and Farm to School networks to see how they can best promote the consumption of locally grown foods to their residents.	Municipalities	Low	Ongoing	Medium	Various
TRORC, State should create mapping resources: A) Locality of grocers, convenience stores, farmers’ markets, farms, agricultural institutions, processing facilities, distributors, community gardens, food banks, and food pantries. B) Identify transportation routes/types to food retail. C) Location of low-income census tracts.	TRORC/State	High	Long-Term	Medium	Various
TRORC and municipalities should educate state and local policymakers on connections between food access and nutrition.	TRORC/ Municipalities	Low	Ongoing	Medium	Various

Healthy Communities					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
Municipalities should support the preservation of large, contiguous blocks of productive agricultural land.	Municipalities	N/A	Ongoing	Medium	N/A
Municipalities should work jointly with other jurisdictions to preserve agriculture land.	Municipalities	N/A	Ongoing	Medium	N/A
The Vermont State Housing Authority and other housing entities should educate policymakers on the relationship of poor housing conditions to health outcomes.	State/Other	Low	Ongoing	Medium	ACCD/Municipal Dues
TRORC should advocate for project approval processes that reflect the Housing Resources chapter's housing-needs allocation for all income levels.	TRORC	Low	Ongoing	Medium	Various
TRORC and municipalities should participate in the review of environmental impact reports.	TRORC	Low	Ongoing	Medium	Various
TRORC and municipalities should advocate for and participate in health impact assessments.	TRORC	Low	Ongoing	Medium	Various
TRORC and municipalities should continue to advocate for plentiful, high-quality drinking water.	TRORC/ Municipalities	N/A	Ongoing	Medium	N/A
The State and TRORC should educate decision makers on links between safe streets and health.	TRORC/State	N/A	Ongoing	Medium	N/A
Municipalities should promote existing trails.	Municipalities	N/A	Ongoing	Medium	N/A
Public health professionals should educate decision makers on the link between social support and health.	Other	N/A	Ongoing	Medium	N/A

Healthy Communities					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
The State and TRORC must continue to educate residents about Accessory Dwelling Units (ADUs).	TRORC/State	Low	Near-Term	Medium	Various
Municipalities should allow staff to review and administer permitting for ADUs.	Municipalities	N/A	Ongoing	Medium	N/A
Municipalities should allow senior housing to be built in traditionally single-family neighborhoods.	Municipalities	N/A	Near-Term	Medium	N/A
Municipalities should create and invest in health care coordinator programs (i.e., community nurse, community healthcare coordinator).	Municipalities	Moderate	Ongoing	Medium	Various
Municipalities should develop incentives for small or convenience store owners to stock healthy and local options.	Municipalities	Low	Long-Term	Low	Municipal
Municipalities should promote and expand farmers markets and community gardens.	Municipalities	Low	Ongoing	Low	Various
TRORC and municipalities should participate in health impact assessments of proposed housing developments.	TRORC/ Municipalities	Low	Ongoing	Low	Various
Municipalities should require new development and significant additions to existing development to provide adequate tree canopy to improve or maintain environmental health.	Municipalities	N/A	Ongoing	Low	N/A

Healthy Communities					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
The State and/or TRORC should map neighborhoods and advocate for connectivity to essential services, walkable routes, recreations opportunities, and transportation options.	TRORC/State	Moderate	Long-Term	Low	Vtrans
Municipalities should conduct walkability and bikability assessments.	TRORC	Low	Ongoing	Low	Vtrans
The State and TRORC should work with local jurisdictions to adopt bike and pedestrian master plans.	TRORC Municipalities	Moderate	Ongoing	Low	Various
Municipalities should promote joint use of park and recreation facilities between communities.	Municipalities	N/A	Ongoing	Low	N/A
The municipality should map public gathering spaces and indicate level of accessibility.	Municipalities	N/A	Ongoing	Low	N/A
The State and/or TRORC, respecting privacy, should use Geographic Information System (GIS) technology to map seniors and disabled citizens' location, housing, health facilities, and other needed and available services.	TRORC/State	Low- Moderate	Long-Term	Low	Various
Municipalities should convene community organizations who serve youth and local leaders to capture ideas and resources to help implement and sustain research-based programs.	Municipalities	N/A	Near-Term	Low	N/A

Historic, Cultural, Archeological					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
Towns are encouraged to clearly outline in their plans those resources deemed worthy of protection. Town officials can participate in the Act 250 process, thus influencing decisions affecting historic sites in their community.	Towns	Low	ASAP	High	MPG
The Regional Commission should continue to support efforts to designate National Historic Register Districts and Sites. In so doing, the Regional Commission should coordinate with the State and affected municipalities. In accordance with Section 106 of the National Historic Preservation Act, the Regional Commission must review all federally funded projects in the region which affect register properties or places to assure that such publicly assisted projects are planned with due consideration to the resource.	TRORC	Low	Ongoing	Medium	RPC
The Regional Commission, as part of its Transportation Planning Program, should continue its work with the Agency of Transportation, town officials, its Transportation Advisory Committee and other groups and organizations to ensure that design standards and plans for proposed transportation projects are reasonably compatible with historic resource needs and values. (See Transportation chapter.)	TRORC	Low	Ongoing	Medium	RPC/Vtrans

Historic, Cultural, Archeological					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
Regional Commission staff should continue to work with the Vermont's public utilities and design professionals to evaluate lighting technologies and efficiencies.	TRORC	N/A	Ongoing	Medium	N/A
To increase public awareness of archeological resources, the Regional Commission encourages archeologists, local and regional groups, towns, and landowners to organize educational programs focused on Vermont. Such a program could be made a part of an overall cultural heritage program through public schools.	TRORC	N/A	Mid-term	Low	N/A
Local planning commissions, conservation commissions, historical societies, and other interest groups are encouraged to develop an archeological plan for their community as part of the overall master planning program.	Towns	Low	Ongoing	Low	MPG
The Regional Commission should assist local and state policymakers in evaluating lighting options. The Regional Commission should consider sponsorship of educational workshops for planning commissions, design professionals, and others to acquaint them to the principles of good lighting design.	TRORC	Low	Mid-term	Low	Various

Historic, Cultural, Archeological					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
Towns interested in planning for outdoor lighting in their communities should consider using their Municipal Plans to establish goals and objectives for lighting. Additionally, consideration should be given to incorporating a lighting section into a town's Zoning Ordinance to cover lighting installations in all or parts of the Town.	TRORC/Towns	Low	Ongoing	Low	MPG

Housing					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
The Regional Commission will continue to assist non-profit housing organizations in the development of affordable housing projects when such efforts are consistent with the policies of the Regional Plan.	TRORC/ Non-Profits	Low	Ongoing	High	Various
Towns within the region should actively cooperate with local and regional non-profit housing trusts to develop and preserve new and existing housing, with mechanisms to assure the perpetual affordability of that housing.	Towns/Others	N/A	Ongoing	High	N/A
Community leaders, housing advocates and the Regional Commission must work to retain Vermont's innovative publicly financed home mortgage lending and housing assistance programs. The region's low and moderate income families, disabled individuals, and the elderly are enabled to secure affordable housing through these programs.	VHCB/VHFA/ TRORC	Low	Ongoing	High	Various
The Regional Commission will assist towns in writing strong housing components in town plans that are based on current data that address proven needs as opposed to only updating highlighted topics from years past to better address highest current needs.	TRORC/Towns	Low	Short-term	High	Various

Housing					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
The Regional Commission will continue to provide professional assistance to member municipalities in the identification of need and implementation of local housing assistance programs.	TRORC/Towns	Low	Ongoing	Medium	Various
The Regional Commission will educate communities on density allowances in towns, encourage communities to allow for ADU approval at the municipal staff level, and enhance local awareness of the need for workforce housing in the region through community forums.	TRORC	Low	Short-term	Medium	Various
The Regional Commission will facilitate discussions with local land developers, bankers, and community leaders to better understand the structural and institutional impediments to providing new housing throughout the region.	TRORC	N/A	Short-term	Medium	N/A
Community leaders within the region will work with state housing agencies, non-profit organizations, and lending institutions to ensure the availability of loan or grant funds for Vermonters to purchase, acquire, or improve their primary homes.	Others	N/A	Short-term	Low	N/A
The Regional Commission will actively help identify land that is suitable for development so that towns may work with developers and existing property owners to promote mutually beneficial partnership opportunities.	TRORC/Towns	Low	Mid-term	Low	Various

Natural Resources					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
The Legislature must keep the Petroleum Cleanup Fund at a level sufficient to meet all cleanup needs.	Legislature	2 Million	Ongoing	High	Federal/State
The Vermont Department of Environmental Conservation's listing of threatened and impaired waters should be targeted for immediate attention.	ANR	n/a	ASAP	High	n/a
Towns in the region are encouraged to cooperate on a watershed-wide basis when planning for surface water quality and use.	Towns	None	ASAP	High	N/A
The Regional Commission should be involved in watershed and basin planning efforts and encourage municipal involvement.	TRORC	Low	Ongoing	High	ANR
Unless there are overriding concerns in the local and Regional Plans, the Agency of Natural Resources shall adopt the highest possible classification and type for water bodies based on their actual condition and use.	TRORC/ANR	N/A	Per Basin Plans	High	N/A
Public and private sectors should refrain from activities that spread invasive plants such as: ill-timed roadside mowing, transporting invasive plants in ditch spoil, and the cleaning of mowing and earthmoving equipment after working in an infested area. Road maintenance personnel should be trained to recognize the invasive plants on the Vermont Noxious Weed Quarantine List and Watchlist.	Towns/Vtrans	Low	ASAP	High	N/A

Natural Resources					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
Towns are encouraged to use mechanisms such as cluster zoning, conservation districts, transferring or purchasing of development rights, or purchasing of land containing critical habitat areas in order to maintain the integrity of large forest blocks and preserve critical habitat.	Towns	High	Ongoing	High	Private/Federal
To protect high-quality forested riparian (river bank, stream bank or lake shore) habitat, towns should prohibit development near these areas and regulate the disturbance of vegetation in riparian zones through general, conditional use, and/or site plan standards.	Towns	\$5000-10,000	ASAP	High	MPG
Municipalities should review existing and proposed water quality classifications of surface waters within town boundaries, or within basins, to determine if classifications meet the uses and needs.	Towns	None	Ongoing	Medium	N/A
Municipalities are encouraged to play an active role in the basin planning process and to prepare water resources elements in municipal plans that are in compliance with state and federal laws.	Towns	Low	Ongoing	Medium	MPG
The Regional Commission, in cooperation with the Agency of Natural Resources - Water Quality Division, Vermont Local Roads Program, and Agency of Transportation, should advise town officials on cost-effective backroad erosion and sediment control.	TRORC/ANR	Low	Ongoing	Medium	Vtrans/ANR

Natural Resources					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
The Agency of Natural Resources and local groups are encouraged to monitor water quality, and when monitoring indicates a water quality violation, to promptly locate the source of degradation when possible.	ANR/Watershed Groups	N/A	Ongoing	Medium	N/A
In preparation for writing any basin plans, the Agency of Natural Resources should conduct a comprehensive assessment of water quality in such basins and identify the source of any known water quality problems.	ANR	N/A	Ongoing	Medium	N/A
The State of Vermont should identify and map significant wetland areas not currently classified as Class 1 or 2 wetlands and petition the Water Resources Panel of the Natural Resources Board (formerly Water Resources Board) to have such areas reclassified at a higher level.	State	Medium	Mid-term	Medium	State
Encourage more accurate and thorough identification of wetlands areas through the use of best available data and the adoption of local wetlands regulations and updated maps by the municipalities in the region.	TRORC	\$5,000- \$15,000 per municipal inventory	Ongoing	Medium	State/Municipal

Natural Resources					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
Town plans and zoning regulations should protect significant natural features and sensitive habitat areas by using setbacks and buffers, particularly for wetlands and vernal pools, before threats to these areas develop. Local officials are encouraged to work with staff from regional offices of the Vermont Department of Fish and Wildlife and wildlife biologists from VINS to assist in identifying and creating inventories of the critical habitat areas and significant natural communities in their municipalities.	Towns	\$10,000- \$20,000 Per municipal inventory	Ongoing	Medium	MPG/VTFW
Towns should adopt zoning regulations that would discourage development near wetlands and vernal pools, and prevent development within 300 feet in conservation districts, in order to protect their functions and native biological diversity and to prevent additional loss of habitat.	TRORC/Towns	\$5000- 10,000	Mid-term	Medium	MPG
Protection of wetlands, riparian areas, vernal pools, the most critical deer wintering areas, and natural grasslands should be considered in revisions to local subdivision regulations.	Towns	\$5000- 10,000	Ongoing	Medium	MPG
The Regional Commission should be prepared to comment upon projects outside the region which may potentially impact upon air quality within the region.	TRORC	Low	Ongoing	Medium	RPC

Natural Resources					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
The Regional Commission should work with the Agency of Natural Resources, town officials, and others on educational outreach about the proper use of floor drains, local spill response capacity, and proper administration of septic regulations. The Regional Commission will coordinate with the Agency of Natural Resources, other state agencies, and local officials in the assessment, cleanup and redevelopment of contaminated (brownfield) sites.	TRORC/ANR	Low	Ongoing	Low	State/Regional
Encourage municipalities in the region to enhance zoning bylaws to protect wetlands that may not be protected under state or federal law.	TRORC	Low	Ongoing	Low	MPG
Work with towns to establish a priority list of wetlands for protection and/or acquisition.	TRORC/Local Conservation Commissions	Low	Ongoing	Low	MPG
Encourage property tax relief to provide an incentive for the protection of designated wetlands.	Towns	N/A	Ongoing	Low	N/A
With the help of specialists from the Department of Fish and Wildlife or the Vermont Institute of Natural Science, towns in the region should work to inventory wildlife species; sensitive areas including wetland, vernal pools, bogs and fens, mature oak trees; and critical habitats for birds, deer, bear, bobcat, heron, and threatened or endangered plant species.	Towns	\$10,000- \$20,000 Per municipal inventory	Mid-term	Low	MPG/VTFW

Natural Resources					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
Towns should work cooperatively and seek assistance from land trusts to maintain large tracts of undeveloped habitat that cross political boundaries.	Towns/State	N/A	Ongoing	Low	N/A
Towns should attempt to identify critical bear habitat areas within the broader areas identified on Vermont bear habitat maps.	Towns	\$10,000- \$15,000 Per project	Mid-term	Low	MPG/VTFW
Air quality should be monitored in the region as part of broader statewide effort so as to determine current and potential threats to air quality. Potential impact areas include village centers or other areas of traffic congestion and high elevations, where pollutants and acidic levels are potentially greater and more harmful to fragile vegetation.	ANR	Moderate	Mid-term	Low	State
Municipalities and state agencies should educate communities about the impacts of trash burning and develop more effective mechanisms to enforce laws prohibiting backyard burning of trash, including the adoption of civil ordinances.	ANR	Low	Ongoing	Low	State/Municipal

Transportation					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
TRORC will assist towns to develop capital improvement plans that addresses paved and gravel road maintenance costs.	TRORC	Low	Ongoing	High	VTrans
Towns and the State should maintain roads and bridges in good condition and must design new transportation facilities to be flood resilient.	Towns/State	Moderate-High	Ongoing	High	Local/State
Towns should identify any local bridges that are redundant and can be abandoned, removed or need not to be rebuilt if destroyed.	Towns	N/A	Short-term	High	N/A
TRORC will work with member towns during plan and bylaw revisions to further connect housing needs to transportation system efficiency, reducing the need to travel solely by car and increasing access to goods and services.	TRORC	Low	Ongoing	High	Various
TRORC will advocate for increased funding for more robust transit services that encourage increased ridership.	TRORC/transit	N/A	Ongoing	High	N/A
TRORC will support funding increases to meet demand in Elderly and Disabled transportation services.	TRORC/transit	N/A	Ongoing	High	N/A
TRORC will advocate for increased capital investments for commuter and human service public transportation.	TRORC/transit	N/A	Ongoing	High	N/A
TRORC will continue coordination with agencies in providing transportation services for elders and persons with disabilities.	TRORC/transit	N/A	Ongoing	High	Vtrans
TRORC will support the start of the Upper Valley US Route 4 commuter bus service.	TRORC	N/A	Ongoing	High	N/A

Transportation					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
TRORC and towns should continue to support public transportation and ride-share programs to reduce the region's dependency on single-occupancy vehicle trips.	TRORC/Towns	N/A	Ongoing	High	N/A
TRORC will work with towns to support land use regulations that increase the density and mixed use development pattern that improves walking and bicycling conditions by shortening trips between where people live, work, and recreate.	TRORC/Towns	N/A	Ongoing	High	N/A
TRORC will continue to support the Safe Routes to School program and encourage more schools to participate in the program – especially those schools within densely settled villages or town centers.	TRORC	N/A	Ongoing	High	N/A
Continue speed studies as requested by Towns.	TRORC	Low	Ongoing	High	Vtrans
Continue collaborating with Vermont Agency of Transportation on paving projects and district leveling prioritization.	TRORC	Low	Ongoing	High	Vtrans
TRORC will continue to work with towns to conduct road safety audit projects through Vermont Agency of Transportation.	TRORC	Low-Moderate	Ongoing	High	Vtrans
TRORC will offer town support as needed as liaisons for Vermont Agency of Transportation projects.	TRORC	Low	Ongoing	High	Vtrans
TRORC will seek out new ways its municipalities can approach issues of density in rural areas.	TRORC	N/A	Mid-term	High	N/A
TRORC will continue to review and participate in Act 250 permit proceedings.	TRORC	Low	Ongoing	High	ACCD

Transportation					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
TRORC will continue to work with Towns to have town plans consistent with regional and state policy.	TRORC	Low	Ongoing	High	ACCD
TRORC will update the Transportation Land Use (Interchange Area) section of this chapter to coincide with any future changes in the Land Use chapter update.	TRORC	Low	Ongoing	High	Vtrans
TRORC will work with local highway departments as requested to minimize stormwater runoff and road/river conflicts.	TRORC	Moderate	Ongoing	High	Various/ANR
The Natural Resources Board must revise Act 250 rules regarding Master Plans to make Master Plans a mandatory requirement for large-scale, multi-phase developments that have the potential for substantial regional impacts.	State	N/A	ASAP	High	N/A
TRORC will work with others to better estimate the full cost of the transportation system.	TRORC	N/A	Ongoing	Medium	N/A
TRORC will work with housing providers and developers to ensure that new multi-family housing, assisted living facilities and health and human service facilities be located in close proximity to services in village and urban centers or along public transportation fixed routes.	TRORC	Low	Ongoing	Medium	Various

Transportation					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
<p>State investments in park and ride lot improvements shall be as identified in the East Central Vermont Park and Ride Needs Analysis (Appendix X). Specifically, the two highest priority Park and Ride sites in the region that currently do not exist but are in high demand include:</p> <ul style="list-style-type: none"> • Royalton I-89 Exit 3 off VT107 (CMG PARK(27)S) • Hartford I-89/I-91 Interchange (CMG PARK(12)SC) 	TRORC/State	Moderate-High	Ongoing	Medium	Vtrans
Towns should apply to the Municipal Park and Ride Program and expand the regional park and ride network.	Towns	N/A	Ongoing	Medium	Vtrans
TRORC will work with towns and Vermont Agency of Transportation to institutionalize pedestrian and bicycle accommodations in all of its planning, engineering, and construction related activities – implement “Complete Streets”. In addition to the existing local land use regulations, develop free-standing Bicycle and Pedestrian Plans for interested towns.	TRORC/State	Low-Moderate	Ongoing	Medium	Various
TRORC will advocate that commercial developments invest in transportation infrastructure and services to increase bicycling, walking or transit, or provide necessary rights-of-way to allow later investment in those facilities.	TRORC	N/A	Mid-term	Medium	N/A
Private businesses should support telecommuting options where practical for employees.	Private Sector	N/A	Ongoing	Medium	N/A

Transportation					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
TRORC will support the implementation of the Northern New England Rail Initiative final recommendations for a Boston to Montreal high speed rail service.	TRORC	High	Ongoing	Medium	Federal/State
TRORC will support improved rail service along I-91 corridor.	TRORC	High	Ongoing	Medium	Federal/State
Continue to conduct road safety audit projects through Vermont Agency of Transportation High Risk Rural Roads program. Focus safety audits on roads that have development proposals and/or are expected to support increased development. If the state declares a road or intersection a high accident location, then conduct a road safety audit and advocate for those improvements to be implemented.	TRORC/State/Town	Low-Moderate	Ongoing	Medium	Vtrans
Work with towns to develop road standards that promote traffic calming in private development.	TRORC	Low	Ongoing	Medium	Vtrans/MPG
TRORC will work with towns to promote traffic calming.	TRORC	N/A	Ongoing	Medium	N/A
TRORC will work with towns and Vermont Agency of Transportation to identify poor pavement conditions for improvement.	TRORC/Vtrans	Low-Moderate	Ongoing	Medium	Vtrans
TRORC shall assist interested communities with studies and planning designed to improve pedestrian and multi-modal networks in Regional Growth Areas.	TRORC	Low	Ongoing	Medium	Various
TRORC shall support efforts to develop municipal parking facilities in Regional Growth Areas.	TRORC	N/A	Ongoing	Medium	N/A
TRORC shall support efforts to develop and improve park and ride lots in village areas.	TRORC	N/A	Ongoing	Medium	N/A

Transportation					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
TRORC shall support development projects in hamlet areas that encourage traditional hamlet design and promote access and walkability.	TRORC	N/A	Ongoing	Medium	N/A
TRORC will encourage communities to develop land use regulations that promote reduced density in rural areas.	TRORC	N/A	Ongoing	Medium	N/A
TRORC shall encourage agricultural and silvicultural businesses to use best management practices that minimize damage to roadways, land, and waterways.	TRORC	N/A	Ongoing	Medium	N/A
TRORC will work with towns and Vermont Agency of Transportation to achieve context sensitive solutions that enhances historic, scenic, agricultural properties of roadway consistent with public safety through transparent public process and project development.	TRORC/State /Town	Low	Ongoing	Medium	Vtrans
Towns should consider parking requirements and minimize the use of impervious surfaces for parking through shared parking, allow reduced parking requirements when supported by data or encourage phased parking development when demand arises.	Towns	N/A	Ongoing	Medium	N/A
Vermont Agency of Transportation, FEMA, ANR, the Vermont Department of Public Safety and others involved in flood recovery should incorporate wildlife and aquatic passage needs into rebuilt bridges and culverts when feasible.	State/ Federal	High	ASAP	Medium	Vtrans/ANR / FEMA

Transportation					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
Towns should consider options to reduce winter maintenance costs, including, but not limited to, downgrading winter road maintenance policies, combined with a public information campaign to alter traveler expectation of snow removal.	Towns	N/A	Ongoing	Low	N/A
Towns should consider shared parking lots with other properties that may become formal or informal park and ride lots.	Towns	N/A	Ongoing	Low	N/A
TRORC will cooperate with private and public initiatives that seek to market walking and bicycling in towns and the region and participate in state and local initiatives that promote bicycling and walking.	TRORC	N/A	Ongoing	Low	N/A
TRORC will use of objective measures to gauge the potential for walking and bicycling could be one element to assess priorities for investments in these modes. These measures could include population density, employment density, and block sizes or intersection density.	TRORC	N/A	Ongoing	Low	N/A
TRORC should provide education and training to large employers the benefits of providing showers and bike lockers for employees that commute by biking.	TRORC	Low	Short-term	Low	Various
Towns, the state, telecommunications providers, and TRORC should map existing cellular and broadband services in the region, identify gaps, and work to provide coverage in those gap areas.	TRORC/State/ Town	Low-Moderate	Mid-term	Low	Various

Transportation					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
TRORC should provide education to employers on benefits of allowing some telecommuting for employees.	TRORC	N/A	Ongoing	Low	N/A
TRORC shall support efforts to promote complete streets projects in village and downtown centers that improve access and walkability and support connectivity with transit opportunities.	TRORC	N/A	Ongoing	Low	N/A
Vermont Agency of Transportation and the Transportation Advisory Committee will work to reduce wildlife crossing collisions through improved signage and wildlife passage facilities.	TRORC/State	Moderate	Ongoing	Low	Various

Utilities and Facilities					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
Municipal plans, per Vermont statutes, shall identify and prioritize future capital improvements/repairs and estimate costs and means of financing for maintenance and future capacity.	Towns	Low	ASAP	High	MPG
TRORC shall assist communities with the identification and prioritization of future capital improvements/repairs.	TRORC	Low	Ongoing	High	Various
TRORC shall offer capital budgeting workshops throughout the region.	TRORC	Low	Ongoing	High	ACCD
Water efficiency programs and codes should be adopted at the state or local level to reduce demand on municipal water systems.	State/Town	Low	ASAP	High	Various
TRORC should identify areas of the region where medical or elderly care facilities would be beneficial.	TRORC	Low-Moderate	Short-term	High	Various
TRORC should review local zoning and subdivision regulations to ensure that they do not have the effect of prohibiting health or elderly care facilities from appropriate areas and to assist with revisions as needed.	TRORC	Low	Ongoing	High	Various
TRORC should work with partners to further identify and document gaps or needs within the regional health care system, particularly for vulnerable populations.	TRORC	Low	Mid-term	High	Various
Continue to participate actively in the Section 248a permitting process.	TRORC	Low	Ongoing	High	ACCD

Utilities and Facilities					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
TRORC will assist communities with the development of interlocal agreements, union municipal districts and other cooperative agreements whenever possible.	TRORC	Low-Moderate	Long-term	High	Various
TRORC shall seek grant opportunities to map water and wastewater systems throughout the region.	TRORC	Low	Mid-term	Medium	Various
When funding is available, municipal plans should inventory water and wastewater systems to identify current and projected capacity gaps.	Towns	Low	Long-term	Medium	MPG
Municipalities shall conduct periodic auditing of all water and wastewater distribution systems for calculation of infiltration and losses.	Towns	Low-Moderate	Ongoing	Medium	Various
TRORC shall continue to assist member towns, alliances, and the Greater Upper Valley Solid Waste Management District in the update and implementation of municipal and regional solid waste plans.	TRORC	Low	Ongoing	Medium	Various
TRORC shall support and participate in any future discussions regarding the development of regional waste management services.	TRORC	N/A	Ongoing	Medium	N/A
TRORC shall further Universal Recycling Law requirements for parallel solid waste collection services through outreach and education with assistance from the Agency of Natural Resources.	TRORC	Low	Short-term	Medium	Various

Utilities and Facilities					
Action	Lead/ Partner	Estimated Cost	Timeline	Priority	Potential Financing
TRORC should work with state partners to clarify or revise Act 250 rules to allow permitting flexibility when a proposed development is consistent with this Plan and has a clearly defined public good.	TRORC	N/A	Short-term	Medium	N/A
Seek out funding for our communities to implement new or sustain existing Wi-Fi Zones in villages and downtowns.	TRORC	Low	Short-term	Medium	Various
To further support outdoor recreation, TRORC will assist communities with the establishment of Conservation Commissions and will support existing Conservation Commissions when possible.	TRORC	Low	Ongoing	Medium	Various
TRORC will foster a partnerships between public investment planning and implementation activities and the private sector, in a manner which advances the goals and policies set forth in this Plan.	TRORC	N/A	Ongoing	Medium	N/A
TRORC shall support the creation of municipal composting facilities for organic wastes where appropriate.	TRORC	N/A	Ongoing	Low	N/A

WORKING LANDSCAPE					
Action	Lead/Partner	Estimated Cost	Timeline	Priority	Potential Financing
TRORC should work with communities to provide or facilitate education about the state's Required Agricultural Practices.	TRORC/ Towns	Low	Ongoing	High	Various
TRORC will evaluate proposed developments involving primary agricultural and forest lands, and their related industries. Where appropriate, it will provide information to federal and state agencies, town boards and commissions, and other parties regarding the probable impacts these resources have on the welfare of the region.	TRORC	Low	Ongoing	Medium	Various
TRORC should organize a regional committee of stakeholders to focus on how the Regional Planning Commission can support the local agricultural and forest products industry.	TRORC	Low	Ongoing	Medium	Various
TRORC, as part of its on-going Technical Assistance Program, will provide planning advice and support to town Planning Commissions, Conservation Commissions, non-profit conservation organizations, and other groups interested in sustaining agriculture and forestry through sound ecological practices.	TRORC	Low	Ongoing	Medium	Various
To promote a better understanding of the farming and forestry practices, and natural resource management in general; the industry, conservation organizations, public schools and the tourism and recreation industries should sponsor continuing educational opportunities to the public.	Other	N/A	Ongoing	Low	N/A

WORKING LANDSCAPE: AGRICULTURE AND FORESTRY

A. Introduction

The TRORC Region has had a strong history of our residents making their living through their land. Like much of Vermont, historically much of the work done in our region once had its roots in the land, whether through farming, forestry or mining. While the face of agriculture and forestry has changed significantly since the 1800's, these vocations remain an essential part of what makes our region what it is. Businesses that utilize the land help to shape it and give it the character that it has today. Without good forestry practices, we would not have healthy forests. Without farming we would not have open rolling fields. In order to maintain our working landscape and the occupations it supports, we must recognize their contributions to our region and be prepared to address the challenges to their sustainability.

B. Agriculture

In 2014, the Vermont Agency of Agriculture, Food & Markets conducted a survey for their report on agricultural enterprises. Respondents to the survey identified the preservation of open space and access to locally grown and processed food as the primary reasons land should be kept in agriculture. Farms provide open space for wildlife habitat, scenic views and a connection to the land that is hard to find in other places. In addition, agriculture is an important piece of our local economy, providing opportunities for entrepreneurship that extend well beyond the farm. As such, to continue to receive the benefits farming has to offer, the TRORC and our communities must continue to support agriculture.

Farming Trends

An analysis of the United States Census of Agriculture data between 2002 and 2012 (2012 being the most recent period of data collected) shows that farming in Vermont is slowly shifting away from the larger scale farms that developed as a result of trends toward consolidation. Between 2002 and 2012, the number of farms in Vermont increased by more than 11%. Growth in farms was at its highest among smaller farms, specifically in the 10 to 49 acre range.

The overall trend in farm growth in Vermont and the Two Rivers-Ottawaquechee region is in farms that are considered "small scale." "Small-scale" farms are those that sell under \$2,500 in agricultural products per year. While the number of small-scale farms continues to grow, these farms only produce 2.3% of Vermont's agricultural income. Generally, these small-scale farms tend to be more diversified and not dependent on a single source of production like dairy.

While the number of larger farms (between 180-1000 acres) has declined between 2002 and 2012, there has been growth in Vermont's largest farms (2000 acres or more) as operating farms purchase the land and stock of neighboring farms when they stop operating. The Region's largest farms are primarily dairy farms.

Farm Economy

Vermont is within easy reach of millions of people in cities like Boston and New York City. Additionally, Vermonters are increasingly seeking locally-sourced, sustainably-produced farm and forest products. Fluctuating fuel prices have led to an increased interest in food and energy security. Vermont is a national leader in innovative education programs based on local food, agriculture, and healthy eating. It is also widely recognized for its strong network of land trusts and other nonprofits that are models for conserving farm and forest lands. As such, there is a growing mix of emerging entrepreneurs and long-time land-based businesses that are constantly evolving to stay competitive. They're producing biofuels, artisan cheese, specialty wood products, produce, breads, and other value-added items – all of which rely on the farm economy.

According to the Vermont Farm to Plate Strategic Plan (2013), between companies responsible for farm inputs such as feed and labor, farms themselves, food processors and wholesale food distributors, Vermont's agricultural economy has almost 9000 businesses employing nearly 30,000 people¹. This economic boon is due in great part to the growing movement in sustainable diversified agriculture—which involves increased local food production and consumption, value-added processing, and diversified farms. In 2012, USDA data indicated the estimated agricultural revenue in Vermont to be \$775 million per year. That number increased to \$2.9 billion when food product output is also considered.

Vermont has continued its efforts to encourage the continued diversification of on-farm businesses and more broadly support rural economic development in both the farm and forestry economic sectors. In 2012, the Vermont Legislature passed Act 142, which created the Vermont Working Lands Enterprise Initiative, which is a state supported grant program aimed at investing in Vermont's farm, food and forest economies.

Challenges

Loss of Farmland – Vermont has lost (on average) nearly 8000 acres of farmland each year, including 1,100 acres of prime crop and pastureland; while the amount of developed land has increased nearly 4,700 acres annually². This trend has slowed since 2013, but the loss of farmland remains a concern, particularly in more populated areas where the pressure to utilize land for commercial or residential purposes is greater.

For many farms (particularly dairy farms), a significant percentage of the lands actively managed do not actually belong to the farm, and instead are leased through agreements with the landowner. Much of the production on these lands is focused on the generation of feed through hay or corn, although some grazing takes place as well. The need to generate feed locally is a strong one, as grain costs are often unstable due to external market fluctuations (such as fuel costs). Local farmers are dependent on a wide range of property owners who are willing to lease their property for the purposes haying or growing corn for feed.

¹ Unfortunately, aggregated data at the regional level is unavailable.

² Sustaining Agriculture: Agricultural Land Conservation, Agriculture Land Use Planning Task Force, Farm to Plate Network, 2013

This relationship can create potential challenges for the farmer. When landowners sell their property to someone who intends to build a home on it, it takes that farmable land out of production. During a survey of farmers in Tunbridge, for example, one farmer indicated that if he were to lose 20 acres of land it would seriously impact his ability to produce his feed locally³. While not without expense, local feed production is more cost-effective than purchasing feed. Keeping farmland in farming is a critical concern as good agricultural land is developed, it is permanently lost to farming and the production of food, forage, and fiber.

Aging Farmers – The average age of Vermont farmers is 56 and over a quarter are 65 and older⁴. This means that many farmers are reaching retirement age. While farm operations are often family owned, there is no guarantee that a family member will take over the farm.

A growing number of young people are interested in becoming farmers or starting a food enterprise business. The challenge is that most farms require one or more family members to hold a full-time job to supplement farm income and maintain access to health insurance. The average wage for farm workers is just over \$11 per hour.

Land and Taxation – Rising tax rates due to increased property values and education costs find owners of farmland faced with a tax bill on land that exceeds its economic value for agriculture purposes. These high property tax bills coupled with the low prices paid in this country for commodity agricultural products like milk, population growth and in-migration, a demand for more housing and accompanying development land in general, and their own lack of retirement savings have all pushed landowners to place their land on the market.

Unless the cost of owning farmland or commercial forest land is reduced, meaning a reduction in property taxes, it becomes difficult to rationalize conventional farming and forestry pursuits. The general problem of taxation is exacerbated because towns and school districts are primarily dependent on property taxes to raise local revenues. Furthermore, any reduction in the amount of taxes received from active open land needs to be made up by non-farm, non-forest, or non-enrolled taxpayers, many of whom are unable to pay more.

Solutions

Current Use and Tax Stabilization – The most common method used to reduce the tax burden on farming and forestry operations is through the Vermont Current Use Program. This program requires that agricultural lands or working forests have management plans to ensure they are actually not just simply being left wild (there is no Current Use program for conservation purposes). The main incentive for Current Use is that it allows participating landowners to have their forest or farmlands valued for their productivity, rather than for development potential, creating a large tax savings. In order to keep the program from being used to simply avoid taxes, there is a penalty for withdrawing from the program, but it is widely seen relatively small, compared to the savings.

The primary objectives of the Program have been to preserve Vermont's agricultural and forestlands, and keep them in production, and achieve greater equity in property taxation based on use. Forty-six

³ Tunbridge Town Plan, 2013

⁴ Farm to Plate Strategic Plan, Executive Summary, July 2013

1 percent (46%) of the Region's total land is enrolled in some form of Current Use, a significant percentage

Town	Total Acres by Town	Total Enrolled Acres	Enrolled Forest Acres	% of total acreage enrolled as Forest	Enrolled Agricultural Acres	% of total acreage enrolled as Ag
Barnard	31,057	18,367	16,701	54%	1,667	5%
Bethel	29,282	16,410	14,665	50%	1,745	6%
Bradford	19,144	5,960	4,445	23%	1,515	8%
Braintree	24,680	14,632	12,454	50%	2,178	9%
Bridgewater	31,680	17,097	16,388	52%	709	2%
Brookfield	26,447	11,371	8,090	31%	3,281	12%
Chelsea	25,655	16,470	12,182	47%	4,287	17%
Corinth	30,943	15,992	13,836	45%	2,156	7%
Fairlee	13,467	6,619	5,636	42%	983	7%
Granville	32,626	13,210	13,033	40%	177	1%
Hancock	24,696	1,551	1,443	6%	108	0%
Hartford	29,434	5,557	4,431	15%	1,126	4%
Hartland	28,988	13,969	11,162	39%	2,806	10%
Newbury	41,294	16,979	13,076	32%	3,903	9%
Norwich	28,617	13,401	11,410	40%	1,991	7%
Pittsfield	13,418	1,432	1,335	10%	97	1%
Plymouth	31,118	7,491	7,415	24%	77	0%
Pomfret	25,251	17,583	13,684	54%	3,899	15%
Randolph	30,796	14,490	8,604	28%	5,886	19%
Rochester	36,560	13,895	12,396	34%	1,498	4%
Royalton	26,102	9,516	7,519	29%	1,997	8%
Sharon	25,797	12,713	11,776	46%	937	4%
Stockbridge	29,471	16,453	15,839	54%	615	2%
Strafford	28,328	16,264	13,305	47%	2,959	10%
Thetford	28,382	13,102	11,051	39%	2,052	7%
Topsham	31,369	12,972	12,041	38%	932	3%
Tunbridge	28,665	16,777	12,919	45%	3,858	13%
Vershire	23,136	15,231	13,664	59%	1,567	7%
West Fairlee	14,616	8,869	8,017	55%	853	6%
Woodstock	28,374	16,308	13,248	47%	3,059	11%

Figure 1: Current Use Enrollment by Town, TRORC Region
Source, Vermont Department of Taxes, 2016

2 of these lands are forested. Out of the total lands enrolled in Current Use, only 15% are agricultural
3 lands. This is due to the Program's strict definition of agricultural use. However, land that is enrolled as

1 agriculture receives a significantly greater tax benefit than forest land. Both figures underrepresent land
2 actually in agriculture and forestry since not all owners take advantage of the program and some small
3 farm operations are under the 25-acre threshold for the program.

4
5 Municipalities have the authority to enter into tax stabilization contracts with owners, lessees or
6 operators of existing or new forest, agricultural, or open lands in order to promote agriculture and open
7 space preservation. These contracts can be designed to stabilize taxes in a number of ways, including:
8 By fixing property values, tax rates, or the amount or percentage of annual tax assessed. Local
9 stabilization can be enacted by town vote or by Selectboard vote (although the Selectboard option has
10 more limitations as to the scope). The choice to offer tax stabilization to farmers impacts the entire
11 community as all other property taxpayers would bear the burden of any tax loss resulting from local tax
12 stabilization.

13
14 **Farmland Preservation** – Preserving farmland is often achieved by utilizing a mix of programs that
15 provide incentives for landowners to keep their land in farming, and regulations that limit the impacts of
16 development on the land. The most common non-regulatory method of farmland preservation is
17 through the purchase of agricultural conservation easements. While preservation efforts may begin at
18 the local level, they often include organizations such as the Vermont Land Trust or the Upper Valley
19 Land Trust, both of which work to actively conserve working lands in the Two Rivers-Ottawaquechee
20 Region. Partners in this process may include the municipality, Vermont Agency of Agriculture, Food and
21 Markets (VAAFM) and UVM's Center for Sustainable Agriculture. The Vermont Housing and
22 Conservation Board, which is the primary funder of land conservation projects in the state, may also
23 play a critical in role in local farmland preservation efforts.

24
25 Regulatory methods use zoning and/or subdivision rules to regulate the location, density and design of
26 development within selected areas to minimize harmful impacts while allowing for a reasonable level of
27 development. Regulatory methods include:

- 28
29 • Overlay Districts - The creation of overlay districts is the most common method of regulating
30 specific areas for the purpose of protecting wildlife and other natural resources. Overlay districts
31 can be used to exclude development on or to impose resource protection or conservation
32 standards within overlay areas. These districts can be used to protect many types of resources.
33
- 34 • Resource Protection Districts - Protect wildlife resources and open space areas or resource
35 based uses such as farming, forestry, recreation from incompatible development.
36
- 37 • Large Lot Zoning - Large lot zoning refers to the designation of a very large minimum lot size
38 within certain zoning districts to accommodate resource-based uses, such as farming or forestry,
39 or to require a pattern of very scattered, low-density development to limit, for example,
40 impervious surfaces and protect surface and groundwater quality.
41
- 42 • Fixed Area and Sliding Scale - Fixed area and sliding scale zoning are two zoning techniques
43 (typically applied in association with subdivision regulations) that are used to differentiate
44 allowed densities of development from district lot size requirements.
45
- 46 • Conservation (Open Space) Subdivision Design - Conservation or open space subdivision design
47 is a subdivision design process wherein subdivisions are intentionally designed to protect rural
48 character and open space.

Each of these methods has its own set of benefits and pitfalls and all of them should be thoroughly evaluated before they are implemented. However, there are many examples of successful regulatory land protection strategies in Vermont. The key to success is to ensure that the community on a whole supports the regulations.

Encourage the production of value-added products – Farm innovation and diversification is essential to sustaining our working landscape. Instabilities in traditional markets such as dairy, means that farmers need to embrace broader ways to utilize their farms and sell their products such as direct to consumer sales, on farm events, participation in farmer’s markets, agri-tourism and the production of value added products.

Direct to consumer sales represents a step away from the traditional model established by the dairy industry. As farms try to take advantage of the growing market for locally produced foods, they are often challenged by the perception that food should be cheap. The artificially low cost of our industrial food system impacts demand for local products. To counter this, farmers must improve consumer education, helping them recognize the broader benefits of buying locally and regionally produced food (social, economic, environmental, etc.). Marketing and market development are key components to educating and encouraging new customers.

Utilizing on farm assets to develop agripreneurial enterprises beyond food production is a way to increase sustainability and encourage economic growth. Many farms are encouraging on-farm events such as weddings, concerts or festivals. Some farms have developed dining establishments that can take advantage of the types of food produced to create seasonally developed menus that focus on fine dining.

As farmers develop these new markets, it is important that existing land use regulation is capable of dealing with the potential impacts. Programs that support new and growing agricultural businesses can be stifled due to planning and implementation barriers at the regional or local level. Regulations that intentionally or unintentionally prohibit value added processing of products not principally produced on farm, on farm events, farm stays or other forms of agritourism where the public is invited on to a property must be reevaluated and the impacts of these potential uses must be balanced with the need to support these new innovations.

It is important to recognize that the “value added” concept goes beyond the development of products. When approached in an ecologically sound manner, farming adds value to our ecosystem. Regenerative agriculture techniques such as permaculture and holistic management utilize a range of approaches, including maintaining a high percentage of organic matter in soils, minimum tillage, biodiversity, composting, mulching, crop rotation, cover crops, and green manures, to improve soil health and biodiversity. By utilizing ecologically sound farming techniques, farmers are adding value to the lands in our region



Figure 2: Example of the benefits of Holistic Agricultural Practices (on left), Karoo Region, South Africa.

by improving their health. This has broad benefits from an ecological standpoint, but also allows for more sustainable agricultural production. Better quality soils can produce better quality products, whether through growing crops or grazing livestock. Better quality products will have an increased marketability and may ultimately bring additional income to the farmer.

C. Forestry

Healthy forests provide a significant number of benefits to our communities, including environmental services (such as clean water supply, clean air, mitigation against climate change, wildlife habitat and biological diversity), and economic benefits (such as tourism, recreation and the wood products industry).

Trends in forest health have been changing over the past decade. In the 2013 US Forest Service's National Forest Inventory and Analysis Program (FIA) report, figures indicated that since 2007 there has been a continuing, though gradual, loss of about 75,000 acres of forestland in Vermont. Developed land in Vermont increased significantly between 1980 – 2010 (67%), as well as subdivision of forest into smaller parcels. This pattern of development growth has led to significant forest fragmentation throughout the state.

Forest Resources

Vermont is one of the most heavily forested states with 4.6 million acres or 75% of its lands covered in trees. The Two Rivers-Ottawaquechee region is situated within the larger Northeastern forest corridor, which contains the Green Mountains (running down the spine of Vermont), the Adirondack Mountains (in eastern New York), and the White Mountains (in western New Hampshire). Accordingly, two famous hiking trails run through the TRORC area: the Long Trail (which stretches from the northern to southern border of Vermont) and the Appalachian Trail (which cuts a path between Georgia and Maine).

At the local level, forestlands might be owned by the federal, state, or even local government, or by private individuals. Some of the private properties have been conserved with the assistance of local land trusts (for example, the Vermont Land Trust or the Upper Valley Land Trust), while others are enrolled in the State's Use Value Appraisal Program (UVA or 'Current Use').

1 Major blocks of forestlands in this region include (but are not limited to):
2

<u>Name</u>	<u>Description</u>
<u>Brushwood Community Forest</u>	<u>In 2009, Brushwood Community Forest was established on approximately 475 acres of relatively undeveloped forestland in the Towns of Fairlee and West Fairlee. With the help of the Trust for Public Land, an additional 580 acres was added in northern Fairlee that had been owned by the Town of Bradford. The area is now owned by the Town of West Fairlee and protected from development through a conservation easement that is held by FPR. The Community Forest abuts the separate West Fairlee Town Forest and the large 1500 acre Fairlee Town Forest. The Community Forest comprises just a small section of the greater 28,000-acre Brushwood Forest area that boasts an extensive trail network, vast undeveloped forestlands, wetlands, and wildlife habitat. The unprotected lands in the larger Brushwood Forest area are facing increasing residential development pressure.</u>
<u>Chateauguay No Town (CNT) Conservation Project</u>	<u>The CNT Conservation Project spans more than 50,000+ acres across Barnard, Bridgewater, and Stockbridge (in the Two Rivers area), as well as Killington (outside of the Two Rivers area). Town representatives convened the project in 1997 to encourage voluntary conservation of private lands in order to maintain current wildlife habitats, promote sustainable forestry, and further other objectives.</u>
<u>Coolidge State Forest (CSF)</u>	<u>CSF encompasses 21,500 acres of land in Plymouth and Woodstock. These lands are part of Coolidge State Park where campsites, hiking trails, and beautiful scenic views are abundant. CSF is the state's largest landholding, and is managed by the Vermont State Parks' Department of Forests, Parks, and Recreation (FPR).</u>
<u>Current Use Lands</u>	<u>Forty-six percent (46%) of the land in the Two Rivers region is enrolled in the state's Current Use Program.</u>
<u>Green Mountain National Forest (GMNF)</u>	<u>With over 400,000 acres, the GMNF is located within several Two Rivers towns, including: Woodstock, Rochester, Hancock, Pittsfield, Stockbridge, Granville, Bridgewater, Pomfret, Hartford, and Norwich. The lands contain portions of the Long Trail, Appalachian Trail, and the Robert Frost National Recreation Trail.</u>
<u>Orange County Headwaters (OCH) Project</u>	<u>The OCH Project was started by landowners in the Towns of Washington and Corinth who had an interest in conservation. Through the Vermont Land Trust and the Upper Valley Land Trust, 31 OCH landowners have conserved 4,500 acres. Much of this land is forested.</u>

<u>Pine Mountain Wildlife Management Area (WMA)</u>	<u>Pine Mountain is one of the larger WMAs in the Two Rivers region. It spans the towns of Topsham and Newbury (within the Two Rivers region), as well as Groton and Ryegate (outside of the Two Rivers region). It is 2,274 acres in size, 95% of which is forested. Managed by the Vermont Fish and Wildlife Department, the Pine Mountain WMA is home to white-tailed deer, black bear, moose, and many other mammals, birds, fish, and amphibians. The area is open for hiking, fishing, trapping, and hunting.</u>
<u>Private Conserved Lands</u>	<u>Many privately-owned lands are protected through conservation easements held by one of the local land trusts, such as the Vermont Land Trust or Upper Valley Land Trust.</u>
<u>Taylor Valley</u>	<u>Taylor Valley is a forested area of approximately 18,000 acres that spans Chelsea, Vershire, Tunbridge, and Strafford. Approximately 1,200 acres of this have been conserved by The Nature Conservancy. The area is managed by the Taylor Valley Conservation Project, which includes private landholders, as well as members of the community who want to maintain what they see as an “ecologically rich and productive area for future generations.”</u>

These areas represent the “anchor areas” that provide for habitat connectivity. However, because they are not all connected, there is a significant amount of land between these areas that is being developed.

Challenges

Forest Fragmentation

The health of many natural communities and wildlife depend on large, uninterrupted areas of forestland, commonly referred to as “forest blocks.” Forest fragmentation is the division or conversion of forest blocks by land development (excluding recreational trails). These areas can be “divided or converted” through the clearing of land, building structures, and other activities associated with development. Even the seemingly simple act of installing roads can affect wildlife movement and increase invasive plants and pests. Development that causes forest fragmentation creates barriers which limit species movement over the landscape, interrupts ecological processes, and impacts genetic diversity.

Since the 1980’s, Vermont has experienced “parcelization,” which is the result of larger tracts of land being divided into smaller ownerships or land holdings. The more individuals that own smaller parcels of forest, the more likely that the land will ultimately be developed with infrastructure (such as roads and utilities) and buildings. The 2015 Vermont Forest Fragmentation Report identifies the following causes for this trend:

- Escalating land prices;
- Increased property taxes;
- Conveyance of land from aging landowners; and
- Exurbanization (the trend of moving out of urban areas into rural areas)

While development pressures have slowed in Vermont since 2010, the damage done to our forestlands has been significant. In several of our communities (including Randolph, Hartland and Brookfield), there are no longer large, contiguous, forested areas to serve as significant wildlife habitat or to act as connections to larger areas of habitat.

Changing Forest Economy

Forest product manufacturing and recreation represents a significant economic driver in Vermont. In 2011, the wood manufacturing industry generated over 1.4 billion in economic benefit for the state, during the same year, forest recreation (e.g. skiing) generated 1.9 billion. Timber harvests are an essential component of the forest economy and for those landowners who are motivated to improve the health of their forestland.

Since 2011, however, the forest industry has experienced several significant changes that threaten its viability. Due primarily to outside forces, paper mills in Maine, which were a significant buyer for a majority of low-grade pulp wood, have stopped operating. While there are opportunities for low-grade woods to be used in renewable energy generation, these have yet to materialize at a scale that off-sets changes to the paper industry.

Changing Forest Health

As the pattern of climate change worldwide progresses, the habitat ranges of many North American species are moving north and to higher elevations. According to the US Environmental Protection Agency in recent decades, in both land and aquatic environments, plants and animals have moved to higher elevations at a median rate of 36 feet per decade, and to higher latitudes at a median rate of 10.5 miles per decade. While animals can move faster than plants, some animals still can only move slowly and only if there is uninterrupted and suitable habitat. Grass and shrub species, including invasives, move faster than trees, which typically can only advance about 100 yards per year. This is significantly slower than the rate habitats are shifting northward. While this climate shift means a range expansion for some species, for others it means movement into less hospitable habitat, increased competition, or range reduction, with some species having nowhere to go because they are already at the top of a mountain or at the northern limit of land suitable for their habitat.

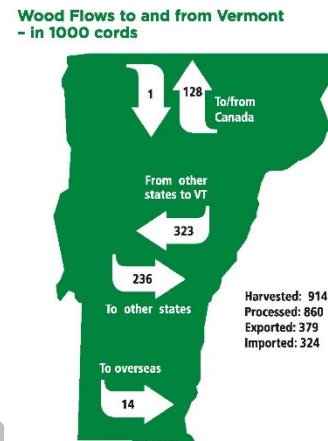
Significant changes in our forest ecosystem will challenge our current forestry management techniques, and our forest economy. Without sound ecological forest management practices, adapting to new forest species and combating invasive species will be challenging.

Another separate, but related, threat to forest health is the spread of invasive species, primarily forest pest insects and diseases. Just as we lost our native chestnut forests and many of our elms, we now face pests to ash (emerald ash borer) and hemlock (wooly adelgid) that could decimate these trees. Many other pests and diseases are on the rise that also threaten maple, beech, and even oak.

Challenges to Maintaining and Enhancing Our Forestlands

In 2011, TRORC formed a Forest Stewardship Committee to explore threats to forest stewardship in this region and develop strategies to maintain and enhance our forestlands in the future. The Committee was comprised of forest landowners, consulting foresters, loggers, and members of local forest health organizations, such as the Linking Lands Alliance and the White River Partnership. They identified the following as this region's top three threats:

- 1) The lack of personal and cultural connection to forests in general, actual forested lands in Vermont, and the many forest products we use and take for granted on a daily basis.
- 2) The lack of a 'buy local' forest products movement, or lack of successful branding/marketing techniques for forest products.
- 3) The decreasing number of manufacturing or wood processing sites in Vermont, which has resulted in Vermonters shipping more raw materials out-of-state to become finished products.



Additional threats were also identified. These include: parcelization; fragmentation; property tax assessments based on the highest potential market value of land; the presence and spread of invasive species; the lack of social, cultural, and institutional support for young adults interested in pursuing a forest related career; state and federal estate and inheritance tax laws (which have placed family landowners into financial predicaments in which they need to subdivide or develop forest land in order to cover the taxes); vulnerability of timber and wood markets to short-term price fluctuations.

Solutions

Support Current Use

Like Agriculture, one of the key state-based efforts to maintain forest lands across Vermont is the Current Use Program (Current Use). Funding of the Current Use Program has been identified by the Northern Forest Lands Council as vital to ensuring that landowners do not over-harvest their forests or opt for liquidation cutting of tracts. In their study that used cost data, stumpage prices, and taxation scenarios, the Council concluded that timber management is only profitable at low taxes per acre (\$2 per acre) and even at that level, only the better sites are profitable. In addition to the problem of high property taxes, forest landowners must grapple with the fact that property taxes are assessed on a yearly basis, and unlike most agricultural crops, timber harvests are not an annual event (indeed, they are usually set apart by decades). In addition to the tax benefits of the program, those lands in current use that are forested require a forestry management plan. The maintenance of these plans contributes to the overall health of our forests. Of the total lands in Current Use in the TRORC region (380,681 acres), a vast majority (321,765 acres) of them are enrolled as forestland.

Reduce Parcelization of Forests

A sustainable and economically viable forest products industry clearly depends on the availability of harvestable wood. Protecting forestlands from parcelization is a key component of maintaining forestry in our region. This can be done through non-regulatory and regulatory means.

- **Conservation Planning** – As part of a local planning process, communities can identify the extent and location of forest resources, prioritize which areas are suitable for resource protection and recommend strategies for conserving these lands. This Plan takes a similar approach through the identification of Resource Conservation Areas in the Future Land Use chapter.
- **Estate Planning** - Municipalities can encourage landowners to engage in estate planning so that forestland can be maintained over multiple generations, thus reducing the future threat of subdivision due to a death in the family, an unforeseen illness, or other events.
- **Land Conservation** – Municipalities can be involved in the land conservation process through the development of a conservation fund (generally managed by a Conservation Commission with oversight from the Selectboard) that acts as a “savings account” which can be used to help conserve land.

Regulatory methods, such as those mentioned in section #, above can also be utilized to protect forestland.

Encourage the Growth of New Forest Product Markets

With changes to the forest industry throughout Vermont, it will be necessary to support programs and initiatives like the Forest Products Value Chain Investment Program (A collaboration between the Vermont Sustainable Jobs Fund, the Northern Forest Center, and the Vermont Working Lands Enterprise Board) that seek to enhance the economic competitiveness of the forest products industry in the region by exploring ways to access new markets outside the state, developing new products that could be produced using Vermont wood and encouraging innovation and facilitating collaboration among industry members.

Encourage Ecologically Sound Forestry Management Practices

Just as farms can be managed in a way that improves soil health, forests can also be managed for both fiber production and to improve habitat and maintain water quality. In order to effectively manage our forestlands in an ecologically sustainable manner, it will be necessary to properly educate landowners and the foresters who manage their lands as to what the best management practices are. Focusing on methods that support and improve biological diversity and forest vitality will help maintain good forest function.

D. Goals, Policies and Recommendations

Goals

1. Sufficient locations of contiguous forestlands ensures that all indigenous species have adequate access to necessities, including, but not limited to food, water, and varied habitat under a changing environment.
2. Agriculture and forestry continues to preserve, reinforce, and revitalize the best characteristics of the Region’s landscape and communities, while also improving soil and forest health.

3. A dynamic diversity of farms, forestry operations and value-added producers in the TRORC Region not only feeds our citizens but also serves as a driver for Vermont's economic development, providing jobs and prosperity in our rural communities.

4. An environment (physical, social, regulatory, and fiscal) that encourages entrepreneurship in agricultural and forestry activities, including those which add value to the region's agricultural and forestry products.

Policies

1. The development of renewable energy generation methods and facilities that utilize woody biomass is encouraged.

2. Forestry practices shall maintain or enhance the diversity of ecosystems existing in the region.

~~Appropriately sited and designed businesses~~ Businesses that are sited and designed in accordance with this Plan and promote the local processing, sale and distribution of native raw materials and products are encouraged. Planning and regulatory review at the state and local level should not unduly restrict the development of "home cottage" industries which complement farm and forestry.

4. To minimize point and non-point source pollution, loggers and foresters must use Accepted Management Practices (AMP) and are encouraged to implement Best Management Practices (BMP) in their operations; while farmers must meet state standards for Required Agricultural Practices. ~~and to minimize point and non-point source pollution.~~

5. It is the policy of TRORC to minimize or mitigate the loss of these resources to development. As an alternative to conventional methods, TRORC endorses use of off-site mitigation techniques to offset the loss of these resources. However, endorsement of off-site mitigation is must be conditioned on finding that the project proposal is:

a. Consistent with this Plan and the Plans of affected municipalities; and

b. Provides an equal or greater public benefit than conservation of the development site itself.

6. Where important natural features, soil conditions, or special resources including, but not limited to, agricultural and forested land are identified, clustered or peripheral development is required to protect such resources and prevent fragmentation and sprawling settlement patterns.

~~Appropriately sited and designed businesses promoting the local processing, sale and distribution of native raw materials and products is encouraged.~~ Planning and regulatory review at the state and local level should not unduly restrict the development of "home cottage" industries which complement farm and forestry.

8. Agricultural land and forested land form the separations between town centers, villages, and hamlets in the traditional regional settlement pattern. Tangible efforts shall be made to preserve this patch-worked balance of open and forested space, to promote compact settlements through creative regional planning, municipal planning, private initiatives, purchases, leases and transfers of development rights and efficient site designs. Contiguous forest and significant agricultural areas shall remain largely in non-intensive uses unless no reasonable alternative exists to provide essential residential, commercial and industrial activities for the region's inhabitants.

9. ~~The Regional Commission recognizes the serious limitations of the local fair market value tax system for farm and forest land and supports implementation of a more effective taxation method that is~~

~~based on current use rather than potential use.~~ The Regional Commission strongly supports property tax reform efforts at the local and state levels that would reduce the costs of land ownership for farming and forestry, while protecting against the Current Use Program's use as a low-cost vehicle for speculative holding of property for future development.

10. The construction of utilities, roads or other physical modifications should skirt tracts of productive agricultural and forest land rather than divide them. ~~Infrastructure improvements should be planned with attention to directing future residential, commercial and/or industrial growth.~~

11. The use of public or private funds for purchase of development rights, or fee purchase of agricultural and forest land for conservation purposes from willing landowners, is supported and should be promoted. Town officials and landowners are encouraged to work with private non-profit conservation organizations to identify options. Factors to be utilized in determining the relative conservation value of land should include:

- a. Evaluation of an active farm operation, a sound financial plan for returning as a viable farm unit, or an active forest management plan with history of planned harvesting;
- b. The project must conform to duly adopted regional and/or municipal plans;
- c. The resource value of the site incorporating such factors as parcel size, soil productivity values, and accessibility;
- d. Threat of loss or conversion to non-farm or forestry use;
- e. Adequacy of existing infrastructure and public investments to serve the use;
- f. Location of the use relative to similar uses; and
- g. Adequacy of past resources management practices.

12. Septage, sewage sludge and any other product of municipal waste processing shall not be applied or injected upon agricultural and forest lands without consistent chemical component testing of both disposal material and receiving medium for potentially harmful substance concentrations. Applications or injections of such products should only occur according to the protocols established and agreed upon by the State of Vermont and the affected municipality for public health and environmental protection.

13. Use of streambank and shoreline buffer strips are necessary for forestry and farming activities. To reduce erosion, buffer strips can consist of certain types of cover crops as well as woody vegetation. The Natural Resource Conservation Service, Conservation Districts, University of Vermont Extension and others should continue efforts to educate landowners as to the benefits of maintaining and improving streambank vegetation and to implement river-long coordinated stabilization programs. Efforts to revegetate streambanks eroded from natural or human activities are supported. Erosion control methods which use vegetation and other natural materials and which protect wildlife habitat are favored over other methods. Rip-rapping of shorelands can be used in appropriate circumstances to protect farmlands from erosion.

14. ~~The Regional Commission~~ TRORC recognizes that certain local land development or subdivisions may conflict with policies to minimize the loss of existing or potential agricultural or forest resources. Furthermore, the ~~Regional Commission~~ TRORC acknowledges that in certain areas agricultural or forestry uses may no longer be viable due to a variety of factors including:

- a. The existence of or planning for roads or sewers in the immediate area which dictate that involved land should be converted to more intensive uses; and

- b. The presence of parcel sizes or site conditions which affirm that conservation efforts to minimize loss of the resource result in marginal public benefit.

15. Support programs that are designed to provide new farmers access to farms and farmland, as well as programs designed to assist retiring farmers with the transition to a new generation.

Recommendations for Action

1. The ~~Regional Commission~~ TRORC, as part of its on-going Technical Assistance Program, will provide planning advice and support to town Planning Commissions, Conservation Commissions, non-profit conservation organizations, and other groups interested in sustaining agriculture and forestry.
2. The ~~Regional Commission~~ TRORC will evaluate proposed developments involving primary agricultural and forest lands, and their related industries. Where appropriate, it will provide information to federal and state agencies, town boards and commissions, and other parties regarding the probable impacts these resources have on the welfare of the region.
3. Local land use planning activities and programs affecting agriculture and forestry should consider the following as ways to promote these industries:
 - i. Development of local plan components, including an inventory, and assessment of farm and forest lands. Although far from satisfactory, past use of the Land Evaluating and Site Assessment (LESA) method for identification of priority lands has been referenced;
 - ii. As part of local bylaws, creation of farm and forest land conservation programs, including:
 - i. Agricultural zoning;
 - ii. Area based allocation;
 - iii. Cluster development;
 - iv. Impact fees;
 - v. Overlay districts;
 - vi. Performance standards;
 - vii. Purchase of development rights;
 - viii. Transfer of development rights.
 - iii. Utilization of the Vermont Housing and Conservation Board program (VHCB) to acquire interests or easements on significant farm and forest lands. Such easements are perpetual voluntary agreements between landowners, the State, the Town, or a conservation trust, such as the Vermont Land Trust or Upper Valley Land Trust;
 - iv. Setting up a town fund for conservation purposes to leverage other public funds or donations for conservation purposes. Note that farm and forest conservation may be a wise move for the long-term fiscal health of the community;
 - v. Stabilization of property taxes for farmers and timberland owners enrolled in the Current Use Program by agreeing to pay the difference that the State does not fully fund under the Program;

- 1 vi. Purchase of lands outright by governmental agencies or conservation organizations; and
 - 2 vii. Support for local and regional marketing and value added industries to improve the
 - 3 economies of farm and forest operations;
 - 4 viii. Support of educational and community programs.
 - 5 4. To promote a better understanding of the farming and forestry practices, and natural resource
 - 6 management in general; the industry, conservation organizations, public schools and the tourism
 - 7 and recreation industries should sponsor continuing educational opportunities to the public.
 - 8 5. TRORC should organize a regional committee of stakeholders to focus on how the Regional Planning
 - 9 Commission can support the local agriculture and forest products industries.
-



Two Rivers-Ottauquechee
REGIONAL COMMISSION



Regional Energy Implementation Plan

A Pathway to Achieving Vermont's Energy Goals

Draft

2/8/17

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Timeline: This represents the fourth full draft of the TRORC Energy Implementation Plan. Comments from the Vermont Department of Public Service (DPS), and the attendees of our public comment forums (held on September 27th, 29th and October 5th, 2016) have been incorporated. The Final draft will be submitted to the DPS for review no later than February 1, 2017.

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INTRODUCTION

BACKGROUND

In 2011, the State of Vermont released a significantly revised Comprehensive Energy Plan (CEP). By law, the CEP is intended to address Vermont's energy future for electricity, thermal energy, transportation and land use. The 2011 Plan represented a substantial change in approach to energy in Vermont by setting a very significant set of goals for the state, most notably to transition the state's energy use from 75% fossil fuels to 90% renewable.

While the 2011 Plan included many strategies and policies intended to reach the proposed goals, many of the Plan's suggested actions were preliminary in nature, directing the state to "investigate" or "explore" potential strategies. The 2011 Plan acknowledged the nexus between reductions in statewide energy use and land use, by setting a goal to "coordinate energy and land use planning."¹ The challenge with such a comprehensive plan is determining the best path to implementation.

Since 2011, a significant amount of study and analysis has been done to further inform the question of "how" to achieve the goals of the CEP. Beginning in 2013, the Public Service Department (DPS) conducted the Total Energy Study (TES), which reviewed the technologies and policies that might achieve Vermont's greenhouse gas and renewable energy goals. The 2016 revision of the Comprehensive Energy Plan further refined the goals, policies and strategies of the 2011 CEP. Between revisions, progress has indeed been made toward addressing "how" to achieve the goals, but it is

¹ Vermont Department of Public Service. Vermont Comprehensive Energy Plan, 2011

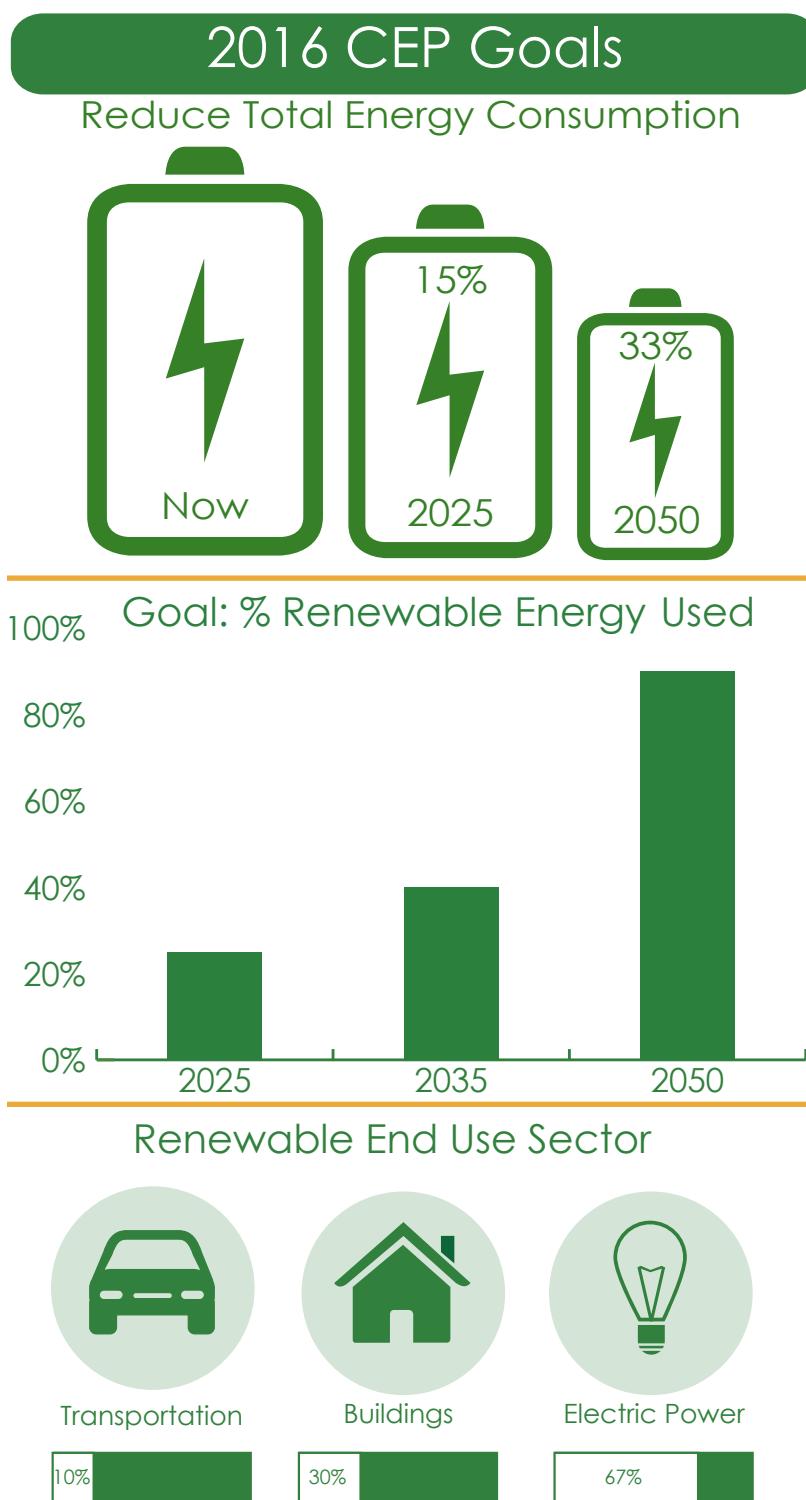
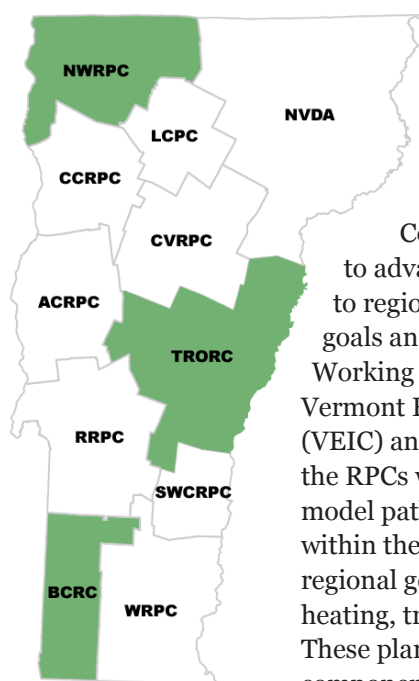


Figure 1: 2016 CEP Goals - VT DPS, 2016

recognized that to do so will require “significant changes in energy policy, fuel supply, infrastructure and technology.”²

DPS/RPC PROJECT

In 2015, the Vermont Department of Public Service (DPS), engaged three of Vermont’s eleven Regional Planning Commissions (Bennington Regional Planning Commission, Northwest Regional Planning Commission and the Two Rivers-Ottawquechee Regional Commission) in a pilot project to advance a total energy approach to regional plans consistent with the goals and policies contained in the CEP. Working with organizations such as the Vermont Energy Investment Corporation (VEIC) and the Energy Action Network, the RPCs were charged with developing a model pathway to 90% renewable energy within their respective regions, identifying regional goals and actions relating to heating, transportation and electric power. These plans would also include a mapping component which identifies areas suitable for different kinds of renewable energy generation.



SUMMARY OF DATA COLLECTION AND ANALYSIS

The Total Energy Study (TES) provided the basis for the data modeling that was used in this Plan. The TES initially proposed three possible models as part of their review:

² Vermont Department of Public Service. *Total Energy Study: Final Report on a Total Energy Approach to Meeting the State’s Greenhouse Gas and Renewable Energy Goals*, 2014



- **Business as Usual** – This model was calibrated to mimic Vermont’s current energy policy, serving to act as a baseline and to show the results of no significant policy changes. While the total amount of energy use in VT would decrease slightly by 2050, it would not meet the state’s energy goals.
- **Carbon Tax Shift** – This model tested the implementation of a revenue-neutral tax on greenhouse gasses emitted from energy resources across all sectors, offset by a corresponding tax reduction or rebate in other areas of the economy. Due to its direct focus on carbon reduction, the carbon tax shift scenarios were able to meet statewide greenhouse gas emission goals, but were not able to achieve the 90% renewable by 2050 target.
- **Total Renewable and Energy Efficiency Standards (TREES)** – This model allocates shares of total energy consumption derived from either renewable energy or improved efficiency over a specified period of time. The TREES policy was ultimately able to meet the 2050 renewable energy goal and was determined to far exceed the 2050 carbon reduction goal.

For the purposes of this project, the Vermont Energy Investment Corp adapted

the Total Energy Study's TREES scenarios (for more information, see Appendix A). Using this scenario, VEIC created and revised a model of the demand and supply of total energy in Vermont. Historic information was primarily drawn from the Public Service Department's Utility Facts 2013 and Energy Information Administration (EIA) data. Projections came from the Total Energy Study (TES), the utilities' Committed Supply, and stakeholder input. Assumptions and specific data sources include:

- The population is assumed to grow at 0.35% per year.³ People per house are assumed to decrease from 2.4 in 2010 to 2.17 in 2050. This supplies the number of households used in the model as the basic unit for residential energy consumption.
- The commercial demand driver was area of commercial buildings. Commercial building data and projections were extracted from inputs in the TES.
- Industrial energy use was entered as the actual totals for each energy type, without a driver specified in the model.
- Transportation energy use is based on projections of vehicle miles traveled (VMT). VMT peaked in 2006 and has since declined slightly. Given this, and Vermont's efforts to concentrate development and to support alternatives to single occupant vehicles, VMT is assumed

in the model to remain flat while population and economic activity grow slightly. VMT county totals are supplied from the Vermont Agency of Transportation (VTrans).

- There will be reductions in energy use due to changes in technology, including building shell and device efficiency improvements.

Energy Demand by Fuel- TRORC Region				
TRORC Fuel Consumption Change 90/50				
Units: Thousand Million BTUs				
Fuels	2015	2025	2035	2050
Avoided vs. Reference	140.7	748.7	1911.8	3151.9
Electricity	1841.1	1830.6	1946.2	2023.7
Natural gas	0	0	0	0
Gasoline	2527.6	2015.2	1018.6	81.2
Jet kerosene	0	0	0	0
Kerosene	68.1	48.3	29.4	0
Diesel	859.8	604.8	363.8	9.7
Residual fuel oil	269.6	260	249	231.4
LPG	1303.1	1028.3	728.1	273.7
Oil	1444.4	1047.8	639	1.2
Ethanol	337.4	225.6	123.1	14.3
Solar	1.2	4.9	8.9	16.1
Hydrogen	0	0	0	0
Coal	129.9	92.8	55.7	0
CNG	20.1	17.8	15.8	13.2
Biodiesel	86.3	455.8	823.9	1405.4
Wood chips	368.4	499.3	629.7	836.6
Wood pellets	127.2	146.8	105.9	145.1
Cord wood	1307	1045.3	784.4	414.5
Total	10831.9	10072	9433.3	8618.1

Table 1: LEAP energy model data, Jan 2017

³ Jones, Ken, and Lilly Schwarz, *Vermont Population Projections-2010-2030, August, 2013*. <http://dail.vermont.gov/dail-publications/publications-general-reports/vt-population-projections-2010-2030>.



Using these data and related assumptions, VEIC conducted an analysis using the Long Range Energy Planning System (LEAP). Designed by the Stockholm

Environment Institute, LEAP is a software tool for energy policy analysis and climate change mitigation assessment. Intended as a medium- to long-term

modeling tool, LEAP was chosen for data assessment in relation to the goals of the CEP. The LEAP model is based primarily on energy demand. The final outcome of VEIC's efforts is **one** scenario by which the state, on a regional level, could achieve the goals of the Comprehensive Energy Plan. This data provides the basis for the strategies described in this Plan.

DATA

Based on the LEAP modeling provided, the TRORC Region will go from consuming over 11,000 million BTU's to around 5,500 million BTU's, a nearly 50% decrease in total energy consumption by 2050. MMBTU, or MBTU, stands for one million British Thermal Units (BTU). A BTU is a measure of the energy content in fuel, and is used in the power, steam generation, heating and air conditioning industries and when comparing different energy sources.

Use of fossil fuels will dramatically decrease, while use of electricity and renewable energy sources will increase. The overall increase in electricity use will be primarily due to the utilization of electric vehicles (EVs) and heat pumps. For more detailed information on the LEAP analysis and additional data, see Appendix A.

KEY ISSUES

While the energy goals established in statute and further refined in the VT Comprehensive Energy Plan provide this plan with clear and specific guidance as to "where we need to go" as a region to improve our energy future, it is more important to understand why these goals were created. The "why" behind the goals (and the development of this Plan) can be explained by looking at three different motivations that are important regionally and statewide: environmental protection, energy security, and economic needs and opportunities.

ENVIRONMENTAL PROTECTION

Our reliance on fossil fuels over the past two centuries has had a profound and enduring impact on air quality, water quality, and climate. The impacts on climate, the global warming that has resulted from the rapid release of billions of tons of carbon that had been locked in solid and liquid fossil fuels, has been well-documented. The worldwide impacts of climate change—destruction of ecosystems, sea level rise that threatens millions of homes, farms, and businesses, greater frequency and intensity of drought and severe storms—already are being observed and every effort needs to be made, locally and globally, to limit future damage and adapt to a changing reality. In Vermont (and in the Region), climate change has the potential to alter the composition of our forests, affect the viability of the tourism economy, and result in more damaging tropical storms, floods, and other severe events.

Other forms of pollution from fossil fuel combustion (e.g., smog, acid rain) also damage natural ecosystems, adversely

affect human health, and cause economic damage. If the region's energy does not come from clean renewable energy sources, it is coming from fossil fuel combustion or nuclear, that pose risks and causes environmental damage where the fuel is mined and processed as well as where it is used to generate electricity. Although local energy generation siting concerns are real and are addressed in Sections 5 and 6 of this Plan, the environmental impacts of obtaining electricity from wind turbines on a Vermont ridgeline or from solar panels along a Vermont roadway should be considered in the context of the impacts of strip mining, wholesale removal of mountains, hydraulic fracturing, and acid runoff from coal mining in other states.

Environmental protection and a desire to reduce Vermont's impact on climate change was the impetus for the development of the Vermont Comprehensive Energy Plan. These targets are fundamentally designed to reduce our contribution to greenhouse gas emissions.

ENERGY SECURITY

The TRORC Region, like Vermont, is reliant upon other states and countries for much of our energy needs. Our region's dependence on fossil fuels is significant. The primary use of these fuels is for space heating, transportation and generation of electricity (although Vermont obtains a significant share of its electricity from hydroelectric and nuclear facilities and relatively little from coal powered generators). According to the US Energy Information Administration, nearly 3/5 of all Vermont households use fuel oil. In the TRORC Region, roughly 13,000 households rely on oil for heating⁴

⁴ U.S. Energy Information Administration, 2014



Damage after Hurricane Irene - Photo Credit: Kevin Geiger

which means a substantial portion of the Region is subject to the price and availability instabilities of a reliance on oil. Of the total 885 million dollars spent on residential energy in the state of Vermont, just over 50% (\$445.8 million) were spent on fuel oil, kerosene or light propane gas.⁵ Vermont's economic system is so closely tied to the availability of fossil fuels that even modest price increases can lead to a slowdown in economic growth and monetary instability. This can have unanticipated adverse impacts at the Regional, municipal, and residential level. For example, increasing fuel prices make it more expensive for a town government to provide traditional public services and maintain existing facilities. Or, rising prices can make it difficult for residents to heat their homes and put enough food on the table (the price and availability of food is usually influenced by fuel prices).

⁵ Ibid

Where the Region's energy is generated is also a concern. Vermont currently obtains much of its electricity from hydroelectric facilities located out of state, primarily Quebec. While these sources of electricity currently provide the region with low-cost, renewable generation, the prospective construction of high capacity transmission lines from Quebec to southern New England may create increased competition for electricity between Vermont and other New England states that are seeking electricity from renewable sources. Reducing the Region's reliance on imported energy, or at least maintaining the same amount of electrical use from sources located outside Vermont, will certainly make the state and region more energy secure, especially in a future where electricity demand is anticipated to almost double by 2050 as the use of fossil fuels is significantly decreased.

It is possible to have a state and region that is more self-reliant for its energy needs. By utilizing the resources that exist in-state and in-region, long term security concerns about energy supply and energy costs can be decreased.



Air sealing a window frame with caulk

Photo Credit: Capstone Community Action

ECONOMIC NEEDS AND OPPORTUNITIES

Our modern economy and lifestyle has been made possible through the use of vast amounts of solar energy stored as fossil fuels. Because a majority of the most readily extractable energy from these sources has been consumed in just over 100 years, and the cost and difficulty of obtaining these resources will increase over time, we will have to adapt our economy and lifestyle in a manner that relies on energy conservation and use of renewable sources of energy. These changes actually represent extraordinary opportunities for economic growth and prosperity if quick and decisive action is taken.

Vermont spends over \$2.7 billion and the TRORC Region approximately \$160 million on energy each year, with the vast majority of those dollars exported out-of-state. This Plan, like Vermont's 2016 Comprehensive Energy Plan, states that overall energy consumption will need to decline by about one-third by 2050 to meet our energy goals. That reduction can be accomplished through changes in land use patterns and the transportation system (reducing the need for driving and by introducing more energy-efficient vehicle technologies), through extensive building upgrades and weatherization; and with energy conservation by means of more efficient appliances and devices.

These improvements will reduce the outflow of money from the region, so that millions of dollars will be retained to circulate in local economies, supporting employment, social services, and improving the quality of life of our communities. Moreover, the changes needed to reduce our energy demand and to produce local renewable energy offer a



Solar Farm in Sharon,
VT - Photo Credit:
TRORC Staff

wide array of business and employment opportunities.

Weatherization of buildings, installation and servicing of new heating systems, procurement and delivery of bio-fuels such as wood pellets and cord wood, and construction and servicing local renewable energy generation facilities offer new jobs and business development opportunities. While providing opportunities for existing fossil fuel based businesses to diversify using their existing capacity and customer networks. Economic growth in the renewable energy sector has been robust over the past five years. Vermont has seen a roughly 20% growth in clean energy employment sectors overall⁶. In 2016, 6% of Vermont's total jobs were in the clean energy sector.

THE GROWING IMPORTANCE OF ELECTRICITY

Electricity is an essential part of our everyday lives and is critical to the vitality of the regional economy. Since the closing of the Vermont Yankee nuclear power plant, Vermont imports most of its electric power. Much of this imported electricity derives from renewable hydroelectricity generated in Canada, with the balance from a mix of generating facilities in the northeast and from a growing supply of small and medium sized renewable in-state sources.

⁶ BW Research Partnership, *Vermont Clean Energy 2016 Industry Report*

The demand for electricity across residential, commercial, and industrial sectors grew rapidly during the second half of the 20th century, but has leveled off in recent years. It is apparent that a variety of aggressive energy conservation programs implemented through the state's energy efficiency utility, Efficiency Vermont, contributed to slowing the growth of electric demand. The need for electric conservation and efficiency improvements will continue, and be amplified by increases in electric demand due to the decline of fossil fuel energy for transportation, mechanical, and space-heating needs. Electricity provides the most viable path toward meeting the state's energy goals in several key areas. Electrification of passenger vehicles, for example, will dramatically reduce energy use in the transportation sector through use of more efficient drive systems, and the energy that is used can be obtained from renewable sources. Similarly, the easiest transformation in space heating of existing residential buildings often is to weatherize the structure and install highly efficient (electrically driven) air source heat pumps.

PLAN FOCUS

In order to implement the state's energy targets, to achieve the significant reductions outlined by the LEAP scenario, and to address the key issues identified above, this Plan will focus on strategies in four areas of energy transformation.

- **Thermal Efficiency and Alternative Heating Systems** – Due to the age of Vermont’s housing stock (see Chapter 2, Thermal Energy Challenges), potential gains from improvements to the thermal efficiency of our homes and businesses are substantial. Eighty percent of residential energy use is dedicated to space heating and domestic hot water.
- **Transportation System Changes and Land Use Strategies** – Vermont, because of its rural nature, is very vehicle-reliant. The pattern of development that has been cultivated since the

development of the automobile has resulted in a significant portion of our overall energy use (34%) being dedicated to transportation. While the use of electric vehicles will help meet the goals of the CEP, we will also need to reevaluate where we live and work in order to reduce travel.

- **Energy Conservation and Efficiency of Delivery and End Use** – Demand-Side Management is the best and lowest-cost option to meet expected demand. Encouraging the installation of energy efficient devices or equipment that will perform work using less energy is essential to reducing our overall energy use. Proper load management can also help reduce demand during peak hours. Demand response techniques can include time of use rates, smart rates and energy use feedback. Changing our individual energy use behavior to embrace conservation is an important component of meeting the goals of the CEP.
- **Mapping Energy Generation Resources and Constraints** – Energy generated by renewable resources is the cornerstone of the CEP. In order to achieve 90% renewable by 2050, we will need to identify where the potential for renewable energy generation exists and balance the need for increased capacity with Vermont’s landscape and the desires of our communities.

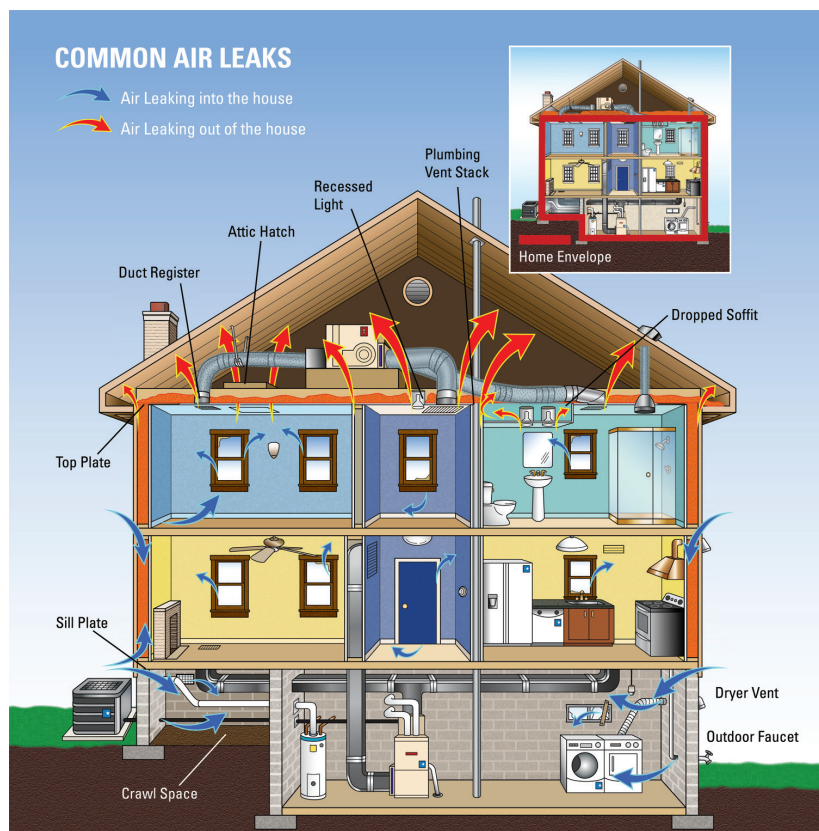


Figure 2: Common Air Leaks in a Home, U.S. EPA

LIFE OF THE PLAN

As with all policy documents, this Regional Energy Implementation Plan will require review and revision over time. It is important to recognize that there will be new data, new technological advances and possible changes in state and Federal energy policy that will need to be considered and incorporated into the Plan. With each action item that is completed, there will likely be more that should be included as we continue to work toward the goals of the CEP at the regional level.

The primary purpose of this Plan is to identify possible paths to implementing the state's Comprehensive Energy Plan at the regional level. Should the goals of the CEP change, this Plan will likewise need to be changed.

2

THERMAL EFFICIENCY AND ALTERNATIVE HEATING SYSTEMS

BACKGROUND

Vermont is the second most petroleum dependent state in the country due to its high use of heating oil

- Northeast Biomass Thermal Working Group

According to the 2016 Comprehensive Energy Plan, 28% of energy demand in Vermont is associated with heating fuels. The reliance on heating from non-renewable sources (fuel oil, natural gas and propane) creates a challenge for Vermonters that extends beyond energy issues. Residents who are considered “low-income” find it challenging to stay comfortable in their own homes due to fuel costs. In 2010, Vermont ranked 44th out of 50 states for energy affordability⁷. In 2010, low-income Vermonters spent an average of \$1,870 more per family, per year, on energy bills than is considered affordable⁸.

The 2013 Thermal Efficiency Task Force’s Report to the General Assembly, notes that “Investing in thermal efficiency improvements – primarily air sealing, insulation, and heating system replacements – can dramatically reduce heating energy use in a building. At current fuel prices, thermal efficiency



Cutting Rigid Foam Board for Insulation - Photo Credit: Capstone Community Action

investments in a home can bring savings of approximately \$1,000 per year over the lifetime of the investment. The value of these savings increases as fuel prices rise.”⁹ Converting to more efficient heating and improving thermal efficiency, will have the effect of reducing financial impacts on low-income communities and moving the Region toward 90% renewable energy by 2050.

The CEP supports Vermont’s thermal efficiency goals, which were established in 2007 and 2008 under Act 92 (10 V.S.A. § 581):

- Improve 20% of housing by 2017 (more than 60,000 units), and improve 25% of housing by 2020 (about 80,000 units).
- Reduce fuel needs by 25% in building units served.
- Reduce fossil fuel consumption across all buildings by 0.5% per year, leading to reductions of 6% by 2017 and 10% by 2025.
- Save \$1.5 billion on fuel bills through improvements installed between 2008 and 2017.

The CEP promotes efficiency and conservation as top priorities in all energy sectors. In 2011 it recommended creating a whole-buildings efficiency road map—including program delivery, consumer outreach, funding and finance mechanisms, and progress metrics—by the end of 2012¹⁰. This goal was not met, but the state has

⁷ Marianne Tyrell, Rebecca Wigg, and Colin Hagan. *Financing Residential Energy Efficiently in Vermont*, Institute for Energy and the Environment, Vermont Law School, July 2011

⁸ Thermal Efficiency Task Force, *A Report to the Vermont General Assembly: Meeting the Thermal Efficiency Goals for Vermont Buildings*, 2013

⁹ Ibid

¹⁰ Vermont Public Service Department. “Facts, Analysis, and Recommendations.” Comprehensive Energy Plan 2011. Volume 2. (December 2011).

made some progress on energy efficiency improvements. Retrofit investments in thermal energy efficiency by Efficiency Vermont and Vermont Gas have reduced energy demand in about 6,700 homes, and investments in thermal efficiency for low-income households eligible for weatherization assistance have reached more than 10,700 homes since 2008, equivalent to roughly \$10 million in annual savings¹¹. However, the current pace of weatherization improvements will fail to meet the state's goals.

NEW CONSTRUCTION

New buildings will need to be built to a significantly higher standard than is provided for by the State's Residential and Commercial Building Energy Code. Net zero constructed buildings are highly efficient and save 30–45% on overall energy costs in comparison with standard buildings¹². Efficiency Vermont's 2015 Net Zero Energy Feasibility Study determined that new construction of residential and office net zero energy buildings is a cost effective investment. These buildings cost less to own and operate than code buildings from the first year into the long term¹³.

HOW WE HEAT

In addition to thermal efficiency improvements, the CEP is seeking a statewide change in how we heat our buildings. This approach will focus primarily on the installation of cold-climate heat pumps which consume

¹¹ Riley Allen, *Thermal Efficiency for Low-Income Households in Vermont: Economic Performance, Energy Justice and the Public Interest*, RAP Energy Solutions, 2015

¹² Efficiency Vermont, 2016

¹³ Efficiency Vermont, *Net Zero Energy Feasibility Study*, 2015

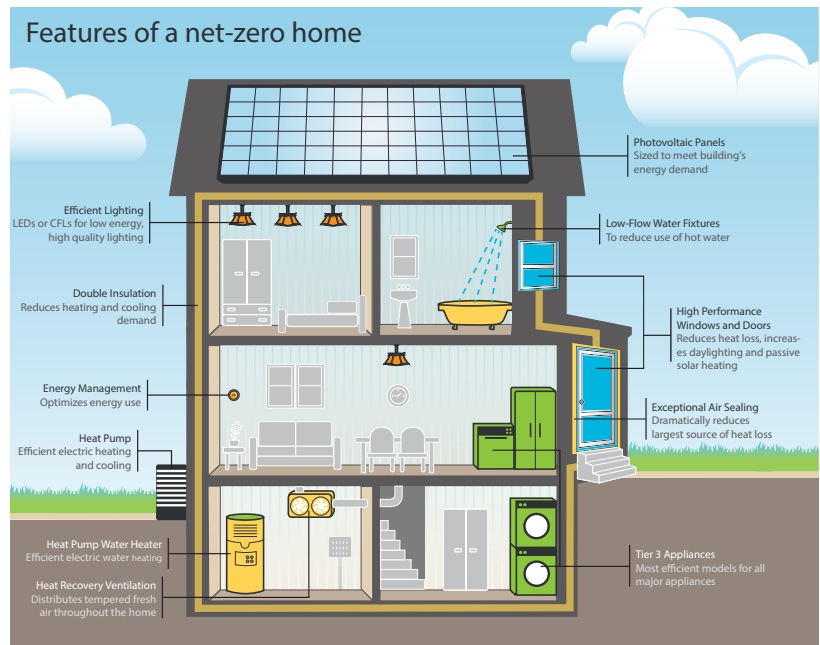


Figure 3 : Features of a Net Zero Home, Efficiency Vermont

far less energy than electric resistance, propane, or oil heating systems. In order to contribute to the state's heat pump installation target (35,000 installed statewide), a total of 3,476¹⁴ will need to be installed in the TRORC Region. Because cold-climate heat pumps are inadequate during extreme sub-zero days (-20 degrees F), homes will require a secondary heat source – preferably one that utilizes some form of woody biomass (wood, wood chip, wood pellet). Pellet stoves are fueled with pellets primarily made of sawdust and wood chips that can effectively heat a home 2,000 square feet and under¹⁵. Also worth considering are geothermal or “ground source” heat pumps. These systems are substantially more expensive than cold-climate heat pumps, but can result in significant energy savings. They

¹⁴ Heat pump installation targets for the Region were determined based on the percentage of Vermont's total housing units that are located in the TRORC Region (over 9%).

¹⁵ http://www.forgreenheat.org/technology/pellet_stoves.html

are better suited to new development than retrofitting into existing buildings due to the technology's requirements. While cold-climate and geothermal heat pumps will work for residences, they cannot adequately meet the demands of some large industrial and commercial users. Thus, the CEP has recognized the need to identify locations for district heating and combined heat and power.

There are barriers to reaching the CEP's thermal efficiency goals. The purpose of this plan element is to identify these barriers, and to provide solutions through policy and action steps that will effectively remove these barriers when properly implemented.

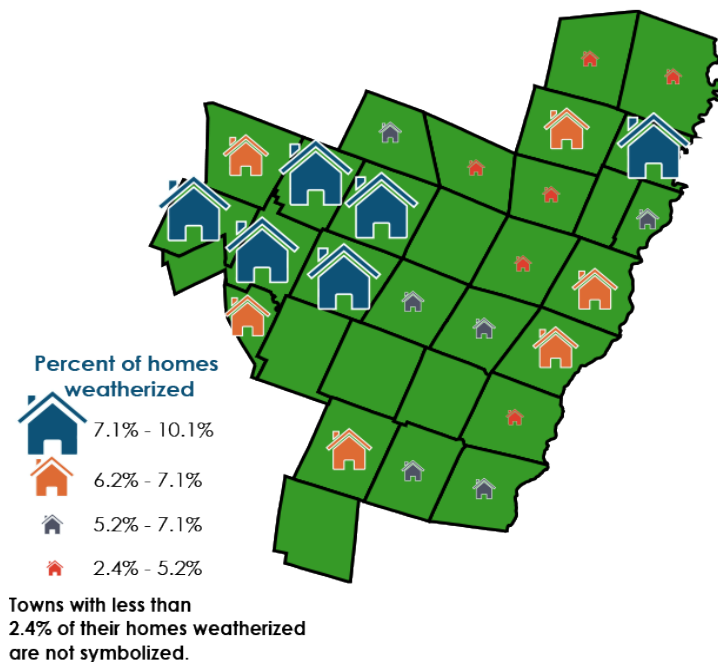


Figure 4 : Percent of Weatherized Homes-Efficiency Vermont, SEVCA, Capstone Community Action

THERMAL ENERGY CHALLENGES

AGING BUILDING STOCK

Residential houses constitute the majority of Vermont's built environment. Residential energy represents 30% of

Vermont's total energy consumption (second only to transportation), with heating being the largest energy consumer¹⁶. Vermont's climate demands heating. In Orange and Windsor counties, 47% of homes were built before 1970¹⁷.

These older homes were constructed before high energy costs made energy conservation practices a priority in the built environment. As a result, a substantial number of homes utilize wasteful amounts of energy and are expensive to maintain. According to the Massachusetts Zero Net Energy Buildings Task Force: "With buildings contributing close to 40 percent of greenhouse gas emissions¹⁸ and consuming 40 percent of energy in the United States, energy efficiency and renewable energy technologies must become central to the way we design and build."¹⁹

In the TRORC Region, it is estimated that only 4.58% of houses built before 2000 have been weatherized. To achieve the state's goal of 25% of homes, a total of 6,477 of the region's housing units will need to be weatherized by 2020.

16 U.S. Energy Information Administration. Vermont Profile Overview. Independent Statistics & Analysis. (July 2012).

17 Leslie Black-Plumeau and Maura Collins, *Housing needs in East Central Vermont*, Vermont Housing and Finance Agency, (October 2013)

18 Greenhouse gases help capture and maintain the temperature of the Earth's surface. They include water vapor, carbon dioxide, methane, nitrous oxide, and a variety of manufactured chemicals. Some are emitted from natural sources; others are a result of human activities. Over the past several decades, rising concentrations of greenhouse gases have been detected in the Earth's atmosphere, which leads to an increase in the average temperature of the Earth's surface.

19 Massachusetts Zero Net Energy Buildings Task Force. *Getting to Zero: Final Report of the Massachusetts Zero Net Energy Buildings Task Force*. (March 11, 2009).

LARGER HOMES

By and large, new homes have grown in size over the past 40 years. In 1973, the average home in the Northeast was roughly 1700 square feet. In 2014, the size of homes in the Northeast had increased by 60% to 2600 square feet.²⁰ While homes are generally more efficient than in the past, more square footage requires more heating.

COST OF IMPROVEMENTS

The up-front cost of energy efficiency improvements and building-scale renewable energy generation remains a challenge. Despite the demonstrated long-term savings benefits, the capital needed to significantly reduce energy consumption and add renewables can be a significant barrier to implementation. When surveyed as part of the East Central Vermont Sustainability Project, 39.5% of those who responded indicated that they could not afford to make their home more energy efficient. Another 33.8% were unable to make energy efficiency improvements because they rent instead of own.

Cost is an issue for all homeowners, but especially for low- and moderate-income homeowners, since cost is a social equity issue. At the commercial and public sector levels, capital and operating budgets are often set independently of each other. There is no opportunity to use the savings from operations to defray capital investments, thus removing the incentive to implement energy improvements.

LAGS IN DEPLOYING ENERGY EFFICIENCY STANDARDS

The owners of the region's buildings (both new and old structures) must be guided

20 U.S. Census Bureau



Photo of 2500 sq foot house

toward net zero energy use. Current state residential and commercial building codes were adopted in March 2015 and were modeled after the International Energy Conservation Code (IECC)²¹. The state has found it problematic to immediately adopt new energy codes, however because the U.S. Department of Energy often lags in completing the necessary support software upgrades for programs contractors use to track energy improvements. Net zero energy use cannot be achieved using current efficiency standards.

The system Vermont uses to track adherence to the Residential Building Energy Standards is a challenge. Currently, there are no state code officials or state permits for energy efficiency. Energy efficiency is self-certified by the building contractor, with a requirement that a completed certificate be submitted

²¹ Introduced in 1998, the IECC addresses energy efficiency on several fronts including cost savings, reduced energy usage, conservation of natural resources, and the impact of energy usage on the environment.

Zoning

Barnard

Bethel

Bradford

Braintree

Brookfield

Chelsea

Fairlee

Hartford

Newbury

Norwich

Plymouth

Pomfret

Randolph

Rochester

Stockbridge

Strafford

Thetford

Vershire

Woodstock

to the municipality where the building is being constructed. However, many communities are unaware of this requirement and have no way to track the submission of certificates. Towns with local code officials may enforce energy efficiency codes and towns with Certificate of Occupancy (COO) requirements must receive an Energy Code certificate before issuing the COO. Nearly two thirds of TRORCs communities (19) have zoning bylaws, but just under half (9) of them require a COO.

To move toward net zero energy use in the built environment, the code must be substantially improved and enforced and contractors and owners must be educated about the code's existence and purpose.

INADEQUATE UNDERSTANDING OF PROGRAMS, COSTS AND METHODS

When surveyed as part of the East Central Vermont Sustainability Project, just over 50% of the respondents indicated that their house was energy efficient. Vermont has an extensive network of organizations with significant experience in energy efficiency services and programs, and this expertise puts our region in a good position to improve thermal efficiency and reduce building energy consumption. This provider diversity can also be a challenge to the average homeowner, who may feel overwhelmed by the multitude of options.

Likewise, service providers may find it challenging to know what assistance, incentives or programs are available, and their customers may not know who to contact to take advantage of them. Every improvement project is different. It can be challenging for the layperson to incorporate renewable energy and energy

efficiency since these services are generally not offered by the same companies. In addition, poorly prioritized improvements can result in lower realized savings.

The prioritization of investments is vital to ensuring where residents can get the best return on their investments. Heat pumps can initially be more expensive than conventional furnaces to install, but can lead to a significant reduction in use of heating fuels, particularly when paired with wood heat. Installing a heat pump without adequately weatherizing the shell of a home, however, may yield a net loss. Weatherization should always be completed prior to, or in tandem with, the installation of a more efficient heating system.

THERMAL ENERGY STRATEGIES

SUPPORT INCREASED FUNDING

With cost being a significant barrier to the implementation of thermal efficiency and renewable energy improvements, it will be essential that programs that provide funding and financing are encouraged to grow. In particular, programs providing assistance to middle and low-income households must increase in funding. Current financing programs include:

1. Vermont's Heat Saver Loan: <http://heatsaverloan.vermont.gov/>
2. Property Assessed Clean Energy (PACE) - available for towns that have adopted a PACE district. Repayment of PACE financing is tied to the property, not to the owner.

3. Neighborworks of Western Vermont Energy Loan: <https://www.nwwvt.org/energy-loan/>
4. Vermont State Employees Credit Union VGreen Energy Savings Solutions loans: <https://www.vsecu.com/energy-savings/about/about-vgreen/what-is-vgreen>
5. Vermont Economic Development Authority offers energy loans to commercial enterprises <http://www.veda.org/financing-options/vermont-commercial-financing/commercial-energy-loan-program/> and small business <https://www.veda.org/financing-options/vermont-commercial-financing/small-business-energy-loan-program/>
6. United States Department of Agriculture Section 504 Home Repair Program <https://www.rd.usda.gov/programs-services/single-family-housing-repair-loans-grants>
7. Efficiency Vermont rebates for central wood pellet furnaces and boilers-\$2,000 cash back <https://www.efficiencyvermont.com/rebates/list/central-wood-pellet-furnaces-boilers-residential>

These financing programs offer key features such as great interest rates and, flexible terms, and ease of application. The loans can also be combined with Efficiency Vermont incentives.

While fuel assistance programs are essential, increased funding to Vermont's Weatherization Assistance Program

(WAP) is needed. Projects such as the Vermont Fuel Efficiency Partnership which provides "deep-energy" retrofits in multi-family buildings whose tenants are income-eligible for the WAP must be encouraged and supported. Fuel distributors must be encouraged to become Energy Service Providers, expanding what they offer so that more homes can be weatherized and energy efficiency increased.

TRORC can support these programs and initiatives by communicating directly with energy providers, state agencies and the legislature. We can provide input on state level initiatives and we can, if the opportunity presents itself, pursue federal funding to support these programs within our region.

SUPPORT THE IMPLEMENTATION OF THE VERMONT ENERGY CODE COMPLIANCE PLAN AND INCREASED ENERGY EFFICIENCY STANDARDS

The DPS has outlined a pathway to increased energy code compliance in a Plan developed in 2012. The state needs to follow this plan. Concurrently, the state needs to continue to move quickly to adopt the International Energy Conservation Code as it is updated, for both commercial and residential buildings. Standards for achieving net-zero design must be incorporated.



Dense Packing walls for insulation- Photo Credit: Capstone Community Action



VERMOD Home in Wilder, VT- Photo Credit: VERMOD Homes

Some regional builders such as Prudent Living's Southscape community (<http://southscapewilder.com/>) and VERMOD (<http://vermodhomes.com/>) are currently constructing net zero possible homes. TRORC can assist communities with continued outreach regarding code compliance. We can also support the DPS as they move forward on adoption of more energy efficient codes.

PROVIDE OUTREACH, COORDINATION AND EDUCATION

TRORC can provide education and outreach to our communities, and support other statewide programs for weatherization and thermal efficiency. TRORC can promote the work of community action agencies and energy service providers.

As a regional entity that works with municipalities, TRORC has a broad network of state and local connections. If adequate funding was available,

TRORC could develop a staff position that would focus specifically on energy assistance, education and outreach. Without duplicating existing services, such as those that Efficiency Vermont, Vital Communities, Energy Action Network, and GMP offer, a TRORC Energy Planner could act as a clearinghouse of energy information for our communities. Through education and outreach at the municipal level, TRORC could ensure that our residents were aware of the opportunities available to them. We could work closely with active municipal Energy Committees and Energy Coordinators to continually update them on new programs, policies or financing mechanisms for weatherization assistance or alternative heating improvements.

Ideally, a Regional Energy Planner would have a basis of knowledge grounded in implementation, so that this staff person would have experience directly related to the installation and implementation of thermal efficiency and renewable energy improvements. This skillset would be particularly valuable in working with builders and energy service providers to help educate them about their customer's needs, but would also provide homeowners with an independent voice that would help them understand weatherization and other energy efficiency options. Acting as a bridge between state-level service providers, contractors and municipal organizations, TRORC would effectively move the region toward meeting the CEPs goals relating to Thermal Efficiency.

THERMAL ENERGY GOALS, STRATEGIES AND ACTIONS

Goal A: Weatherize at least 25% of the regions housing stock by 2020

Strategy A.1: Weatherize at least 25% of the regions housing stock by 2020 (approximately 6,477 units)

Action:

1. Support programs such as Zero Energy Now!, Weatherize Upper Valley with Vital Communities, and GMP's eHome by providing outreach and education to local energy committees and their communities.
2. Support and promote the Energy Action Network (EAN) energy dashboard and educate towns as to its use and benefits.
3. Develop and distribute information regarding the available financing mechanisms for weatherization assistance including information about the financial advantages of energy improvements.
4. Seek funding for an independent staff person who can work with homeowners to understand weatherization and other energy options.
5. Support state efforts to provide additional funding for weatherization improvements, especially for low and moderate income populations.
6. Work with utilities to implement their Tier 3 fuel-switching mandates through education and outreach to help promote weatherization.
7. Work with fuel dealers to encourage them to become energy service providers.
8. Work with owners of rental housing to educate them of the financial benefits of weatherization investments.
9. Connect rental property owners with contractors and energy service providers to complete weatherization projects and provide property owners with available incentives and rebates.
10. Support K-12, higher education and vocational education initiatives to bring energy ideas and solutions into the classroom by working with organizations such as Vermont Energy Education Program (<http://veep.org/>).
11. Work with Neighborworks Heat Squad, COVER and community action agencies to promote their weatherization services.
12. Work with local educational institutions such as Vermont Technical College to encourage continued technical training related to energy efficiency improvements.
13. Support programs and initiatives that encourage the development of small homes (less than 1000 sq feet) as a way to reduce energy use.

Goal B: By 2020, reach 30% of new buildings built to net zero ,100% by 2030

Strategy B.1: Support net zero energy construction throughout the region

Action:

1. Support Net-Zero building programs by providing outreach and education to local energy committees and their communities.
2. Provide outreach to towns and contractors on the use and enforcement of residential and commercial building energy standards for all new construction.

3. Support statewide efforts to increase energy efficiency code standards and statewide energy code enforcement by communicating regional concerns about enforcement with the legislature, and encouraging communities that have zoning to include a Certificate of Occupancy when they revise their regulations if they do not already have one. Provide outreach to communities with a COO to ensure that they are tracking submission of the RBES certificate.

Goal C: Install 3,500 efficient cold climate heat pumps by 2050²²

Strategy C.1: Support a regional shift away from fossil fuel as a source of heat

Action:

1. Partner with Efficiency Vermont, Green Mountain Power and others to identify and promote cold climate heat pumps. Develop outreach materials and public meetings.
2. Seek incentive funding through Renewable Energy Standards Act “Tier 3” resources.
3. Coordinate all outreach efforts with fuel dealers and electrical contractors (potentially creating opportunities for electrical contractors to work with fuel dealers).
4. Provide communities with an analysis of potential areas that are suitable for ground source heat pumps when data is available.
5. Provide information to builders and developers regarding the benefits of geothermal systems (including heat pumps).

Goal D: Increase the use of efficient wood heat

Strategy D.1: Support the adoption of efficient wood and biomass heating systems for new construction, as replacements for fossil fuel furnaces and backup heat systems for heat pumps.

Action:

1. Conduct outreach and education by coordinating with vendors and contractors to hold informational public forums.
2. Encourage state policy to increase incentives and rebates for efficient wood heat equipment, through communication with the Legislature.
3. Provide outreach and education to communities to ensure they are aware of existing incentives and rebates.
4. Identify potential users of district heating and wood heating systems: schools, college campuses, apartment complexes, shopping centers, industrial parks and village centers.
5. Provide guidance to communities seeking to develop district heating systems.
6. Conduct outreach efforts to public and non-profit entities and housing organizations to provide information on biomass options.
7. Partner with project developers to promote the possibility of combined heat and power and district heating options.
8. Maintain forest health as a prerequisite to a sustainable wood energy fuel supply by modifying Regional Plan to protect forests and habitat.

²² All heat pumps for this goal must be identified as “qualifying models” by Efficiency Vermont through their rebate program.

TRANSPORTATION SYSTEM CHANGES AND LAND USE STRATEGIES

3

BACKGROUND

Vermont is one of 17 U.S. states that consumes more energy for transportation than any other sector.²³ The transportation sector is responsible for 37% of the total energy consumed in Vermont,²⁴ powered mostly from gasoline (76%) and diesel (20%).²⁵ To reach state energy goals, Vermonters will need to shift away from petroleum powered vehicles to electricity and biofuels. While transportation fuel switching is vital to reaching state energy and greenhouse gas reduction goals, it is also important to recognize that land use choices are inextricably linked to our transportation system. Vermonters tend to travel farther from their homes to employment, services, and shops than do other Americans.

The CEP seeks to reduce Vermont's total transportation energy use by 20% from 2015 levels by 2025. In the TRORC Region, the following targets would apply:

- Hold statewide Vehicle Miles Traveled (VMT) per capita levels to 2011 (11,402 VMT per capita).²⁶
- Reduce the number of single occupancy vehicle (SOV) trips by 20% by 2030. (75% of vehicle trips in TRORC Region are SOV).
- Triple the number of state park and ride spaces.²⁷ (TRORC has a total of 18 state and municipal park and rides, totaling 558 spaces).

²³ U.S. Energy Information Agency (EIA), 2015

²⁴ Vermont Agency of Transportation, *The Vermont Transportation Energy Profile*, 2015

²⁵ Ibid.

²⁶ 2016 CEP, p.140

²⁷ Ibid

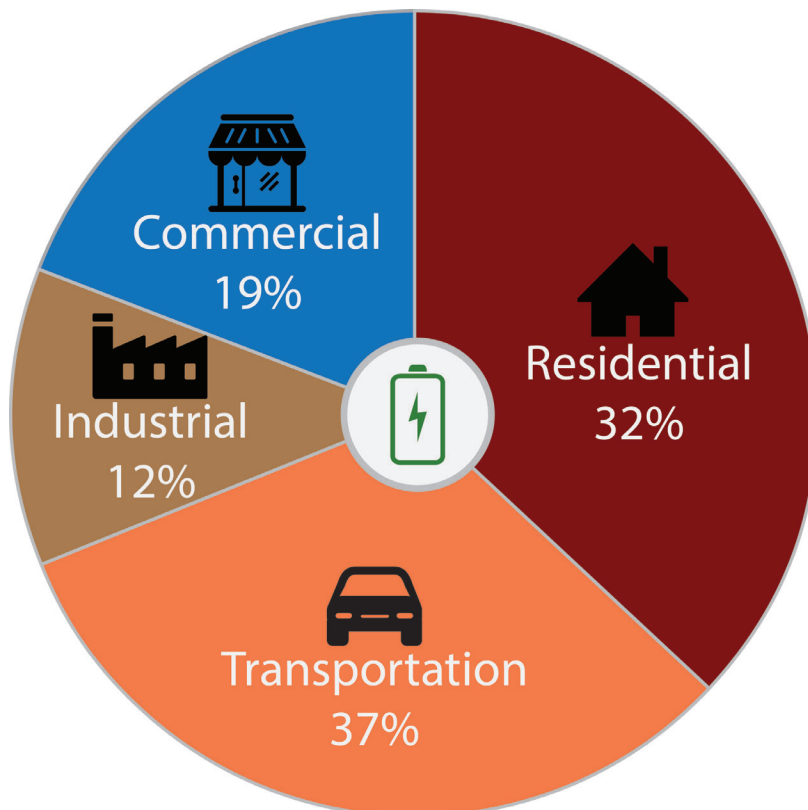


Figure 5: Vermont Energy Consumption, 2013 (U.S. EIA)

- Increase public transit ridership by 110% to 1.9 million trips annually. Currently, Stagecoach and Advance Transit together count for 950,000 trips annually.
- Quadruple Vermont based passenger rail trips annually.²⁸
- Ten percent of vehicles are Electric Vehicles (EVs) by 2025.

The 2015 Vermont Transportation Energy Profile notes that “progress toward achieving the CEP objective is likely to lag in the early years due to the necessity

²⁸ We have no data on how many passenger rail trips occur annually in the TRORC region

of upfront investments and the slow pace of behavior change. Progress may be particularly slow for metrics related to the vehicle fleet since cars and trucks typically have a long operating life. Thus, cases where the state is currently lagging in achieving a particular objective should not be taken to mean that the objective cannot be achieved.” In fact, the state is currently exceeding targets relating to VMT (2014 per capita VMT was 11,356, which is below the 2011 baseline of 11,402). However, on

all other CEP transportation targets the state lags behind.

To achieve these transportation energy goals, the Region’s transportation would need to become more efficient through fuel switching and an increase in the utilization of electric vehicles. Additionally, our pattern of land use and related travel would need to change to reduce daily trips.

TRANSPORTATION AND LAND USE CHALLENGES

TRADITIONAL PATTERNS OF DEVELOPMENT

The traditional Vermont landscape is defined by densely populated villages and downtowns, surrounded by open countryside. This pattern, which is recognized and supported in Vermont’s statutory planning goals, is also the key reason why transportation uses the largest portion of our energy. Where we live, work, go to school, shop, utilize services and recreate determines how far we drive.

Much of Vermont’s appeal to homeowners is the ability to own a house in the country, as reflected in our current settlement pattern. While many communities have small villages or downtowns, residential development in our towns is mostly located outside of these areas on rural roads. Rural roads (Class 3 and Class 4) make up a majority (67%) of roads in the TRORC region. The choice to live in a rural setting leads to longer commutes for work, shopping and services.

The rural nature of our region also means that there are limited locations for key centers of employment. Businesses commonly locate closer to larger centers of population, more robust municipal

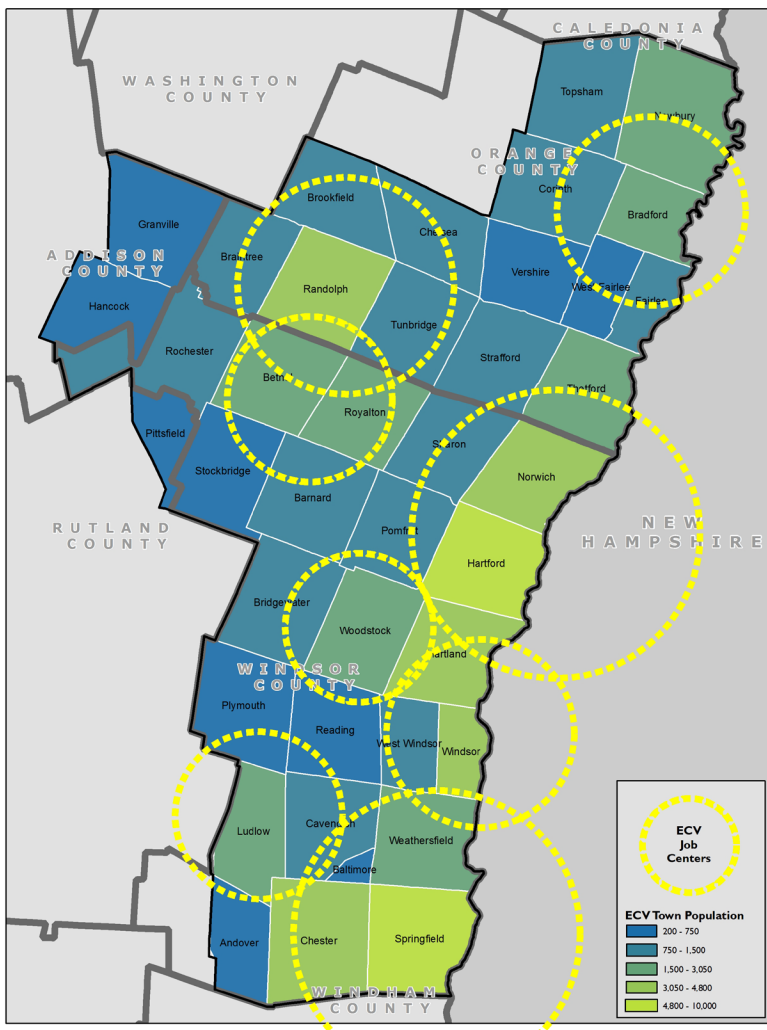


Figure 6: ECV Employment Centers - TRORC

services and fast and easy transportation routes. Out of the 30 towns in the TRORC Region, only seven could be considered centers of employment. These are Bethel, Bradford, Hartford, Norwich, Randolph, Royalton and Woodstock.²⁹ Further, a significant number of those who live in Orange and Windsor counties work outside of the region in the Hanover/Lebanon, NH or Montpelier, VT areas. A large portion of the TRORC Region is outside of these centers of employment.

This dispersed pattern of development is further encouraged by the way we regulate development locally. Many communities allow village-scale densities (one to two acre) in all locations, including rural areas. If this pattern of development persists, these communities could be forced to build new roads in rural areas to serve new development, resulting in undue costs to taxpayers for road maintenance and increasing VMT.

LACK OF AVAILABLE PUBLIC TRANSIT

Public transit provides less than 1% of the transportation in our region. The rural character of the region presents challenges for a traditional public transportation system. Long distances between homes and employment centers strain existing commuter bus routes, while the need for transportation in low population density areas presents a uniquely rural challenge to the system. The region has several public transportation services which are vital to our region's population. Elderly and disabled transportation services give alternatives to people who wish to live independently but who are unable to drive themselves.

²⁹ Note that the towns included in Figure 6 include several towns outside of the TRORC Region

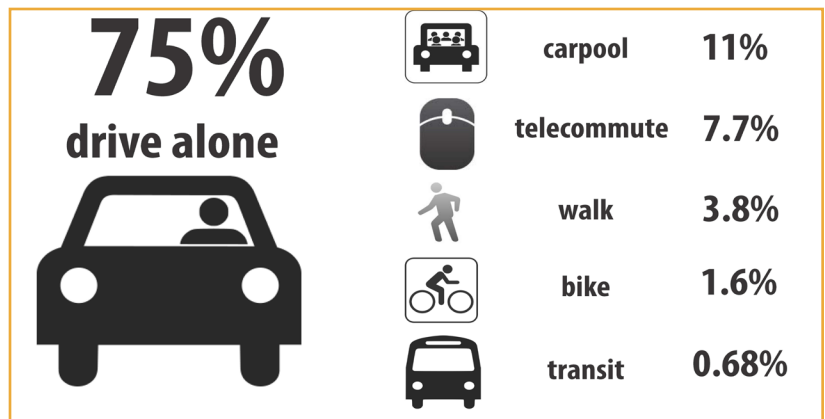


Figure 7: How the region is getting to work- TRORC, 2012

From Figure 7, it is clear that a significant portion of commuters drive alone to get to work. The Regional Transportation Network map (Figure 8, on following page) illustrates that access to public transit is difficult in many parts of our region.

In areas where local transit services are available, other challenges exist. Commuter bus routes that stop at regular intervals along their routes extend the length of the trip, making it quicker for someone with a car to drive themselves instead. The impact of regular stops can also make it challenging to time arrivals and departures in an economic center with hours of employment. Capacity is also an issue. Busses could expand to hold 50 riders versus 24, but that would require transit stops to be reconfigured to accommodate larger vehicles.

Regular fixed route services, such as those in Hartford and Norwich could increase ridership by adding additional busses and increasing the frequency of service. But to do so requires additional busses and drivers, both of which require significant funding. Funding also limits the hours of operation. Fixed route services in our region are limited to early

morning through evening, which means potential riders who work shifts outside of the traditional 9-5 model cannot take advantage of public transit.

Finally, there are perceptions that public transit is a service geared towards low

income citizens. While it is true that these demographic groups benefit from public transit, public transportation services are available and useful to everyone.

INSUFFICIENT LAND FOR COMMUTER LOTS

Existing park and rides are struggling to meet demand due to space limitations. A number of existing areas could likely serve twice the population of commuters if they had adequate area for expansion. Many existing park and ride areas are not designed or sized to accommodate public transit services (allowing for bus circulation and efficient transfer of passengers). Additionally, there are very limited locations where new commuter lots could be built. New lots are needed at Exit #1 and #3 on I-89 and more spaces are needed at Exit #2 on I-89.

LACK OF EVCHARGING STATION INFRASTRUCTURE

The average range of an Electric Vehicle is currently limited to an average of 120 miles on a full charge, although a few models can travel as far as 200-300 miles. Given the distance between our communities and centers of employment, it is essential that the ability to recharge EVs is readily available to the EV owner. There are currently only six locations with public EV charging stations in the TRORC region.

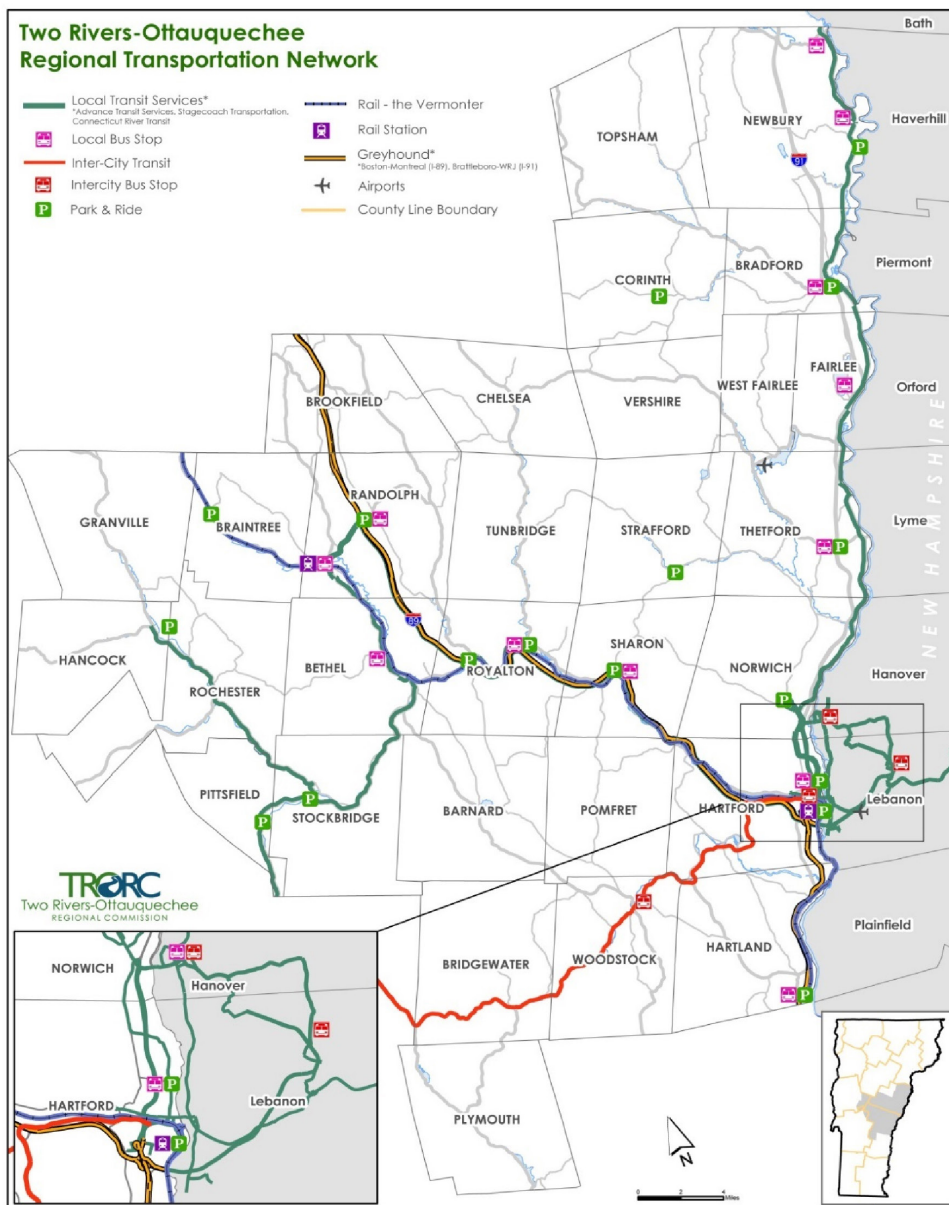


Figure 8: TRORC Regional Transportation Network

DEVELOPMENT PROGRESSES WITHOUT ADEQUATE CONSIDERATION OF PUBLIC TRANSIT OR ENERGY EFFICIENT TRANSPORTATION METHODS

Developments that occur in areas that are either right on or nearby a public transit route are sometimes planned without considering this service. If not considered during the planning stage, it is difficult to integrate public transit services into completed site plans. Likewise, the location of residential subdivisions away from a transit line can limit public access. Diverting an existing route to a new location is expensive and can have negative impacts on existing services.

Act 250 considers public transit as part of Criterion 5 (Transportation), but at the local level, integration of public transit services into the development review process is less common. It is not yet common that public transit agencies are involved in the beginning of the planning or conceptual design process. This means that design standards for bus pull-offs, sufficient stopping distances/sight lines, bus shelter amenities, bike racks, and sidewalks are not included as part of the permitting process.

TRANSPORTATION AND LAND USE STRATEGIES

SUPPORT SMART GROWTH AND PLANNING

In order to achieve the CEP's goals, transportation energy use cannot be ignored as we strive to create more energy-efficient buildings. Essentially, "location matters!" The region should embrace smart growth which, "can help communities balance competing demands



Illustration of Smart Growth- Photo Credit: ACCD

by supporting the rural landscape, helping existing places thrive, and creating great new places." Embracing smart growth reduces energy use, and provides cost savings for both households and municipalities, while creating vibrant communities and taking pressure off our natural resources.

Development that is more effectively directed within and adjacent to historic downtowns, villages, and neighborhoods will reduce the need for motorized transportation. In 2006, via Act 183, Vermont codified its own detailed guiding principles for local and regional land use

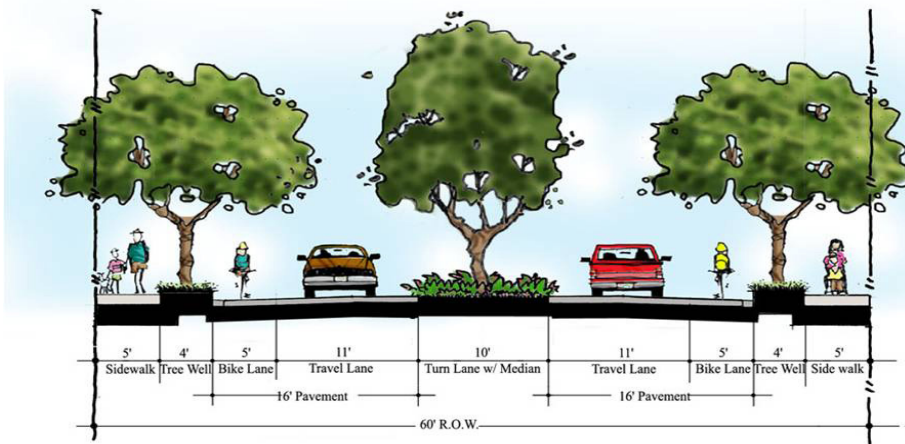


Illustration of a Complete Street- Photo Credit: Complete Streets

Streets. Complete Streets focus on multi-modal transportation, public transit and pedestrian travel.

Encouraging economic development initiatives that keep individuals working in their home communities, rather than commuting to work, such as “maker” or “coworking” spaces and expanded high speed internet can also have an impact on Vehicle Miles Traveled. Likewise, communities can support infill development and concentrated commercial and institutional activities in our villages and downtowns.

decisions based upon the smart growth principles. Although communities are not required to plan, those that do are encouraged to uphold planning and development goals that reinforce smart growth principles, such as Complete

Poorly Planned Public Transit Example

This bus turnout is an example of a poorly planned public transit stop. The busses on this route are 8ft wide and need at least 11ft of area to safely allow for passengers to enter and exit the bus. Additionally, in this example, the tapered bus stop will not accommodate the length of the bus.

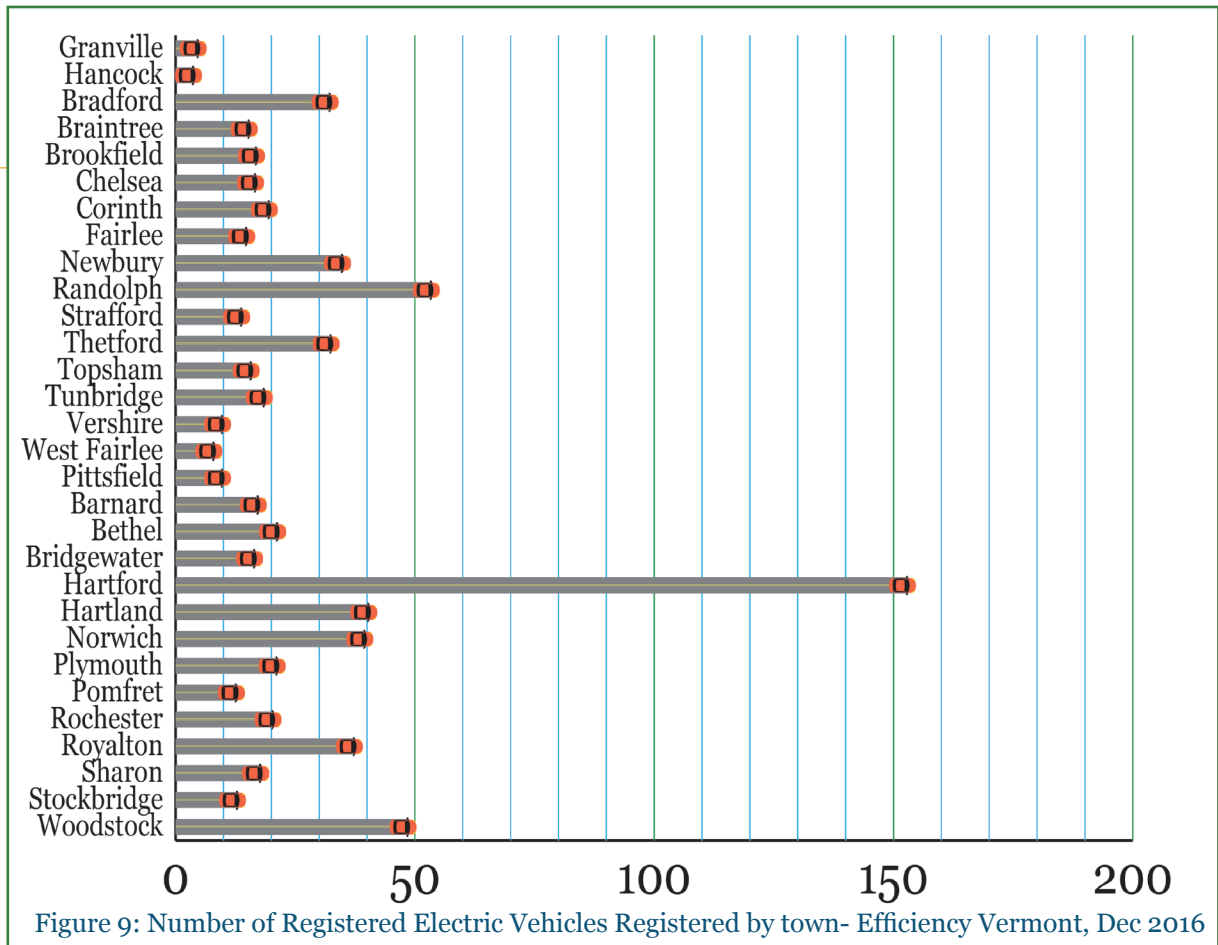


ENCOURAGE HIGHER DENSITY IN LESS RURAL AREAS

In order to reduce Vehicle Miles Traveled, communities will need to continue to encourage higher density development, particularly housing, within their villages and downtowns. In turn, they will need to reduce density in more rural areas. Communities with village scale density (2 acres or less) in rural areas that are not served by existing major roads should seek to reduce density, to discourage the proliferation of residential development in areas that require driving.

ENCOURAGE EMPLOYERS TO SUPPORT REDUCED VMT

Local employers have a role in reducing vehicles miles traveled. On average, Vermonters drive 15 miles to work each way. Assuming a telecommuter works one day a week from home, with two weeks of annual vacation time, telecommuting could decrease round trip commuter travel by roughly 1,500 miles per year per commuter. If telecommuting is not practical due to lack of adequate internet access or because of a specific



business model, employers can encourage carpooling, cycling, or the use of public transportation. For example, Dartmouth College provides a van service for employees in Bradford, Chelsea and Vershire. GW Plastics is working on a van service to Royalton from Barre. State employees can catch a van from Randolph to the National Life building in Montpelier. Area employers including King Arthur Flour, Vital Communities, Hypertherm and RSG, Inc. provide monetary incentives for employees to carpool or take public transit.

SUPPORT INCREASED CONSIDERATION FOR PUBLIC TRANSIT AND ELECTRIC VEHICLES IN LOCAL AND STATE PERMIT REVIEWS

Clear policy at the Regional level will ensure that under Act 250, public transit and electric vehicles are given adequate consideration. Large scale commercial and residential developments need to consider their relationship with public transit in terms of where they are located and the infrastructure they provide for employees who want to use it. Likewise, developers can include EV charging stations in their plans.

SUPPORT THE DEVELOPMENT OF ALTERNATIVE FORMS OF PUBLIC TRANSIT

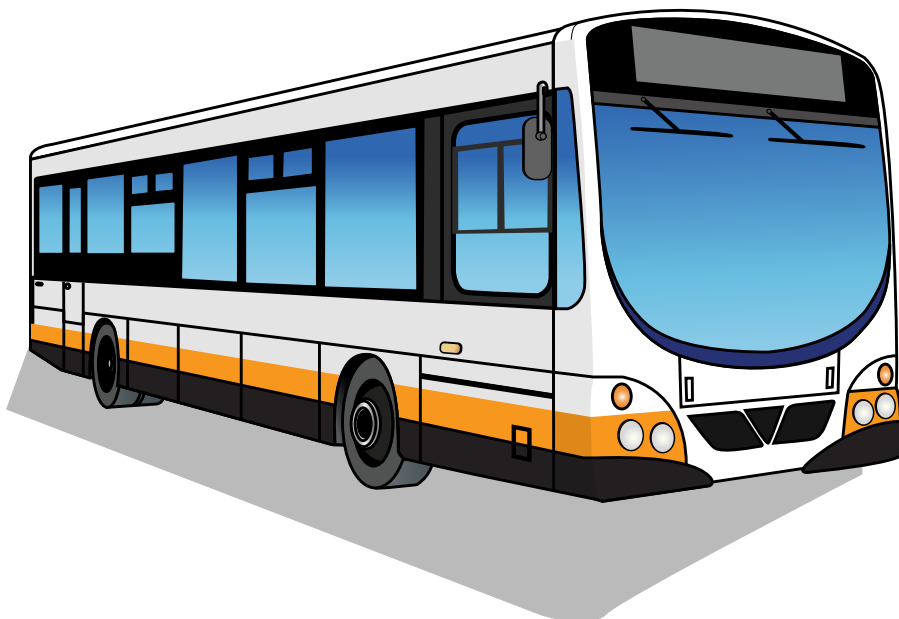
In addition to traditional public transit models, growth in forms of transit driven by technology (such as Uber and CarShare Vermont) should be encouraged.

INCREASE FUNDING FOR PUBLIC TRANSIT INITIATIVES AND INVESTMENTS

Adding additional busses along existing commuter routes would allow transit providers to expand their hours and capture riders who work outside of traditional 9-5 business hours. Larger busses located along transit routes would allow for more riders.

SUPPORT THE DEVELOPMENT OF INTERMODAL TRANSIT FACILITIES

The development of several intermodal transit facilities that would allow commuters to connect with mass transit including trains and busses, could improve regional access to public transit and reduce VMT overall.



TRANSPORTATION GOALS, STRATEGIES AND ACTIONS

Goal A: Hold Statewide VMT per capita to 2011 levels (11,402 VMT per capita)

Strategy A.1: Reduce vehicle miles traveled by supporting efforts to provide the Region with opportunities to work closer to home and by requiring public transit opportunities for large scale development.

Action:

1. Encourage communities to develop bylaws that allow for the development of “makerspaces”²⁹ as a way to reduce VMT. Revise the TRORC Regional Plan to include support for makerspaces in villages and downtowns.
2. Support continued expansion of high speed internet to allow for telecommuting.
3. Partner with employers to invest in workplace incentives for carpooling, cycling, public transportation use and telecommuting.
4. Modify the Regional Plan to include specific language that requires developments that have a Substantial Regional Impact (as defined in the Plan) under Act 250 to include regional transit infrastructure. Consultation with transit providers may be required.
5. Modify the TRORC Regional Plan to require a transit stop for all residential and large commercial land developments subject to Act 250 if there is not currently a stop within 1/4 mile.
6. Support new bike/pedestrian projects in the region.
7. Revise the Regional Plan to more clearly support the goal of densely populated villages and urban centers surrounded by open countryside. This will include identifying areas where high density development, such as is common in Villages and urban centers, is less appropriate.
8. Work with groups such as the Vermont Bicycle and Pedestrian Coalition (VBPC), Local Motion and the Green Mountain Bicycle Club to educate and encourage safe bicycling as a transportation alternative in the region.

Goal B: Reduce the number of single occupancy vehicle trips by 20% by 2030, through carpooling and public transit.

Strategy B.1: Support programs and planning initiatives that will reduce single occupancy trips throughout the Region.

Action:

1. Support community car sharing by promoting programs such as Go Vermont and CarShare Vermont.
2. Provide technical assistance to communities interested in implementing Complete Streets to increase density and mixed uses in compact settlements and to foster transit-oriented development along major roads in rural areas.
3. Continue to identify locations for additional park and rides (state and municipal).
4. Continue to prioritize efforts to expand existing park and ride infrastructure.
5. Support the development of intermodal transit facilities within the region to allow underserved areas access to multiple forms of transportation.

³⁰ A “makerspace” is a physical location where people gather to share resources and knowledge, work on projects, network, and build. Makerspaces provide tools and space in a community environment—a library, community center, private organization, or campus.

6. Continue to support local transit providers through technical assistance.
7. Increase coordination between TRORC, VTrans and local transit providers to ensure a seamless regional transit system.
8. Investigate the feasibility of commuter rail along the I-91 corridor.
9. Work with communities to incorporate the principles of Smart Growth into their municipal plans and bylaws and to support creative economic development concepts that allow residents to live and work in their communities.

Goal C: Increase the percentage of electric vehicles to 90% by 2050 in the Region.

Strategy C.1: Ensure that land use policy and regulation are designed to encourage daily use of EVs.

Action:

1. Modify TRORC Regional Plan to require EV charging stations for developments over a certain size.
2. Modify the TRORC Regional Plan with language that requires EV parking spots and infrastructure for all commercial, industrial and multi-family development subject to Act 250.
3. Encourage state policy changes to offer state buyer incentives for EVs.
4. Promote and share information provided by Drive Electric Vermont including their video highlighting the costs and benefits of EVs.
5. Consider other EVs as part of this Plan such as light-duty and heavy-duty trucks, bicycles and motorcycles.
6. Encourage municipalities to take advantage of Village Designation Electric Vehicle Charging Station grants.

Goal D: Increase the use of sustainable biofuels.

Strategy D.1: Support investment and development of sustainable biofuels.

Action:

1. Support and promote the Vermont Bioenergy Initiative in cooperation with the VT Sustainable Job Fund's Bioenergy Initiative by modifying the TRORC Regional Plan to address on-farm biofuel production under Act 250.
2. Identify locations for alternative fuel stations in the Region and modify the Regional Plan to include them as allowed uses in appropriate locations.
3. Support efforts to switch municipal medium and heavy duty vehicles to biodiesel blends.

ENERGY CONSERVATION, EFFICIENCY OF DELIVERY AND END USE

4

BACKGROUND

The CEP recognizes the significant economic and environmental benefits of energy efficiency, conservation, and renewable energy sources, while seeking diverse sources of electricity production, to ensure grid reliability, and maintain the lowest-cost integrated resource planning principles. Since 2005, electricity consumption in Vermont has declined and retail electric rates in Vermont are the second lowest in New England.

The data modeling used to create the scenario that this Plan uses to achieve the goals of the CEP projects a 40% decrease in overall energy use in the TRORC region. However, the significant reduction in fossil fuels as part of our energy portfolio ultimately requires an increase in our dependence on electricity. As is shown in the graphic above, following the LEAP model developed for this Plan, one possible path for the Region to achieve 90% by 2050 includes increasing electric demand by 9.9% (from 2015 levels) to offset decreases in fossil fuel use. The increase in electric consumption will be due to the utilization of new electric technologies, such as cold climate heat pumps and electric vehicles that rely on electricity. This fundamental change in the type of energy we use will require substantial changes at the utility scale.

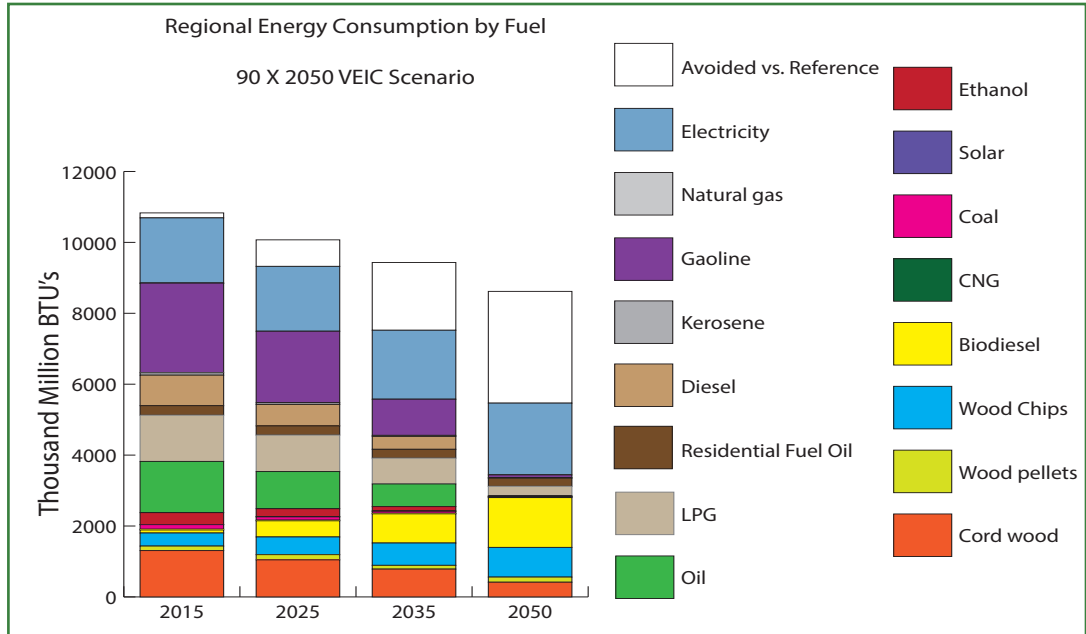
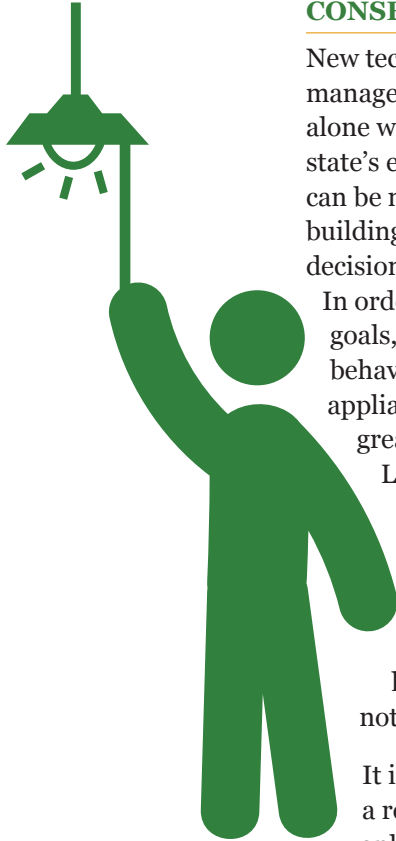


Figure 10: Regional Residential Energy Consumption by fuel - VEIC

DEMAND- SIDE MANAGEMENT

Demand-Side Management is the best and lowest-cost option to meet expected demand. Encouraging the installation of energy efficient devices or equipment that will perform work using less energy and improving building shells to reduce the need for building heat is essential to reducing our overall energy use (see How We Heat, Chapter 2). Additionally, proper load management can help reduce demand during peak hours. Demand response techniques can include time of use rates, smart rates and energy use feedback. But even with fully implemented demand-side management, fuel-switching will require new sources of renewable energy.



CONSERVATION & EFFICIENCY

New technology, demand-side management and renewable generation alone will not be sufficient to achieve the state's energy goals. Gains in efficiency can be made through appliance standards, building energy codes, customer economic decisions, and publicly funded programs.

In order to achieve the state's energy goals, people will have to alter their behavior patterns, to use electric appliances, lighting, and heat with greater thought given to conservation.

Large-scale energy savings can be achieved by effectively encouraging many people to make small individual changes such as turning down thermostats, air drying clothes and turning off lights and electronic devices when not in use.

It is important to recognize that from a regional standpoint, TRORC can only indirectly implement many of the strategies related to electricity.

Many of the components that are needed to implement this section of the Plan require direct action from utilities, energy generators and state and federal governments, and buy-in from our communities.

CHALLENGES

ELECTRICITY WILL MAKE UP A LARGER PART OF OUR ENERGY FUTURE

As indicated earlier in this chapter, Vermont will need to significantly increase the amount of electricity available in order to offset the impacts of fuel switching. While energy efficiency and conservation will help reduce the amount of electricity

needed, meeting the goals of the CEP will mean that in the TRORC region, we will go from using 1.8 TMBTU of electricity to 2.1 TMBTU. Because 90% of our energy must be from renewable energy, new renewable energy generation facilities will need to be built throughout our region, creating another set of challenges.

POWER DISTRIBUTION SYSTEM IS NOT DISTRIBUTED GENERATION

The Vermont electric grid was developed to function as an importer of electricity. As with the rest of the United States, Vermont depends on a small number of centralized power plants, the vast majority of which are located outside of the state. This classic model of energy distribution has a number of significant disadvantages due to inefficiencies and power loss over lengthy transmission lines.

Our existing grid is not fully capable of allowing the placement of small renewable energy generation facilities in every

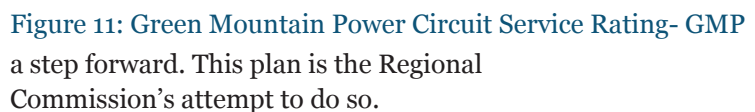
Electricity use in the TRORC Region is predicted to increase from 1.8 TMBTU of electricity to 2.1 TMBTU in 2050

- LEAP Model, 2016

REGIONAL AND MUNICIPAL PLANNING DOES AN INADEQUATE JOB WITH REGARD TO RENEWABLE ENERGY GENERATION

31 Green Mountain Power, 2015
<http://gmp.maps.arcgis.com/apps/Viewer/index.html?appid=546100cc60c34e8eb659023ea8ae03f3>

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As noted in Section 2, Vermont has an extensive network of entities with significant experience in energy efficiency and renewable energy generation services and programs. The plethora of options is often overwhelming, leading homeowners to be slow at implementing and combining energy efficiency improvements or renewable generation systems.

What are Renewable Energy Credits?

Renewable energy credits (RECs) are the tracking and legal attribute that qualifies electricity as a “green” renewable energy source for accounting purposes. RECs can be “unbundled” from the electric output and sold to anyone that needs renewable credits to comply with state renewable portfolio standards or wants to purchase renewable energy. Electricity that has been “unbundled” from its credits does not count as renewable in terms of meeting Vermont’s renewable energy targets. It is important to note that the REC system is only an accounting system. Energy developed renewably is still a renewable resource that will ultimately reduce our reliance on fossil fuels.

Why sell the RECs?

The primary reason Vermont’s legislature supported the purchase and sale of RECs was to encourage growth of the renewable energy generation industry. This has been a remarkably successful concept. The sale of RECs has helped keep overall electric rates down, while allowing for the deployment of more renewable energy systems. Many renewable energy generation facilities depend on sale of RECs to capitalize their development.

Do we have to sell the RECs?

Many Vermont renewable energy projects keep their RECs. With the passage of Act 56 in 2015, Vermont will be required to meet 55% of their energy sales from renewable energy in 2017 and 75% in 2032. As a result, more RECs will be retired in state, helping ensure that Vermont is able to reach its renewable energy targets.

Once the credits are sold, are they gone for good?

RECs are sold on a yearly basis. So, the developer of a net-metered solar system could sell the RECs for the first five years of operation to help fund the development of the system, and retire the remaining credits over the life of the system.

BEHAVIORAL PATTERNS DO NOT REFLECT A NEED FOR ENERGY CONSERVATION

Much of what we do depends, in one form or another, on energy. Where we live and work, how we get from place to place, how we design, build and heat our houses, and how we use our land are all patterns of behavior. Behaviors are controlled by social norms to a large extent.³³ Current social norms do not favor energy conservation, tending toward a more consumptive model. Education sustained over time will have an impact on behavior.

RENEWABLE ENERGY CREDITS CAN BE SOLD OUT OF STATE

All New England states are required to meet state-mandated renewable energy requirements. When renewable energy generation facilities are built, the development gains Renewable Energy Credits (REC) which utilities throughout the region can purchase to claim the renewable attributes of generation that they do not own. In Vermont, many developers utilize the sale of RECs to help fund the construction of the project. The challenge is that RECs are often sold to utilities outside of Vermont. The energy generated by a renewable energy generation facility that has sold its RECs out of state does not count toward the State’s energy goals. This has caused some conflict and opposition to further renewable energy development.

³³ Shove, E., 2003, ‘Converging conventions of comfort, cleanliness and convenience.’ In: Journal of Consumer Policy, Vol. 26, No. 4, 12.2003, p. 395–418.

ELECTRICITY STRATEGIES

IMPROVE DEMAND-SIDE MANAGEMENT

In addition to energy efficiency improvements to reduce heating and cooling costs in our homes and transitioning to electric vehicles, there are other techniques that can be used to reduce energy use. Utilities can install Advanced Meter Infrastructure (AMI), which increases system reliability and load management capabilities with two-way communications technology. AMI includes smart meters to enable utilities and customers to track and manage the flow of energy more efficiently, curb peak demand, lower energy bills, and integrate renewable energy sources and storage to the grid.

AMI data and Smart Meter technology can allow utilities to implement Smart Rates, which vary the price of electricity to accurately reflect the cost of electricity: lower rates for low demand and higher rates during peak. This can help influence customers to change their electricity consumption patterns in response to changes in energy price over time or to incentivize payments designed to induce lower electricity use during peak.

PROMOTE BEHAVIORAL CHANGE TO ENCOURAGE CONSERVATION

Programs such as Efficiency Vermont, Go VT and Button Up! are designed to educate people on ways they can change their behavior to reduce energy consumption and greenhouse gas emissions. If provided with well thought out and well organized materials, local energy committees can successfully implement programs like these at the local level. Additionally, as mentioned above, properly designed Smart

Rates can either encourage or discourage usage at certain times of the day, for example, which in turn affects resource development and utilization choices. Small changes in routine, such as shifting power-hungry activities to “off-peak” hours in the morning or evening can help ease the load on the Region’s power grid.

ENCOURAGE THE DEVELOPMENT AND USE OF STORAGE TECHNOLOGY

Electrical Storage can closely align customer loads with periods of lower electric demand, store solar electricity to use during peaks or provide some back-up during power outages. Using storage can help reduce electrical demand peaks across the network, making it more reliable.



Tesla Powerwall- Photo Credit: Green Mountain Power

FOCUS GRID IMPROVEMENTS ON SYSTEM STABILITY, RELIABILITY AND AFFORDABILITY

Green Mountain Power covers a majority of the TRORC Region. The utility is constantly striving to improve existing infrastructure. Improvements to existing facilities are often subject to Act 250 review, which the Regional Commission reviews as part of their technical assistance

program. The CEP desires a significant portion of Vermont's energy to be produced near where it is consumed by many coordinated actions by distributed energy users, rather than through singular central control.³⁴

RETIRE MORE RENEWABLE ENERGY CREDITS IN STATE

Changes in legislation have made it possible to retire RECs in-state, thus allowing us to further increase our renewable energy portfolio. Act 56, which was passed in 2015, has increased the number of RECs that need to be retired in state.³⁵ Efforts to increase that cap or encourage their retirement in-state, should continue in order to ensure that the goals of the CEP are reached.

INCREASE THE NUMBER OF RENEWABLE ENERGY GENERATION FACILITIES

To accommodate the increase in use of electricity due to fuel switching, electric vehicles, etc., the Region will need to encourage the development of new renewable energy generation facilities that retire their RECs in state. In order to ensure that facilities are developed, the Regional Commission and its municipalities will need to clearly identify areas where they are appropriate.

EMBRACE ENHANCED ENERGY PLANNING AS DEFINED IN ACT 174

Act 174 was passed in an effort to support energy planning and the development of renewable energy. The Act creates an optional level "enhanced energy planning" that would include policies relating to energy conservation, efficiency and the development and siting of renewable energy resources, including an identification of where they are and are not appropriate. TRORC will, with proper funding from DPS, assist interested communities with their enhanced energy planning efforts.

³⁴ Department of Public Service, *Comprehensive Energy Plan*, 2015

³⁵ Act 56 requires 1% of Tier 2 electric power to be from distributed generators (< 5MW) supporting VT electric grid in 2017 to 10% in 2032.

ELECTRICITY GOALS, STRATEGIES AND ACTIONS

Goal A: Meet 25% of remaining energy need from renewables by 2025, 40% by 2035 and 90% by 2050. Meet end use sector goal of 67% renewable electric by 2025.

Strategy A.1: Support the continued development of renewable energy generation that counts toward the goals of the CEP

Action:

1. Encourage communities and residents to identify areas with the potential for renewable energy generation.
2. Provide education and outreach to municipalities on energy generation.
3. Develop easy to understand materials about the state's energy goals and how they interact with local and regional planning.
4. Advocate for continued incentives that lead to the retirement of Renewable Energy Credits in-state so that the Region can accurately track progress toward the goals of the CEP.
5. Support the implementation of smart rates.
6. Help meet the standards set forth in Act 174 for Enhanced Energy Planning.

Goal B: Use Demand-Side Management to manage the expected electric energy demand increase of by 2050 in the TRORC region.

Strategy B.1: Educate our communities about the programs and tools available to further reduce energy demand.

Action:

1. Promote Efficiency Vermont and other incentive programs to reduce electric energy use and encourage the use of devices and equipment that perform work using less energy input than otherwise necessary, such as Energy Star or CEE2, 3 or Advanced appliances.
2. Encourage state policy to adopt energy storage mandates and incentive programs.
3. Promote the use of programs such as eHome and Zero Energy Now!, in conjunction with Green Mountain Power and the Building Performance Professionals Association of Vermont (BPPA-VT), through outreach and education.
4. Work with BPPA-VT to encourage HVAC and weatherization providers to join the organization to provide holistic energy advice to the Region.
5. Support and provide outreach for Energy Action Network's Community Energy Dashboard and Efficiency Vermont's customer engagement web portal and home energy reports.
6. Support efforts to develop programs that encourage energy conservation through behavioral change by advocating for a roll-out of smart rates in the region through work with local energy committees and education and outreach.
7. Provide support for grid improvements that will allow improved renewable energy generation facility coverage in our region by actively participating in the Act 250 and Section 248 review process.

5

RENEWABLE ENERGY GENERATION

BACKGROUND

The State's goal of 90% renewable energy by 2050 represents a substantial shift from our energy portfolio. Renewable portfolio standards are state or local level policies that mandate all or certain types of electricity producers to supply a minimum share of their electricity from designated renewable resources.

Sixty percent of Vermont's electricity currently comes from renewable sources, a majority of which is hydropower generated by Hydro Quebec. Vermont currently has no large-scale centralized electricity generation. To reach the state's renewable energy generation targets, more generation will need to be developed (with RECs retired in state).

RENEWABLE ENERGY GENERATION

The TRORC Region currently hosts 77MW of renewable energy capacity, the bulk of which comes from existing hydroelectric sites. All existing or permitted generation capacity as of 2015 was factored into the LEAP modeling used as part of the RPC Energy Project.

Based on the LEAP model, in the low wind scenario the TRORC region would need to accommodate 25 MW of new wind, 8 MW of new hydro and 178 MW of new solar in order to adequately contribute to the goal of 90% renewable by 2050.

It is important to recognize that the model developed and utilized in this Energy Implementation Plan is one path to reach the state's energy goals. The targets specified above are not to

be considered hard targets, but are instead intended to provide the region with an idea of how much renewable energy might need to be generated in order to play a role in achieving 90% renewable by 2050. These targets should be used by communities as they formulate their own plans and policies with regard to renewable energy generation, particular those communities seeking to meet the Enhanced Energy Planning standards of Act 174.

SOLAR

Solar is the most viable source of renewable energy generation in the TRORC region due to the nature of our topography and land cover. Based on GIS mapping analysis, there are roughly 124,354 acres of land in our region that have the potential³⁶

³⁶ Solar potential is determined using GIS analysis of topography based on slope and direction (azimuth) for ground mounted solar. Addition-

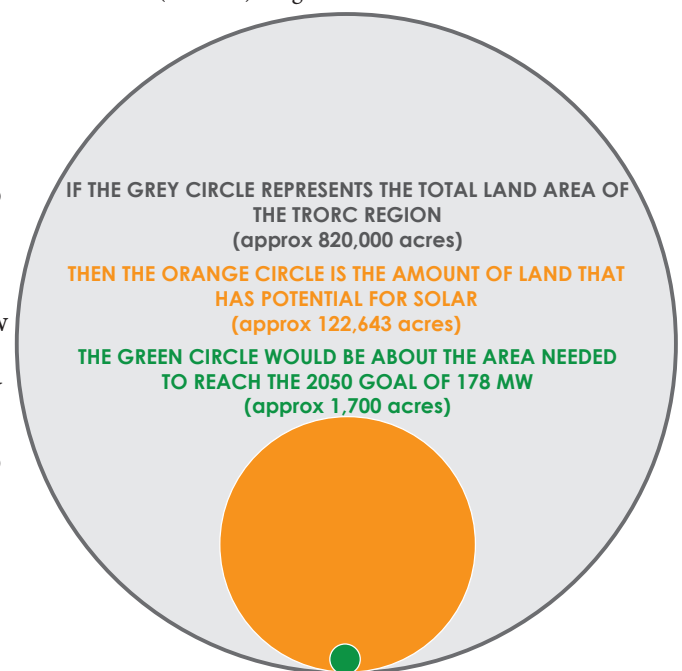


Figure 12: Solar Potential Diagram

of producing solar energy, which is about 9% of the region's total land area. Not all land that has the potential to generate solar energy is appropriate for this use, however. Many areas have conditions that may make them unsuitable, such as hydric soils, wetlands or flood plains. Other suitable locations may be better used for other purposes, such as locations with prime agricultural soils.

Roof-top solar (or solar facilities on existing structures) is often considered a viable alternative to commercial-scale production. However, as indicated by the infographic above, even using extremely optimistic projections, roof-top solar might account for only 42MW of generating capacity (24% of the projected solar production needed by 2050). As such, even when encouraging extensive development for rooftop solar, a majority of the new renewable solar power generated in the TRORC region will be commercial scale. Existing and proposed commercial solar facilities in our region have ranged from small (1.5kW) to large (20MW). The amount of land needed for a facility depends entirely on the scale. It takes roughly 9 acres for 1MW of solar generation.³⁷

WIND

Wind energy generation has several advantages over solar. Wind turbines have a more significant amount of "up-time" in terms of generated energy because they can operate 24 hours a day. Additionally, they are able to produce energy during the

al factors in analysis included the removal of "known level 1 constraints." See Chapter 6 for more information.

³⁷ Based on analysis of existing and proposed facilities in the TRORC region. CEP estimates the amount of acres per MW at 7.

WHAT ABOUT ROOFTOP SOLAR?

Rooftop solar will be a piece of the renewable energy generation puzzle, but commercial scale generation will still be the primary generator. Using the perfect (but unlikely) scenario described below, rooftop solar could generate 42MW of electrical capacity.



There are roughly 4000 residential structures within the areas that have been identified as having solar potential.

If 100% of those structures are properly oriented and structurally compatible, and each one chooses to install systems at an average of 4KW capacity, it could account for...

16 MW



There are roughly 414 small commercial structures (<40K sq ft) within the areas that have been identified as having solar potential.

If 100% of those structures are properly oriented and structurally compatible, and each one chooses to install systems at an average of 20KW capacity, it could account for...

8 MW



There are roughly 90 large commercial structures (>40K sq ft) within the areas that have been identified as having solar potential.

If 100% of those structures are properly oriented and structurally compatible, and each one chooses to install systems at an average of 200KW capacity, it could account for...

18 MW

Figure 13: Rooftop solar Potential Capacity, TRORC Region

winter, when sunlight is less available for solar production. But, because of the need for constant wind speed, commercial scale wind energy generation facilities generally require areas with elevated topography (where wind speeds are generally higher). Only 20% of the TRORC region has topography that can offer potential for wind speeds that make commercial-scale wind energy generation³⁸ cost-effective. On average, out of the 30 towns in the TRORC region, only about 16% of the land in each community is elevated enough to offer significant potential for commercial-scale wind. But, it is possible to generate energy in areas with lower wind speed. These are more practical on the residential scale, rather than commercial scale.

While the benefits of wind power are substantial, the location of utility scaled wind energy turbines and associated facilities can adversely interfere with scenic, natural and historic resources. Past versions of the TRORC Regional Plan have focused primarily on the aesthetic impact

³⁸ Digitally modeled wind speed (based on topography) analyzed at 3 hub heights.

of these facilities, but it is fair to say that in order to encourage the development of renewable energy, we must accept a reasonable amount of impact to the scenic quality of the region. That said,

Not All Generation is Equal

In some communities, there may be a preference for one kind of renewable energy generation vs. another. The target information provided as part of the LEAP model specifies targets for solar, wind and hydro generation. It is possible (but not simple) to “swap” one generation type for another (for example, a town could decrease the amount of solar in a community in favor of more wind).

It is important to recognize the different types of renewable energy are not equal, and each have a different “capacity factor” (actual output over time). For example, a solar system with a capacity of 100 megawatts, won’t produce energy at that level all the time because the sun is not available 24 hours a day, 365 days a year. Solar in Vermont is generally considered to have a capacity factor of 15%. Wind generation in VT, on the other hand, has a capacity factor of roughly 25-30%, because winds are more constant. This means that if a community was determined to reduce the number of wind towers needed to reach the goals of the CEP, significantly more solar would be needed to make up the lost capacity.

our primary concern with these facilities is the impact on our region’s natural environment. Because much of the area in which even small utility-scale wind systems would be built is currently undeveloped, careful consideration to the impact on natural and wildlife communities must be taken into consideration. Wind generation facilities need to be carefully sited so they don’t destroy or significantly imperil necessary wildlife habitat blocks, migratory bird patterns, or wildlife corridors. Wind turbines, power lines, access roads, and other components of a generating system have been known to disrupt the physical and ecological relationships of habitats. Approvals or permits for this use should not be awarded unless evidence clearly establishes that habitats will not experience an undue adverse impact.

As with solar, not all land that has the potential to generate wind energy is appropriate for that use. The areas suitable for wind development can be challenging to access and difficult to permit, making them less profitable for the developer. By and large commercial scale wind is less desirable than solar.

HYDRO

Hydroelectric energy generation is one of the lowest-cost, steady power producers available to the TRORC region. There are currently twelve hydroelectric facilities in operation in the TRORC region, which account for 51,840 kW of existing capacity.

There are two main forms of hydropower: run-of-river which uses the natural flow of water to generate power and facilities that store water behind an impoundment. Run-of-river systems rely on seasonal rainfall and runoff to produce power, resulting in periods of low production. Impounding

Town	Type	Utility	Capacity kW	Annual kWh	Owner	Stream/River
Bethel	GNM	GMP	330	12000000	Bethel Mills	Third Branch, White River
Newbury	GRD	GMP	970	33000000	Boltonville Hydro	Wells River
Newbury	GRD	GMP	270	1096000	GMP	Wells River
Newbury	GRD	GMP	5	23000	Sardnar Thanhuser	Halls Brook
Bradford	GRD	GMP	1500	4335000	GMP	Waits River
Hartford	GRD	GMP	37400	148850000	TransCanada	Connecticut River
Hartford	GRD	GMP	3790	6904000	GMP	Ottauquechee River
Hartford	GRD	GMP	645	2780000	Simon Pearce Glass	Ottauquechee River
Hartland	GRD	GMP	4000	12100000	North Hartland, LLC	Ottauquechee River
Hartland	GRD	GMP	2180	5834000	GMP	Ottauquechee River
Hartland	GRD	GMP	250	800000	Jay Boeri	Lulls Brook
Woodstock	GRD	GMP	500	1429000	GMP	Ottauquechee River

Table 2: Existing Hydro Generation Facilities, TRORC Region 2015
GNM= Group Net Metered, GRD= Grid, GMP= Green Mountain Power

water behind a dam allows for control of the water flow, resulting in consistent electric production.

The pathway developed by the LEAP model includes a suggested allocation of 8GW of additional hydroelectric capacity in the TRORC Region. Recognizing that the development of new, commercial-scale hydroelectric facilities is unlikely, gains in hydroelectric energy generation will be made by upgrading and improving existing infrastructure including dams that are not currently outfitted for hydro. There are 35 existing dams in the TRORC Region that have the potential to generate hydroelectric power.³⁹ However, these facilities only have the estimated capacity of 2,700 kW. It is hoped that through advanced operational controls, more efficient equipment and/or conservation flow turbines, additional energy can be generated at existing facilities within our region.

³⁹ Data (L. Barg, *The Undeveloped Hydroelectric Potential of Vermont*, 2007) used includes existing dams with low-to high hazard risk. Existing structures identified as having “significant hazard potential” were not included.

Hydroelectric development necessitates balancing priorities. While the benefits of generating electricity from local renewable resources are evident, they are not without associated costs. The power output from a given stream must be moderated by environmental considerations. A minimum stream flow, adequate to support aquatic life forms, needs to be maintained and impoundments need to be designed with water quality, land use, and recreation considerations in mind.

BIOMASS

Biomass generally consists of woody and non-woody solid biomass, and is most commonly used in heating, although it can be used to produce electricity and transportation fuel as well. An estimated 37% of Vermont households heat at least in part with firewood

Biomass Defined

Biomass, in its simplest form, is defined as organic matter renewable over time. Woody biomass is the accumulated mass, above and below ground, of the roots, wood, bark, needles, and leaves of living and dead woody shrubs and trees.

Biomass also includes manure and herbaceous crops such as switchgrass, miscanthus and reed canarygrass.



Anerobic Digester, Vermont Technical College

TRORC Region is home to only one biomass related electricity generator, the Vermont Technical College Community Anaerobic Digester. Using manure and food wastes, the facility harnesses biogasses through anaerobic digestion to fuel a generator that generates power. The system has a capacity of 375 kW of electrical generation, excess heat is used to supplement the college's heating system. In addition to VTC's digester, six other facilities use large-scale biomass for heating. In addition to heating their own

40 Department of Public Service, *Comprehensive Energy Plan*, 2016

Town	Name	Primary Use of Facility
Randolph	Vermont Tech Community Anaerobic Digester	Anaerobic Digester
Newbury	Blue Mountain Union School	Heat
Hartford	Hartford High School	Heat
Randolph	Randolph Union High School	Heat
Topsham	Limlaw Chipping	Heat
Vershire	Mountain School of Milton Academy	Heat
Hartford	White River Junction VA Medical Center	Heat
Sharon	Sharon Elementary	Heat

Table 3: Biomass Facilities in the TRORC Region, 2015

facilities, Limlaw Chipping in Topsham, produces wood chips used for heating of several significant entities including the National Life building, where a number of state offices are located, and Norwich University.

Vermont, with 78% of the state forested, has the potential to increase the use of this renewable resource, and consequently reduce its dependency on fossil fuels and mitigate climate change⁴¹. In the TRORC Region, there are 685,000 acres of forestland (84% of our region), roughly 91,153 Green Tons⁴² of which could be considered Net Available Low-grade Growth (NALG) wood—wood that would be appropriate for use as biomass fuel above and beyond current levels of harvesting. Other types of biomass, such as perennial grasses are now being used nationally as a solid fuel in some power plants as well as targeted as a choice feedstock for such advanced biofuels as cellulosic ethanol. Grass-based biomass can also be pressed into pellets, briquettes, and cubes and used as a heating fuel to replace or complement fuels made from wood fibers. Including a thermal component in the use of solid biomass for energy increases a combustion system's efficiency more than threefold.⁴³ However,

in Vermont, woody biomass remains the most immediately viable and largest potential source of biomass.

There are no specific targets for

41 Vermont Law School: Institute for Energy and the Environment, *Woody Biomass: The Path Toward a Sustainable Use of Vermont's Forests*, 2015

42 Biomass Energy Resource Center, *Vermont Wood Fuel Supply Study (2010 Update)*, 2010

43 Biomass Energy Resource Center, *Grass Energy Basics*, 2017

additional biomass production in the pathway developed with the LEAP model. This is in part due to a need to further investigate how biomass production for energy and heating would interact with Vermont's strong policy of forest protection. It is also because investigations into the sustainable production of grass-based biomass are in their early phases. Initial studies indicate that it is possible for Vermont to produce grass-based biomass for energy generation only at a small scale in part due to the lack of available farmland.

Commercial biomass energy generation facilities should be located close to available biofuels to reduce transportation impacts and costs. A biomass power plant would require a great deal of space to accommodate the various stages of collection and conversion of the mass into fuel before burning it to produce electricity. Water can also pose a problem as biomass facilities require large quantities to handle the recycling process of waste materials. Materials would have to be transported to and from the facility, so truck traffic should be a consideration in selecting a site. Additionally, before a biomass energy generation facility is located in the TRORC region, developers should prove that their proposed project will not negatively impact the rural character of the community or the local road system.

Despite the lack of specific targets for the development of biomass, this Plan (and the LEAP model) recognizes that utilization of woody biomass, particularly for heating, will need to be a significant part of the pathway to achieving the state's energy goals.

CERTIFICATE OF PUBLIC GOOD (CPG)

Any new renewable energy generation facility that is connected to the grid, must apply for a certificate of public good. As part of this process, the Public Service Board must find that:

- The Project must not unduly interfere with the orderly development of the region, with due consideration having been given to the recommendations of the municipal and regional planning commissions, the recommendations of the municipal legislative bodies, and the land conservation measures contained in the plan of any affected municipality.
- The Project must meet a need for present and future demand for services. The Project will not have an adverse impact on system stability and reliability.
- The Project will not have an undue adverse impact on aesthetics, historic sites, air and water purity, the natural environment, the use of natural resources, and public health and safety, with due consideration having been given to the criteria specified in 10 V.S.A. §§14724a(d) and 6086(a)(1) through (8) and (9) (K) and greenhouse impacts.

State agencies, municipalities and the regional planning commissions are considered parties by right, in a Section 248 proceeding. Although the CPG process includes elements of review that are similar to Act 250, it is a very different process. Any facility that applies for a

CPG is exempt from consideration under a municipality's zoning regulations. With the ratification of Act 174 in 2016, Regional Commissions and communities that are granted a determination of energy compliance for enhanced energy planning will have their approved municipal plans receive greater weight under Section 248.

CHALLENGES

BIOMASS

Proper forest management is essential to sustainable woody biomass production. Much of the land enrolled in the Current Use Value Appraisal(UVA) program in the TRORC Region is forested, and as such a forest management plan is required. Most forest management plans are designed to encourage the growth of higher quality wood which will yield a higher harvested value for the landowner. As a result, the bulk of what loggers harvest out of these areas is lower quality wood. 75- 80% of the volume of harvested wood by loggers is typically low grade fiber (pulp, firewood or whole tree chips).

While in many instances, the thicker "boll wood" (stem of the tree, not suitable specification for sawing into boards, with no brush), can be chipped and used for boiler fuel; the tops and branches of the trees are utilized primarily in electricity generation plants such as the power stations in Ryegate and Burlington. The challenge is that these two facilities, the only biomass electricity generation plants in Vermont, cannot utilize all of the low-quality product harvested out of our forests.

Attempts to develop new biomass energy generation facilities have taken place in the TRORC region, the most recent of which

was considered in Randolph. However, due to significant local resistance to these facilities none have been built. The efficiency of large-scale biomass electricity generation facilities remains a barrier as well. A highly efficient gasification biomass system emits roughly 60% of its potential as thermal energy, generating only 40% as electricity. Siting these projects in areas that can receive truck traffic without interfering with residential neighborhoods but also in proximity to large consumers of thermal energy is ideal.

SOLAR SITING

Significant growth in the solar energy production sector in Vermont has sometimes led to a backlash against proposed facilities. The primary concern is one of aesthetics. For some, it is challenging to reconcile the appearance of a solar farm against the traditional rural character of the region. Residents may also perceive a loss of property value when a solar facility locates near their home, although there is no hard data available to support this perception.

Also of concern are the natural resource implications of solar farms. Often these facilities are proposed in areas that are being used for agricultural purposes on valuable prime agricultural soils. While it is possible to conduct some forms of farming on land occupied by a solar system (such as small ruminant grazing – see Appendix D), most agricultural uses become impractical. For those farmers that lease land for feed production, the removal of actively used farmland from the pool of available land has the potential to negatively impact their operation.

WIND SITING

Wind energy generation, although not as prolific as solar, also has opposition due to aesthetic and noise impacts. Because these facilities locate on ridgelines in order to maximize production, they are visible from a much greater distance than solar. Additionally, residents who neighbor a wind facility may experience negative effects from the noise and flicker of the spinning turbines.⁴⁴

Large scale wind energy facilities can have environmental impacts as well. Much of the land on our ridges is undeveloped, making it prime wildlife habitat. The installation of wind energy generation facilities and the infrastructure needed to maintain them (roads), leads to the fragmentation of continuous blocks of forestland, which can disrupt migration patterns for wildlife.

HYDRO SITING

As discussed earlier in this section, LEAP modeling suggests that additional hydro capacity can be achieved by retrofitting existing dams. However, out of the total facilities with the potential to generate hydropower, 22 have been identified as having a “significant hazard potential.”

The development of new hydroelectric projects is challenging. New hydro projects must seek permitting from the Federal government, which can be time consuming and intensive. Any development in our waterways requires a strict analysis of potential environmental impacts.

⁴⁴ Jeffery, Roy MD FCFP , Carmen Krogh, Brett Horner, *Adverse health effects of Industrial Wind Turbines*, Canadian Family Physician, 2013

CPG PROCESS IS COMPLICATED

For many communities, the process of intervening in a CPG can be expensive, difficult and time consuming.⁴⁵ The highly technical and legal nature of the CPG process can make it challenging for municipal officials to understand how to actively and effectively participate in the process. In the case of smaller solar energy generation facilities (<15kW) which are subject to an expedited CPG process, municipalities have no voice at all.

UNCLEAR REGULATORY GUIDANCE

Some communities that have attempted to address renewable energy siting in their Municipal Plans have found the PSB’s decision making process unclear, due to the challenge of understanding what “due consideration” is. In cases such as PSB Docket #3188 (Cold River), the PSB stated that “the Rutland Town Plan does not contain any written standard to preserve the scenic beauty of the proposed project site.” The decision discounted Rutland’s solar siting setback standards as “too specific” and bordering on zoning, which is not considered as part of the CPG process. While it is fair to say that Rutland’s approach may have not been well executed and ultimately had additional flaws that contributed to the PSB’s decision, the lack of clear guidance as to how communities can plan for renewable energy generation is a significant issue for our communities.

In Docket#8302 (Apple Hill), the PSB rejected a petition for a certificate of public good in Bennington, VT. The primary reason for the denial was based on the PSB’s determination that the proposed solar facility “violated a clear, written

⁴⁵ Solar Siting Task Force Report, 2015

community standard” in the Bennington Town Plan as is defined under the Quechee Test.⁴⁶ The PSB explained that in order to be considered a clear, written community standard, it must be “intended to preserve the aesthetics or scenic beauty of the area” where the proposed project would be located and must apply to specific resources in the proposed project area. A clear written community standard must be more than simply “general in nature” and do more than seek “to promote good stewardship of scenic resources without identifying specific actionable standards.” While some have seen this as a step in the right direction in terms of clarifying how the PSB makes decisions, some planners remain somewhat surprised that the language in the Bennington plan was deemed to meet the “clear written standard” test.

Solutions

SUPPORT SUSTAINABLE BIOMASS GENERATION

With the closing of pulpwood and biomass consuming facilities in Maine, (a loss of nearly 30-40 % of the market for low grade timber in the northeast), the local market for low-grade wood has been significantly impacted. This will affect proper forest management due to the reduced economic viability of harvesting low grade timber to attain Use Value Appraisal (UVA) management plan objectives. By supporting and encouraging the development of sustainable biomass systems in the region, TRORC can add

⁴⁶ Act 250’s Criterion 8 addresses aesthetic impact within the parameters of the so-called Quechee Analysis, which was established to provide a consistent and defensible method for evaluating the aesthetic impacts of projects undergoing Act 250 review.

another component of energy production in the Region and support the sustainable forestry economy. Any new facilities should be located in areas where the significant waste heat from electricity production can be utilized through district heating and cooling (through heat pumps) or industrial applications.

IMPROVE REGIONAL AND MUNICIPAL ENERGY PLANNING FOR RENEWABLE ENERGY

As long as the goals of the CEP remain a part of state policy and if Regional Planning Commissions and municipalities wish to play a part in achieving those goals, TRORC and municipalities should take an active role in energy planning. By utilizing available energy data produced by the Regional Commission and other organizations, municipalities can identify where renewable energy generation facilities are preferred, and at what scale is most appropriate for reaching the goals of the CEP. In addition, Towns can provide specific standards that will help protect significant natural or scenic areas in accordance with the vision of the community.

CONTINUE TO SUPPORT LEGISLATIVE CHANGES THAT REWARD GOOD PLANNING

In the 2015 Solar Siting Task Force report, the Task Force indicated that it “seeks to strengthen the contribution that town and regional planning will make to the siting of solar generation contemplated in the state’s Comprehensive Energy Plan. Accomplishing this requires both effective regional and local planning for solar generation and the effective consideration of the guidance such planning offers in the Section 248 regulatory process...”

Recognizing that this goal should apply to all forms of renewable energy, Act 174 gives communities who take the time to consider their role in reaching the goals of the CEP more significant consideration under the Section 248 process. Good energy planning should continue to be recognized as requiring some level of GIS energy data analysis, the identification of areas where renewable energy generation is appropriate and the inclusion of language which provides clear, written standards for review under Section 248.



Vermont State House Montpelier, VT- Photo Credit: Wangkun Jia

RENEWABLE ENERGY GENERATION GOALS, STRATEGIES AND ACTIONS

Goal A: Meet 25% of remaining energy need from renewables by 2025, 40% by 2035 and 90% by 2050. Meet end use sector goal of 67% renewable electric by 2025.

Strategy A.1: Support the continued development of renewable energy generation that counts toward the goals of the CEP

Action:

1. Encourage communities and residents to identify areas with the potential for renewable energy generation.
2. Provide education and outreach to municipalities on energy generation.
3. Develop easy to understand materials about the state's energy goals and how they interact with local and regional planning.

Goal B: Increase the amount of renewable energy generated in the TRORC region to 163 MW by 2050

Strategy B.1:

Action:

1. Develop a Renewable Energy Siting guide and maps and work with communities to identify areas where renewable energy generation is appropriate and preferred.
2. Identify areas where biomass energy generation facilities might be appropriate, and support efforts to develop new facilities.
3. Support and encourage state efforts to provide stable and predictable renewable energy policy incentives including net metering and standard offer.
4. Advocate for a stronger regional role in the PSB permitting process.
5. Continue to support efforts at the legislative level to strengthen the capacity of regional planning commissions and municipalities to plan for renewable energy generation and provide that information to the PSB and DPS in a manner that will be meaningful in the §248 CPG process.
6. Identify areas where biomass energy generation facilities might be appropriate, and support efforts to develop new facilities.

SITING OF RENEWABLE ENERGY GENERATION FACILITIES IN THE TRORC REGION

6

REGIONAL IMPACTS OF ENERGY GENERATION

Regional electrical generation has positive potential to our communities, through the generation of jobs as well as adding to the tax base. While larger-scale facilities will generate more energy, and would have a more substantial impact on the economy, they would likewise have more potential negative impacts.

For the Two Rivers-Ottawaquechee Region, a more sustainable approach to electrical generation is preferred and is likewise consistent with Vermont's Comprehensive Energy Plan. Facilities like combined-cycle combustion turbines that are used for district electrification and heating are more appropriate than other fossil fuel-driven facilities. These systems could offset otherwise needed transmission infrastructure upgrades, reduce reliance on fossil fuels for heating, and provide moderately priced energy to parts of Vermont.

While there are potential opportunities for gas-powered generation facilities, TRORC believes that in order to reduce our reliance on fossil fuels (a primary goal of the CEP), we must focus on energy generation that is sustainable. It is the preference of this

Plan that new energy generation facilities that are proposed within the Two Rivers-Ottawaquechee Region be renewable. We believe that there are opportunities for generation through wind, solar, hydro and biomass, each of which has its own unique impact and potential.

The development of new renewable energy generation facilities in the TRORC is a necessary component of reaching the state's energy targets. However, in order to protect our natural, scenic and historic resources while encouraging renewable energy development, a regional inventory of areas that are suitable or unsuitable for renewable energy generation has been developed.

PREFERRED AREAS

While the development of any type of renewable energy generation facility is subject to review on a site by site basis, some areas are better suited than others. Act 174 specifically identifies preferred areas, a majority of these are included as part of the Regionally identified preferred areas as well. They are:

- A parking lot canopy over a paved parking lot, provided that the location remains in use as a parking lot and is not located in



Concept Design of Parking Lot Solar Canopy- Photo Credit: SunCommon

an area identified as unsuitable by this Plan or the Municipal Plan of the municipality in which the development is proposed.

- A new or existing structure that is not located in an area identified as unsuitable by this Plan or the Municipal Plan of the municipality in which the development is proposed.
- Land certified by the Secretary of Natural Resources to be a brownfield site as defined under 10 V.S.A. § 6642, provided that the location is not in an area identified as unsuitable by this Plan or the Municipal Plan of the municipality in which the development is proposed.
- A sanitary landfill as defined in 10 V.S.A. § 6602, provided that the Secretary of Natural Resources certifies that the land constitutes such a landfill and is suitable for the development of the plant.
- The disturbed portion of a gravel pit, quarry, or similar site for the extraction of a mineral resource, provided that all activities pertaining to site reclamation required by applicable law or permit condition are satisfied prior to the installation of the plant.
- A specific location designated in a duly adopted municipal plan under 24 V.S.A. chapter 117 for the siting of a renewable energy plant or specific type or size of renewable energy plant, provided that the plant meets any siting criteria recommended in the plan for the location, provided

that it is not located in an area identified as unsuitable by this Plan.

- A site listed on the National Priorities List (NPL) that has received confirmation from the U.S. Environmental Protection Agency or the Vermont Agency of Natural Resources (ANR), and is not located in an area identified as unsuitable by this Plan or the Municipal Plan of the municipality in which the development is proposed.
- A new hydroelectric generation facility at a dam in existence as of January 1, 2016, or a hydroelectric generation facility that was in existence but not in service for a period of at least 10 years prior to January 1, 2016 and that will be redeveloped for electric generation, if the facility has received approval or a grant of exemption from the U.S. Federal Energy Regulatory Commission.

Recognizing that there may be other areas that are also well-suited to the development of renewable energy generation, the following criteria should be applied to proposals that are not in areas indicated above. If a proposed development is not on the list above, but meets ALL of the criteria below, it shall be considered a preferred area for the purposes of this Plan.

CRITERIA FOR IDENTIFICATION OF ADDITIONAL REGIONALLY PREFERRED AREAS

- Must not be identified as an Unsuitable Area
- Must not be identified as a Significant Area
- Must be located in an area that has reliable and safe access to the grid (as determined by the local power provider)
- Must not require significant improvements to existing transmission infrastructure

UNSUITABLE (PROHIBITED LOCATIONS)

The Regional Plan identifies some areas as unsuitable for most forms of development due to their natural or scenic value, and to protect our citizens from potential natural disasters. As such, the following locations shall be considered unsuitable for renewable energy generation facilities:

- Floodways shown on FEMA Flood Insurance Rate Maps (except as required for hydro facilities),
- River Corridor Areas as identified by the Vermont Department of Environmental Conservation,
- Class 1 and Class 2 Wetlands as indicated on Vermont State Wetlands Inventory maps or identified through site analysis,
- Vernal Pools (as Identified by ANR or through site analysis),
- State-significant Natural Communities and Rare, Threatened, and Endangered Species,

- Wilderness Areas, including National Wilderness Areas,

- Unsuitable Areas as identified in a duly adopted Municipal Plan that has received a determination of energy compliance from the Department of Public Service or the Regional Planning Commission,

- Within Regional Growth Areas as identified in the TRORC Regional Plan, ground mounted commercial or group-net metered solar facilities are unsuitable unless specifically identified as a preferred area in a duly adopted Municipal Plan that has received a Determination of Energy Compliance,

- Within Resource and Conservation Areas, ground mounted commercial or group-net metered solar facilities that require substantial clearing of vegetation are unsuitable.

SIGNIFICANT AREAS

There are many areas that have the potential for renewable energy generation, but include possible constraints that may make these locations less desirable on a site-by-site basis. In those areas where renewable energy generation potential exists that are neither preferred nor unsuitable, all new generation, transmission, and distribution facilities shall be sited and designed to avoid or, to otherwise minimize and mitigate adverse impacts to the following:

- Historic districts, landmarks, sites and structures listed, or eligible for listing, on state or national historic registers,
- Public parks and recreation areas, including state and municipal parks, forests and trail networks,

- State or federally designated scenic byways, and municipally designated scenic roads and viewsheds,
- Special flood hazard areas identified by National Flood Insurance Program maps (except as required for hydro facilities),
- Public and private drinking water supplies, including mapped source protection areas,
- Primary agricultural soils mapped by the U.S. Natural Resources Conservation Service,
- Agricultural Soils (VT Agriculturally Important Soil Units),
- FEMA Special Flood Hazard Areas.
- Protected Lands (Updated 07/26/2016 – State Fee Lands and Private Conservation Lands)
- Act 250 Agricultural Soil Mitigation areas (as Identified by ANR)
- Deer Wintering Areas (as Identified by ANR)
- ANR's Vermont Conservation Design Highest Priority Forest Block Datasets
- Forest Blocks – Connectivity, Interior and Physical Land Division (as Identified by ANR)
- Hydric Soils (as Identified by ANR)

COMMERCIAL- SCALE RENEWABLE ENERGY FACILITY SITING GUIDE

7

BACKGROUND

The growth of the renewable energy generation industry in Vermont over the last five years has been remarkable. As a measure of current growth of commercial solar development in Vermont for example, it took Green Mountain Power (GMP) from 2008-2014 to hit a net metering cap of 4% of peak load, and less than two years to reach the increased cap of 15%.⁴⁷ The proliferation of commercial wind energy generation in Vermont has been decidedly slower, primarily due to the costs of development and the complicated permitting requirements. Hydro development has dropped off significantly since the early 1990s, due to a number of factors including the loss of economic incentives and stricter permitting requirements.”⁴⁸

The State of Vermont has spent a number of years analyzing the issues relating to energy siting. In 2012, Governor Shumlin formed the Energy Generation Siting Policy Commission. The Siting Commission was tasked with developing recommendations and guidance on best practices for the siting approval of large-scale renewable energy generation projects (those projects that exceed the net metering threshold at the time), and for public representation in the siting process. Ultimately, one of the key components of the Siting Commission’s final report was an “increased emphasis on planning.”⁴⁹

In 2015, in response to the rapid growth of solar development, the legislature created

the Solar Siting Task Force. In their report to the legislature in 2016, the Solar Siting Task Force echoed the recommendations of the Siting Commission, acknowledging that “effective planning has the potential to shape the municipal, regional and state energy future.”⁵⁰

This guide is intended to provide communities with the background, data and suggested approaches needed to effectively address the impacts of renewable energy generation facilities while working toward the goals of the Vermont Comprehensive Energy Plan.

BARRIERS TO GOOD PLANNING

Reports from the Siting Commission and the Solar Siting Task Force indicate that energy planning needs to be improved at the regional and municipal level.

- **Unclear Guidance** – As discussed in Section 5, some communities that have attempted to address renewable energy siting in their Municipal Plans have found the PSB’s decision making process confusing, due to the challenge of defining “due consideration”.
- **Planning is Not Mandatory** – Land use planning is optional for municipalities unless a community wants to adopt zoning or subdivision regulations.⁵¹ Even for those communities that do have a Plan, it is not required that the Plan be consistent with the state’s planning goals (Section 4302). While communities that have a Plan must address energy, and must have

⁴⁷ Department of Public Service, *Comprehensive Energy Plan*, 2016

⁴⁸ Ibid

⁴⁹ Energy Generation Siting Policy Commission, *Siting Electric Generation in Vermont: Analysis and Recommendations*, April 2013

⁵⁰ Solar Siting Task Force, Solar Siting Task Force Report, January 22, 2016.

⁵¹ V.S.A. Title 24, §4381 -

policies that support renewable energy generation, there is no requirement that there be an in depth analysis of potential locations for new facilities.

- **Difficulty Reconciling Renewable Energy Generation with Aesthetic and Natural Resource Impacts** – Many communities have grown resistant to the development of commercial-scale renewable energy generation facilities because they feel that these facilities break with the distinct rural character of their communities or negatively impact natural resources. While renewable energy is by and large supported by Vermonters,⁵² the “not in my back yard” phenomenon is not uncommon when a facility is proposed.

IMPORTANT CONSIDERATIONS

Before a community begins to plan for renewable energy generation facilities, it is essential to recognize several things:

- **Consider “Enhanced Energy Planning”⁵³** – Act 174 establishes rules that provide communities with the opportunity to have their plans receive greater consideration (referred to as “substantial deference”) under Section 248. Through the standards set by the Department of Public Service, the Regional Commission is authorized to review municipal plans (when requested) to determine if the

⁵² Vermont Public Radio, VPR Poll, 2016 – 70% indicated support for a “large solar array” in their community. 56% indicated support for large wind power turbines in their community.

⁵³ NOTE: This language reflects standards that will be released in November of 2016.

state’s “Enhanced Energy Planning” standards are met.

- **Completely prohibiting renewable energy generation facilities from your community, is unlikely to be considered “in the public good.”** –The primary purpose of the Section 248 process is to determine whether a proposed renewable energy generation facility successfully meets the criteria required to determine that it is “in the public good.” Over the past several years, statute has been revised to give communities a more significant voice in this process. But, in the case of a Municipal Plan that attempts to outright prohibit (or has the effect of prohibiting) renewable energy generation completely, will be seen by the Public Service Board running counter to the “public good” concept.
- **Plans need firm language, and clear, written standards** – General plan language that speaks of protecting viewsheds or scenic areas is not useful to the PSB. Communities must use strict language like “shall” and “must” to make it clear that a provision is mandatory. There must also be clear standards that apply to all development within a specific area. Protected areas must be clearly identified – you cannot say “all roads are scenic,” but instead must say something like “The North Road is considered a scenic resource due to its open view of the eastern slope of the Green Mountains.” Specificity with regard to what you are

protecting, why you are protecting it and where it is, is essential. For example:

- o **Bad Example:** “Multi-family housing is discouraged in Rural Areas.” Not specific enough.

- o **Good Example:** “The location of multi-family housing in Rural Areas is not compatible with this Plan.” This is a clear standard.

- **Define your Land Use Areas Clearly** - In addition to judicious use of “shall” and “must,” communities must carefully define land use areas in the Plan. This means having a clear purpose statement, a clearly defined area that is tied into the purpose statement (usually addressed in the map, with related narrative) and standards under which land should be developed to achieve the purpose.
- **Identify Where Renewable Energy Generation is Preferred** - Indicating good locations for renewable energy generation that are clearly supported by the policies of the Plan is important. Such an approach would clearly be consistent with legislative intent to encourage renewable energy generation. By identifying where the preferred locations are or developing standards for what constitutes a preferred site and why they are preferred, towns are providing clear guidance to developers and the Public Service Board. Direct public support for preferred locations as outlined in the municipal plan, will be appealing to developers.

- **Communicate with Developers**
 - Most renewable energy generation developers are interested in working with communities to ensure that their development is well-received.

HOW TO EFFECTIVELY PLAN FOR RENEWABLE ENERGY GENERATION FACILITIES

CONSIDER CEP GENERATION TARGETS

The process should begin with an understanding of how your community can work toward the goals of the CEP. Through modeling and data analysis, TRORC has developed renewable energy capacity targets that can be used to reach the goals of the CEP (Appendix C). Communities should review this information as a starting point to determine how much renewable energy generation should occur in their community to achieve the 90/50 goal.

It is important to understand that these targets are not exact. The LEAP model is based primarily on demand. If population is incorporated into the consideration, the targets will increase. The recommended approach is to utilize a target range for your community.

UTILIZE AVAILABLE MAP DATA

TRORC has generated map data that indicates where energy generation potential exists for solar, wind and hydro.⁵⁴ This data should be the starting point for the identification of where renewable

⁵⁴ A map of biomass land cover is included as well, but it is not a representation of potential beyond identifying what could be harvested for biomass energy production.

energy generation should be located within your community.

Map Constraints (Level 1 & 2)

This data has been designed to exclude certain areas based on specific constraints (referred to as Level 1 constraints). Level one constraints include floodways and river corridors, federal wilderness area, rare and irreplaceable natural areas, vernal pools and class one and two wetlands. Any area with potential for energy generation that has a level one constraint, has been removed from the map layer.

Other areas that have generation potential, but require consideration in relation to their natural resources, are identified as Level 2 constraints. These areas include agricultural and hydric soils, conserved lands, special flood hazard areas, deer wintering areas and class 3 wetlands.

Areas with level two constraints appear on the maps, but are not identified as “Prime” areas (for the purposes of this project, “prime” is used to describe an area of renewable energy generation potential that is unencumbered by either Level 1 or Level 2 constraints).

Communities should review the Level 1 and 2 constraints (see sidebar). If there are other constraints that your community feels should be included, or should be reclassified (for example, some communities may not view deeryards as a Level 2 constraint), TRORC may be able to assist with map revisions provided there is adequate funding available for the service.⁵⁵

IDENTIFY PREFERRED LOCATIONS

The maps included as part of this guide were developed at the regional scale. As such, they do not include preferred locations. Communities should use their local knowledge to identify preferred areas first. They can include preferred locations as legislated in Act 174:

- New or existing structures
- Parking lot canopies
- Previously developed tracts
- Brownfields⁵⁶
- Sanitary landfills⁵⁷
- Existing dams
- Disturbed portions of

⁵⁵ If funding through TRORC is unavailable, a Municipal Planning Grant could be used to fund this process.

⁵⁶ As certified by the Secretary of Natural Resources as defined under 10 V.S.A. §6602

⁵⁷ As certified by the Secretary of Natural Resources as defined under 10 V.S.A. §6602

gravel pits⁵⁸ or quarries

- Sites listed on the National Priorities List (NPL)

Other considerations when identifying preferred areas within your community include existing infrastructure. For example, an area with immediate access to three-phase power or an upland area with existing road access may be more desirable than an area without.

IDENTIFY SIGNIFICANT NATURAL, CULTURAL, HISTORIC OR SCENIC RESOURCES

Municipal plans are required to include “a statement of policies on the preservation of scenic and historic features and resources.” If your Plan does not include an adequate inventory of these locations, it will be important to identify them in the context of areas with the potential for renewable energy generation. Such an inventory should include:

- Historic sites, structures, districts, cultural landscapes
- Archaeological resources
- Scenic viewsheds, ridgelines, specific road corridors; designated scenic byways
- Places that have special meaning to the community
- Areas with significant natural resources

It will be very important to identify exact locations as part of this plan. In past decisions of the PSB relating to renewable energy generation facilities, it has been made clear that generalizations will not carry weight with the Board. Protected

⁵⁸ Provided that all activities pertaining to site reclamation required by law or by permit are satisfied before installation.

areas must be clearly identified – a Plan cannot say “all roads are scenic,” but instead must say something like “The North Road is considered a scenic resource due to its open view of the eastern slope of the Green Mountains.” Specificity with regard to what are you are protecting is essential.

Additionally, it will be important to describe why these areas are significant, whether because of the presence of a known endangered species, or because the bulk of the community uses an area for outdoor recreation. Documentation of the resource’s importance is necessary to developing a good energy plan.

INVOLVE THE PUBLIC

All good planning processes require public input beyond the public hearings required by statute for Municipal Plans. Engaging the public in discussions about potential changes to the Town Plan early and often is strongly suggested as part of this guide. Communities should consider:

- **Outreach:** Place regular articles in the town newsletter or local paper of record to give updates on what issues or potential changes to the Plan are being discussed.
- **Collect Public Input:** The best plans utilize multiple methods to collect public input. Methods include (but are not limited to):
 - o Written or Online surveys
 - o Live surveys
 - o Public forums
 - o Coffee table discussion groups
 - o Targeted presentations
- **Present Proposals:** As you work through the process, be sure to

keep the public involved. Multiple presentations at varying intervals will keep people informed and allow you to receive valuable input. This may allow you to better refine your energy plan into something that adequately reflects the community’s vision while still working toward the goals of the CEP.

FIND A BALANCE

The state’s energy goals are written into statute, and it is a requirement of statute that municipalities include policies on renewable energy generation (as well as energy conservation). Ideally, communities will see the positive benefits of working towards the state’s energy goals, but it is important to strike a balance between those goals and a community’s vision for the future.

BRING IT TOGETHER

Using map data and guidance from the public, your community can write an energy plan that specifically addresses issues relating to renewable energy generation. It can reflect the vision of your community and provide adequate opportunity for growth of renewable energy generation that will reach the regional and state targets.

Important things to consider when soliciting input

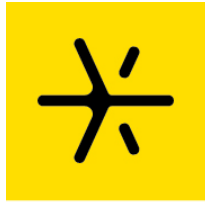
Surveys – Written surveys must be crafted so that they are easily understood. Additionally, the method of distribution must be carefully considered so as to have a maximum rate of return.

Online Surveys – Not all residents have access to or are comfortable using the internet. Online surveys should never be the primary method of data collection.

Public Forums – Need to be well organized and well run. Including food as part of the program (particularly for an evening forum) can help increase attendance.

Localized or “Coffee Table” discussion groups – Bringing the conversation to a specific part of your community, particularly one that has a particularized interest in proposed changes can be beneficial.

Targeted presentations – There are many community groups that can provide an excellent audience and valuable input into your process. This could include church groups, local business organizations, etc.



**Vermont
Energy Investment
Corporation**

Two Rivers-Ottawaquechee Regional Energy Modeling

A Pathway to Reaching Vermont's
Energy Goals

*Appendix A: Outputs and Methodology
February 2017*

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A. Introduction

This document supplements the regional energy plans created by each Regional Planning Commission (RPC). It was developed by Vermont Energy Investment Corporation (VEIC) as documentation to modeling work performed for the RPCs. An award from the Department of Energy's SunShot Solar Market Pathways program funded the creation of a detailed statewide total energy supply and demand model. The VEIC team used the statewide energy model as a foundation for the region-specific modeling efforts. More detailed methodology is included at the end of this report.

B. Statewide Approach

Historic information was primarily drawn from the Public Service Department's Utility Facts 2013¹ and EIA data. Projections came from the Total Energy Study (TES)², the utilities' Committed Supply³, and stakeholder input.

Demand Drivers

Each sector has a unit that is used to measure activity in the sector. That unit is the "demand driver" because in the model it is multiplied by the energy intensity of the activity to calculate energy demand.

The population change for each region is calculated from town data in *Vermont Population Projections 2010-2030*.⁴ Growth rates are assumed constant through 2050.

RPC	Annual Growth
Addison	0.00%
Bennington	0.02%
Central VT	0.12%
Chittenden	0.48%
Lamoille	1.46%
Northwest	0.87%
NVDA	0.21%
Rutland	-0.27%
Southern Windsor	0.24%
Two Rivers	0.29%
Windham	0.34%

People per house are assumed to decrease from 2.4 in 2010 to 2.17 in 2050. This gives the number of households, the basic unit and demand driver in the model for residential energy consumption.

¹ Vermont Public Service Department, *Utility Facts 2013*, http://publicservice.vermont.gov/sites/dps/files/documents/Pubs_Plans_Reports/Utility_Facts/Utility%20Facts%202013.pdf

² Vermont Public Service Department, *Total Energy Study: Final Report on a Total Energy Approach to Meeting the State's Greenhouse Gas and Renewable Energy Goals*. December 8, 2014. http://publicservice.vermont.gov/sites/psd/files/Pubs_Plans_Reports/TES/TES%20FINAL%20Report%2020141208.pdf.

³ Vermont Public Service Department provided the data behind the graph on the bottom half of page E.7 in *Utility Facts 2013*. It is compiled from utility Integrated Resource Plans

⁴ Jones, Ken, and Lilly Schwarz, *Vermont Population Projections-2010-2030*, August, 2013. <http://dail.vermont.gov/dail-publications/publications-general-reports/vt-population-projections-2010-2030>.

Projected change in the **energy demand from the commercial sector** was based on commercial sector data in the TES. The demand driver for the commercial sector is commercial building square feet which grow almost 17% from 2010 to 2050.

The team entered total **industrial consumption** by fuel from the TES directly into the model. It grows from 1.1 TBtu in 2010 to 1.4 TBtu in 2050.

Transportation energy use is based on projections of vehicle miles traveled (VMT). VMT peaked in 2006 and has since declined slightly.⁵ Given this, and Vermont's efforts to concentrate development and to support alternatives to single occupant vehicles, VMT per capita is assumed to remain flat at 12,000.

The regional models use two scenarios. The **reference scenario** assumes a continuation of today's energy use patterns, but does not reflect the Vermont's renewable portfolio standard or renewable energy or greenhouse gas emissions goals. The main changes over time in the reference scenario are more fuel efficient cars because of CAFE standards and the expansion of natural gas infrastructure. The **90% x 2050_{VEIC} scenario** is designed to achieve the goal of meeting 90% of Vermont's total energy demand with renewable sources. It is adapted from the TES TREES Local scenarios. It is a hybrid of the high and low biofuel cost scenarios, with biodiesel or renewable diesel replacing petroleum diesel in heavy duty vehicles and electricity replacing gasoline in light duty vehicles. Despite a growing population and economy, energy use declines because of efficiency and electrification. Electrification of heating and transportation has a large effect on the total demand because the electric end uses are three to four times more efficient than the combustion versions they replace.

C. Regionalization Approach

The demand in the statewide model was broken into the state's planning regions. Residential demand was distributed according to housing units using data from the American Community Survey. Commercial and industrial demand was allocated to the regions by service-providing and goods-producing NAICS codes respectively. Fuel use in these sectors was allocated based on existing natural gas infrastructure. In the commercial sector, it was assumed that commercial fuel use per employee has the same average energy intensity across the state. All commercial natural gas use was allocated to the regions currently served by natural gas infrastructure, and the rest of the fuel was allocated to create equal consumption by employee.

The industrial sector was assumed to be more diverse in its energy consumption. In the industrial sector, natural gas was allocated among the regions currently served by natural gas based on the number of industrial employees in each region. Other non-electric fuels were

⁵ Jonathan Dowds et al., "Vermont Transportation Energy Profile," October 2015, <http://vtrans.vermont.gov/sites/aot/files/planning/documents/planning/Vermont%20Transportation%20Energy%20Profile%202015.pdf>.

distributed among regions without access to natural gas, as it was assumed that other non-electric fuels were primarily used for combustion purposes, and that purpose could likely be served more cheaply with gas. Transportation demand was primarily regionalized through population. The passenger rail sector of transportation demand was regionalized using Amtrak boarding and alighting data to create percentages of rail miles activity by region.⁶ The freight rail sector of transportation was regionalized using the following approach: in regions with freight rail infrastructure, activity level was regionalized by share of employees in goods-producing NAICS code sectors. Regions without freight rail infrastructure were determined using a Vermont Rail System map and then assigned an activity level of zero.⁷ A weighting factor was applied to regions with freight rail infrastructure to bring the total activity level back up to the calculated statewide total of freight rail short-ton miles in Vermont. Each region's share of state activity and energy use is held constant throughout the analysis period as a simplifying assumption.

D. Results

The numbers below show the results of the scenarios in “final units,” sometimes referred to as “site” energy. This is the energy households and businesses see on their bills and pay for. Energy analysis is sometimes done at the “source” level, which accounts for inefficiency in power plants and losses from transmission and distribution power lines. The model accounts for those losses when calculating supply, but all results provided here are on the demand side, so do not show them.

The graphs below show the more efficient 90% x 2050 _{VEIC} scenario, which is one path to reduce demand enough to make 90% renewable supply possible. This scenario makes use of wood energy, but there is more growth in electric heating and transportation to lower total energy demand. Where the graphs show “Avoided vs. Reference,” that is the portion of energy that we do not need to provide because of the efficiency in this scenario compared to the less efficient Reference scenario.

⁶ National Association of Railroad Passengers, “Fact Sheet: Amtrak in Vermont,” 2016, https://www.narprail.org/site/assets/files/1038/states_2015.pdf.

⁷ Streamlined Design, “Green Mountain Railroad Map” (Vermont Rail System, 2014), http://www.vermontrailway.com/maps/regional_map.html.

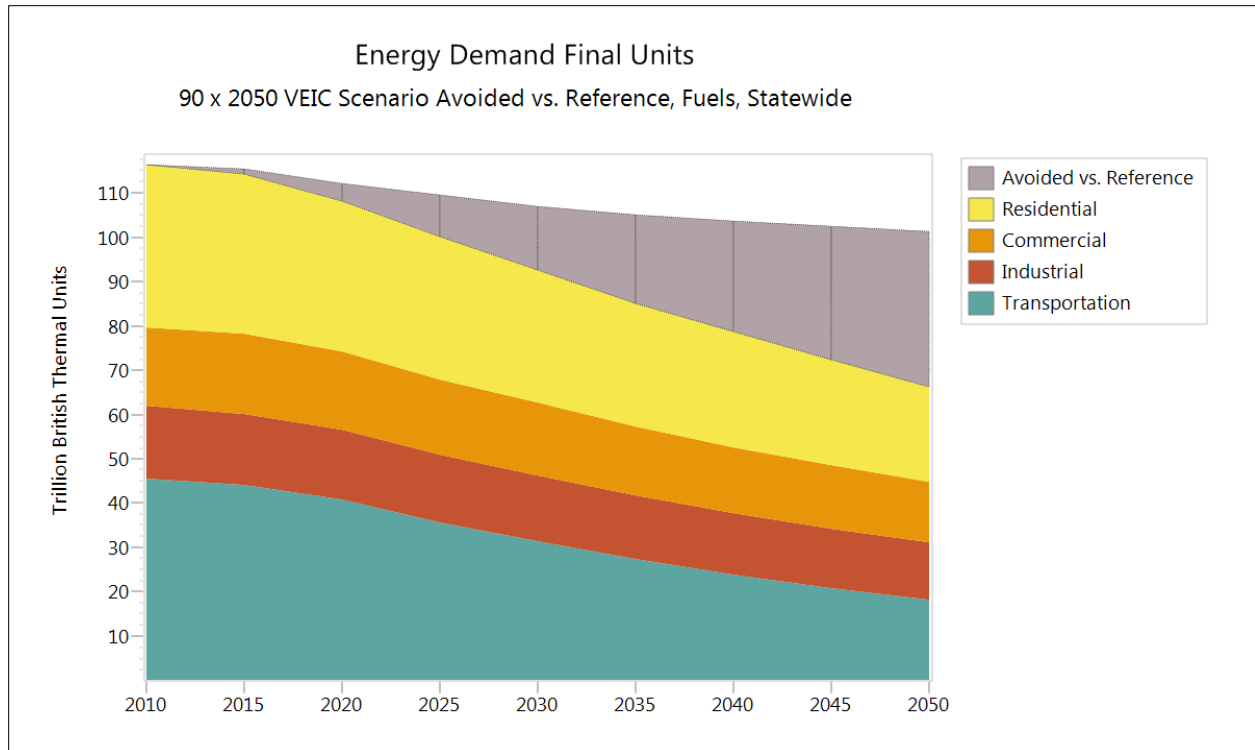


Figure 1 - Statewide energy consumption by sector, 90% x 2050 _{VEIC} scenario compared to the reference scenario

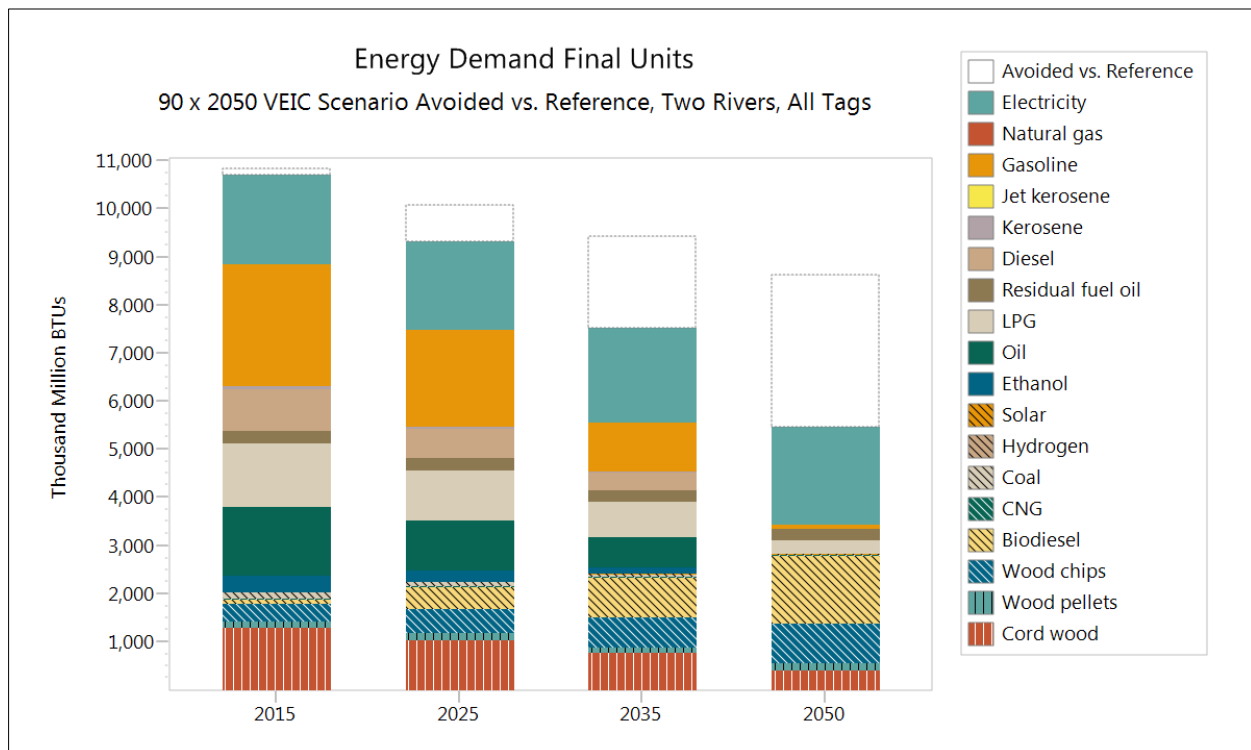


Figure 2: Regional energy consumption by fuel. 90% x 2050 _{VEIC} scenario compared to the reference scenario

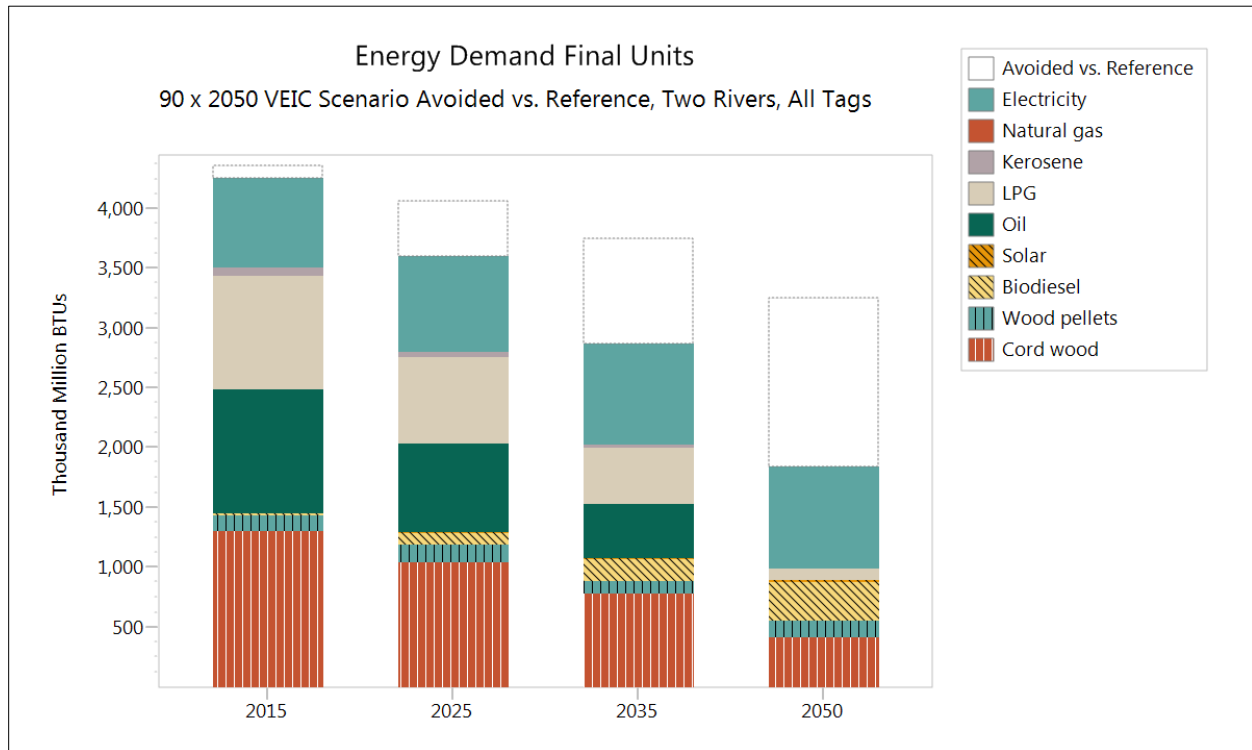


Figure 3: Regional residential energy consumption by fuel, 90% x 2050_{VEIC} scenario compared to the reference scenario

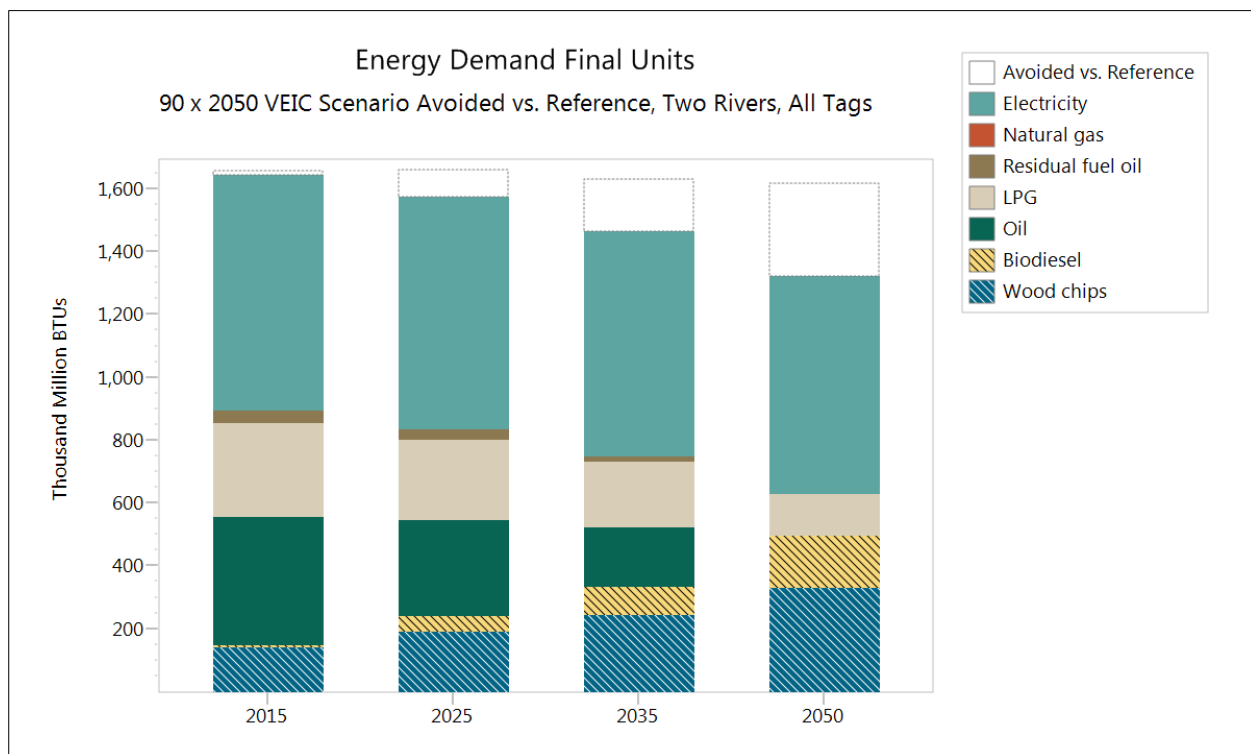


Figure 4: Regional commercial energy consumption by fuel, 90% x 2050_{VEIC} scenario compared to the reference scenario

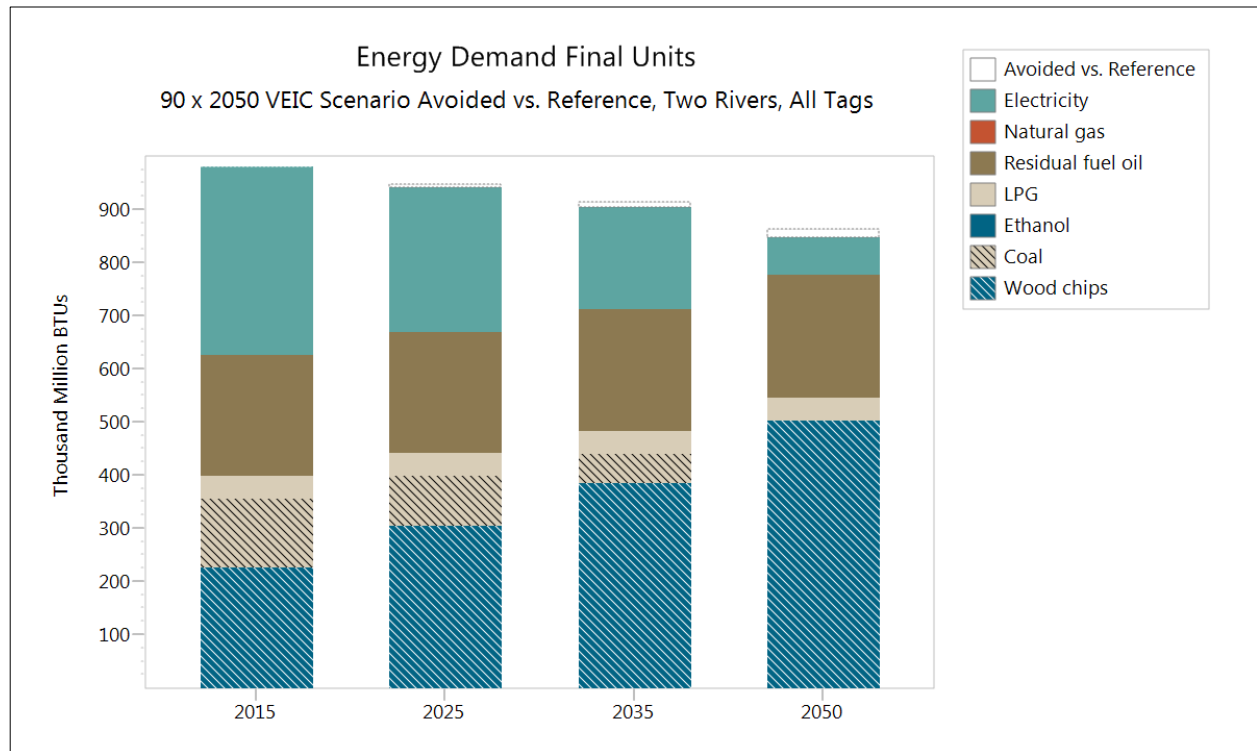


Figure 5: Regional industrial energy consumption by fuel

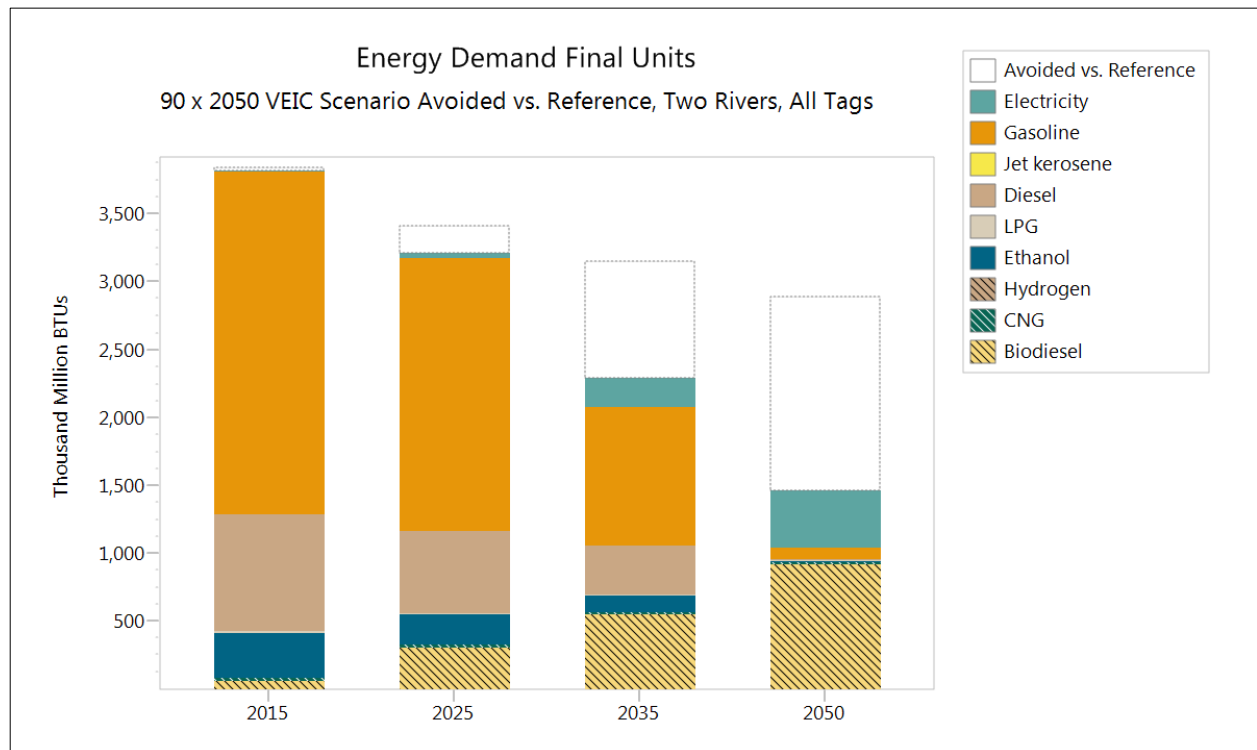


Figure 6: Regional transportation energy consumption by fuel

E. Detailed Sources and Assumptions

Residential

The TES provides total fuels used by sector. We used a combination of industry data and professional judgement to determine demand inputs at a sufficiently fine level of detail to allow for analysis at many levels, including end use (heating, water heating, appliances, etc.), device (boiler, furnace, heat pump) or home-type (single family, multi-family, seasonal, mobile). Assumptions for each are detailed below. All assumptions for residential demand are at a per-home level.

Space Heating

The team determined per home consumption by fuel type and home type. EIA data on Vermont home heating provides the percent share of homes using each type of fuel. 2009 Residential energy consumption survey (RECS) data provided information on heating fuels used by mobile homes. Current heat pumps consumption estimates were found in a 2013 report prepared for Green Mountain Power by Steve LeTendre entitled *Hyper Efficient Devices: Assessing the Fuel Displacement Potential in Vermont of Plug-In Vehicles and Heat Pump Technology*. Future projections of heat pump efficiency were provided by Efficiency Vermont Efficient Products and Heat Pump program experts.

Additional information came from the following data sources:

- 2010 Housing Needs Assessment⁸
- EIA Vermont State Energy Profile⁹
- 2007-2008 VT Residential Fuel Assessment¹⁰
- EIA Adjusted Distillate Fuel Oil and Kerosene Sales by End Use¹¹

The analyst team made the following assumptions for each home type:

- Multi-family units use 60% of the heating fuel used by single family homes, on average, due to assumed reduced size of multi-family units compared to single-family units. Additionally, where natural gas is available, the team assumed a slightly higher percentage of multi-family homes use natural gas as compared to single family homes, given the high number of multi-family units located in the Burlington area, which is

⁸ Vermont Housing and Finance Agency, "2010 Vermont Housing Needs Assessment," December 2009 http://www.vtaffordablehousing.org/documents/resources/623_1.8_Appendix_6_2010_Vermont_Housing_Needs_Assessment.pdf.

⁹ U.S. Energy Information Administration, "Vermont Energy Consumption Estimates, 2004," <https://www.eia.gov/state/print.cfm?sid=VT>

¹⁰ Frederick P. Vermont Residential Fuel Assessment: for the 2007-2008 heating season. Vermont Department of Forest, Parks and Recreation. 2011.

¹¹ U.S. Energy Information Administration, "Adjusted Distillate Fuel Oil and Kerosene Sales by End Use," December 2015, https://www.eia.gov/dnav/pet/pet_cons_821usea_dcu_nus_a.htm.

served by the natural gas pipeline. The team also assumed that few multi-family homes rely on cordwood as a primary heating source.

- Unoccupied/Seasonal Units: On average, seasonal or unoccupied homes were expected to use 10% of the heating fuel used by single family homes. For cord wood, we expected unoccupied or seasonal homes to use 5% of heating fuel, assuming any seasonal or unoccupied home dependent on cord wood are small in number and may typically be homes unoccupied for most of the winter months (deer camps, summer camps, etc.)
- Mobile homes—we had great mobile home data from 2009 RECS. As heat pumps were not widely deployed in mobile homes in 2009 and did not appear in the RECs data, we applied the ratio of oil consumed between single family homes and mobile homes to estimated single family heat pump use to estimate mobile home heat pump use.
- The reference scenario heating demand projections were developed in line with the TES reference scenario. This included the following: assumed an increase in the number of homes using natural gas, increase in the number of homes using heat pumps as a primary heating source (up to 37% in some home types), an increase in home heated with wood pellets, and drastic decline in homes heating with heating oil. Heating system efficiency and shell efficiency were modeled together and, together, were estimated to increase 5-10% depending on the fuel type. However, heat pumps are expected to continue to rapidly increase in efficiency (becoming 45% more efficient, when combined with shell upgrades, by 2050). We also reflect some trends increasing home sizes.
- In the 90% x 2050 _{VEIC} scenario, scenario heating demand projections were developed in line with the TES TREES Local scenarios, a hybrid of the high and low biofuel cost scenarios. This included the following: assumed increase in the number of homes using heat pumps as a primary heating source (up to 70% in some home types), an increase in home heated with wood pellets, a drastic decline in homes heating with heating oil and propane, and moderate decline in home heating with natural gas. Heating system efficiency and shell efficiency were modeled together and were estimated to increase 10%-20% depending on the fuel type. However, heat pumps are expected to continue to rapidly increase in efficiency (becoming 50% more efficient, when combined with shell upgrades by 2050). We also reflect some trends increasing home sizes.

Lighting

Lighting efficiency predictions were estimated by Efficiency Vermont products experts.

Water Heating

Water heating estimates were derived from the Efficiency Vermont Technical Reference Manual.¹²

¹² Efficiency Vermont, “Technical Reference User Manual (TRM): Measure Savings Algorithms and Cost Assumptions, No. 2014-87,” March 2015, <http://psb.vermont.gov/sites/psb/files/docketsandprojects/electric/majorpendingproceedings/TRM%20User%20Manual%20No.%202015-87C.pdf>.

Appliances and Other Household Energy Use:

EnergyStar appliance estimates and the Efficiency Vermont Electric Usage Chart¹³ provided estimates for appliance and other extraneous household energy uses.

Using the sources and assumptions listed above, the team created a model that aligned with the residential fuel consumption values in the TES.

Commercial

Commercial energy use estimates are entered in to the model as energy consumed per square foot of commercial space, on average. This was calculated using data from the TES.

Industrial

Industrial use was entered directly from the results of the TES data.

Transportation

The transportation branch focused on aligning with values from the Total Energy Study (TES) Framework for Analysis of Climate-Energy-Technology Systems (FACETS) data in the transportation sector in the Business as Usual (BAU) scenario. The VEIC 90% x 2050 scenario was predominantly aligned with a blend of the Total Renewable Energy and Efficiency Standard (TREES) Local High and Low Bio scenarios in the transportation sector of FACETS data. There were slight deviations from the FACETS data, which are discussed in further detail below.

Light Duty Vehicles

Light Duty Vehicle (LDV) efficiency is based on a number of assumptions: gasoline and ethanol efficiency were derived from the Vermont Transportation Energy Profile.¹⁴ Diesel LDV efficiency was obtained from underlying transportation data used in the Business as Usual scenario for the Total Energy Study, which is referred to as TES Transportation Data below. Biodiesel LDV efficiency was assumed to be 10% less efficient than LDV diesel efficiency.¹⁵ Electric vehicle (EV) efficiency was derived from an Excel worksheet from Drive Electric Vermont. The worksheet calculated EV efficiency using the number of registered EVs in Vermont, EV efficiency associated with each model type, percentage driven in electric mode by model type (if a plugin hybrid vehicle), and the Vermont average annual vehicle miles traveled. LDV electric vehicle efficiency was assumed to increase at a rate of .6%. This was a calculated weighted average of 100-mile electric vehicles, 200-mile electric vehicles, plug-in 10 gasoline hybrid and

¹³ Efficiency Vermont, "Electric Usage Chart Tool," <https://www.efficiencyvermont.com/tips-tools/tools/electric-usage-chart-tool>.

¹⁴ Jonathan Dowds et al., "Vermont Transportation Energy Profile," October 2015, <http://vtrans.vermont.gov/sites/aot/files/planning/documents/planning/Vermont%20Transportation%20Energy%20Profile%202015.pdf>.

¹⁵ U.S. Environmental Protection Agency: Office of Transportation & Air Quality, "Biodiesel," [Wwww.fueleconomy.gov](http://www.fueleconomy.gov/feg/biodiesel.shtml), accessed August 19, 2016, <https://www.fueleconomy.gov/feg/biodiesel.shtml>.

plug-in 40 gasoline hybrid vehicles from the Energy Information Administration Annual Energy Outlook.¹⁶

Miles per LDV was calculated using the following assumptions: data from the Vermont Agency of Transportation provided values for statewide vehicles per capita and annual miles traveled.¹⁷ The total number of LDVs in Vermont was sourced TES Transportation Data. The calculated LDV miles per capita was multiplied by the population of Vermont and divided by the number of LDVs to calculate miles per LDV.

The number of EVs were sourced directly from Drive Electric Vermont, which provided a worksheet of actual EV registrations by make and model. This worksheet was used to calculate an estimate of the number of electric vehicles using the percentage driven in electric mode by vehicle type to devalue the count of plug-in hybrid vehicles. Drive Electric Vermont also provided the number of EVs in the 90% x 2050_{VEIC} scenario.

Heavy Duty Vehicles

Similar to the LDV vehicle efficiency methods above, HDV efficiency values contained a variety of assumptions from different sources. A weighted average of HDV diesel efficiency was calculated using registration and fuel economy values from the Transportation Energy Data Book.¹⁸ The vehicle efficiency values for diesel and compressed natural gas (CNG) were all assumed to be equal.¹⁹ Diesel efficiency was reduced by 10% to represent biodiesel efficiency.²⁰ Propane efficiency was calculated using a weighted average from the Energy Information Administration Annual Energy Outlook table for Freight Transportation Energy Use.²¹

In the 90% x 2050_{VEIC} scenario, it was assumed HDVs will switch entirely from diesel to biodiesel or renewable diesel by 2050. This assumption is backed by recent advances with biofuel. Cities such as Oakland and San Francisco are integrating a relatively new product called renewable diesel into their municipal fleets that does not gel in colder temperatures and has a much lower overall emissions factor.²² Historically, gelling in cold temperatures has prevented higher percentages of plant-based diesel replacement products.

¹⁶ U.S. Energy Information Administration, "Light-Duty Vehicle Miles per Gallon by Technology Type," *Annual Energy Outlook 2015*, 2015, https://www.eia.gov/forecasts/aeo/data/browser/#/?id=50-AEO2016&cases=ref2016~ref_no_cpp&sourcekey=0.

¹⁷ Jonathan Dowds et al., "Vermont Transportation Energy Profile."

¹⁸ Ibid.

¹⁹ "Natural Gas Fuel Basics," *Alternative Fuels Data Center*, accessed August 19, 2016, http://www.afdc.energy.gov/fuels/natural_gas_basics.html.

²⁰ U.S. Environmental Protection Agency: Office of Transportation & Air Quality, "Biodiesel."

²¹ US Energy Information Administration (EIA), "Freight Transportation Energy Use, Reference Case," *Annual Energy Outlook 2015*, 2015, <http://www.eia.gov/forecasts/aeo/data/browser/#/?id=58-AEO2015®ion=0-0&cases=ref2015&start=2012&end=2040&f=A&linechart=ref2015-d021915a.6-58-AEO2015&sourcekey=0>.

²² Oregon Department of Transportation and U.S. Department of Transportation Federal Highway Administration, "Primer on Renewable Diesel," accessed August 29, 2016, <http://altfueltoolkit.org/wp-content/uploads/2004/05/Renewable-Diesel-Fact-Sheet.pdf>.

Although there has been some progress toward electrifying HDVs, the VEIC 90% x 2050 scenario does not include electric HDVs. An electric transit bus toured the area and gave employees of BED, GMTA, and VEIC a nearly silent ride around Burlington. The bus is able to fast charge using an immense amount of power that few places on the grid can currently support. The California Air Resources Board indicated a very limited number of electric HDVs are in use within the state.²³ Anecdotally, Tesla communicated it is working on developing an electric semi-tractor that will reduce the costs of freight transport.²⁴

The total number of HDVs was calculated using the difference between the total number of HDVs and LDVs in 2010 in the Vermont Transportation Energy Profile and the total number of LDVs from TES Transportation Data.²⁵ HDV miles per capita was calculated using the ratio of total HDV miles traveled from the 2012 Transportation Energy Data Book and the 2012 American Community Survey U.S. population estimate.^{26,27} The total number of HDVs and HDV miles per capita were combined with the population assumptions outlined above to calculate miles per HDV.

Rail

The rail sector of the transportation branch consists of two types: freight and passenger. Currently in Vermont, freight and passenger rail use diesel fuel.^{28,29} The energy intensity (Btu/short ton-mile) of freight rail was obtained from the U.S Department of Transportation Bureau of Transportation Statistics.³⁰ A 10-year average energy intensity of passenger rail (Btu/passenger mile) was also obtained from the U.S Department of Transportation Bureau of Transportation Statistics.³¹ Passenger miles were calculated using two sets of information. First, distance between Vermont Amtrak stations and the appropriate Vermont border location were estimated using Google Maps data. Second, 2013 passenger data was obtained from the

²³ California Environmental Protection Agency Air Resources Board, "Draft Technology Assessment: Medium- and Heavy-Duty Battery Electric Trucks and Buses," October 2015, https://www.arb.ca.gov/msprog/tech/techreport/bev_tech_report.pdf.

²⁴ Elon Musk, "Master Plan, Part Deux," *Tesla*, July 20, 2016, <https://www.tesla.com/blog/master-plan-part-deux>.

²⁵ Jonathan Dowds et al., "Vermont Transportation Energy Profile."

²⁶ "Transportation Energy Data Book: Edition 33" (Oak Ridge National Laboratory, n.d.), accessed August 18, 2016.

²⁷ U. S. Census Bureau, "Total Population, Universe: Total Population, 2012 American Community Survey 1-Year Estimates," *American Fact Finder*, 2012, http://factfinder.census.gov/bkmk/table/1.0/en/ACS/12_1YR/B01003/0100000US.

²⁸ US Energy Information Administration (EIA), "Freight Transportation Energy Use, Reference Case."

²⁹ Vermont Agency of Transportation Operations Division - Rail Section, "Passenger Rail Equipment Options for the Amtrak Vermonter and Ethan Allen Express: A Report to the Vermont Legislature," January 2010, <http://www.leg.state.vt.us/reports/2010ExternalReports/253921.pdf>.

³⁰ U.S. Department of Transportation: Office of the Assistant Secretary for Research and Technology Bureau of Transportation Statistics, "Table 4-25: Energy Intensity of Class I Railroad Freight Service," accessed August 26, 2016, http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_04_25.html.

³¹ U.S. Department of Transportation: Office of the Assistant Secretary for Research and Technology Bureau of Transportation Statistics, "Table 4-26: Energy Intensity of Amtrak Services," accessed August 26, 2016, http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_04_26.html.

National Association of Railroad Passengers.³² Combined, these two components created total Vermont passenger miles. We used a compound growth rate of 3% for forecast future passenger rail demand in the 90% x 2050_{VEIC} scenario, consistent with the historical growth rates of rail passenger miles in Vermont.³³ Passenger rail is assumed to completely transform to electric locomotion. Freight rail is assumed to transform to biodiesel or renewable diesel.

Air

The total energy of air sector used appropriate FACETS data values directly. The air sector is expected to continue using Jet Fuel in both scenarios.

³² National Association of Railroad Passengers, “Fact Sheet: Amtrak in Vermont,” 2016, https://www.narprail.org/site/assets/files/1038/states_2015.pdf.

³³ Joseph Barr, AICP et al., “Vermont State Rail Plan: Regional Passenger Rail Forecasts.”

Appendix B: Energy Mapping

The Regional Energy Implementation Plan includes four maps which are intended to aid communities in determining the most appropriate areas to locate renewable energy generation facilities in their towns. Utilizing town-level energy targets developed through the LEAP model, communities can further refine their policies relative to renewable energy generation system siting. **These maps are intended for planning use only.**

Making the Maps

Maps for this project were developed using Geographic Information Systems (GIS). Each map utilizes available data to identify the areas where potential renewable energy generation is possible and then modifies those data layers to reflect constraints that may impact that potential. For each of the four focus-types of renewable energy, we analyzed the following:



Solar

Topography of land analyzed based on slope and direction (azimuth) conducted in GIS for ground-mounted solar.



Wind

Digitally modeled wind speed (based on topography) analyzed at 3 hub heights.



Hydro

Existing dams analyzed for potential capacity based on Community Hydro report. No new dams considered.



Biomass

Land coverage used to determine amount of harvestable wood.


Refining the Maps

Once the base maps were developed, we further refined the dataset to exclude areas that, by their nature, cannot or should not be developed and those areas that may include a resource that a community may wish to protect.


Known Constraints – Known constraints include areas that should not be developed with renewable energy generation facilities, such as wetlands, river corridors, roads, floodways, rare and irreplaceable areas, etc. Any areas with Known Constraints that were identified as having the potential for renewable energy generation were removed from the maps.

Possible Constraints – Possible constraints include areas that may impact the siting of renewable energy generation facilities, but do not necessarily preclude their development. This includes areas such as floodplains, source protection areas, deer wintering areas, habitat blocks, prime agricultural soils, etc. These areas are identified as locations with potential on the maps, but are colored to identify that they have a Possible Constraint that might have an impact on development potential.


Solar Energy Potential



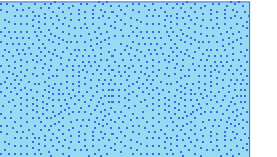
Substations




3 Phase Power Lines




Transmission Lines




Lakes/Ponds




No constraint 1m 3 phase line



Constraint

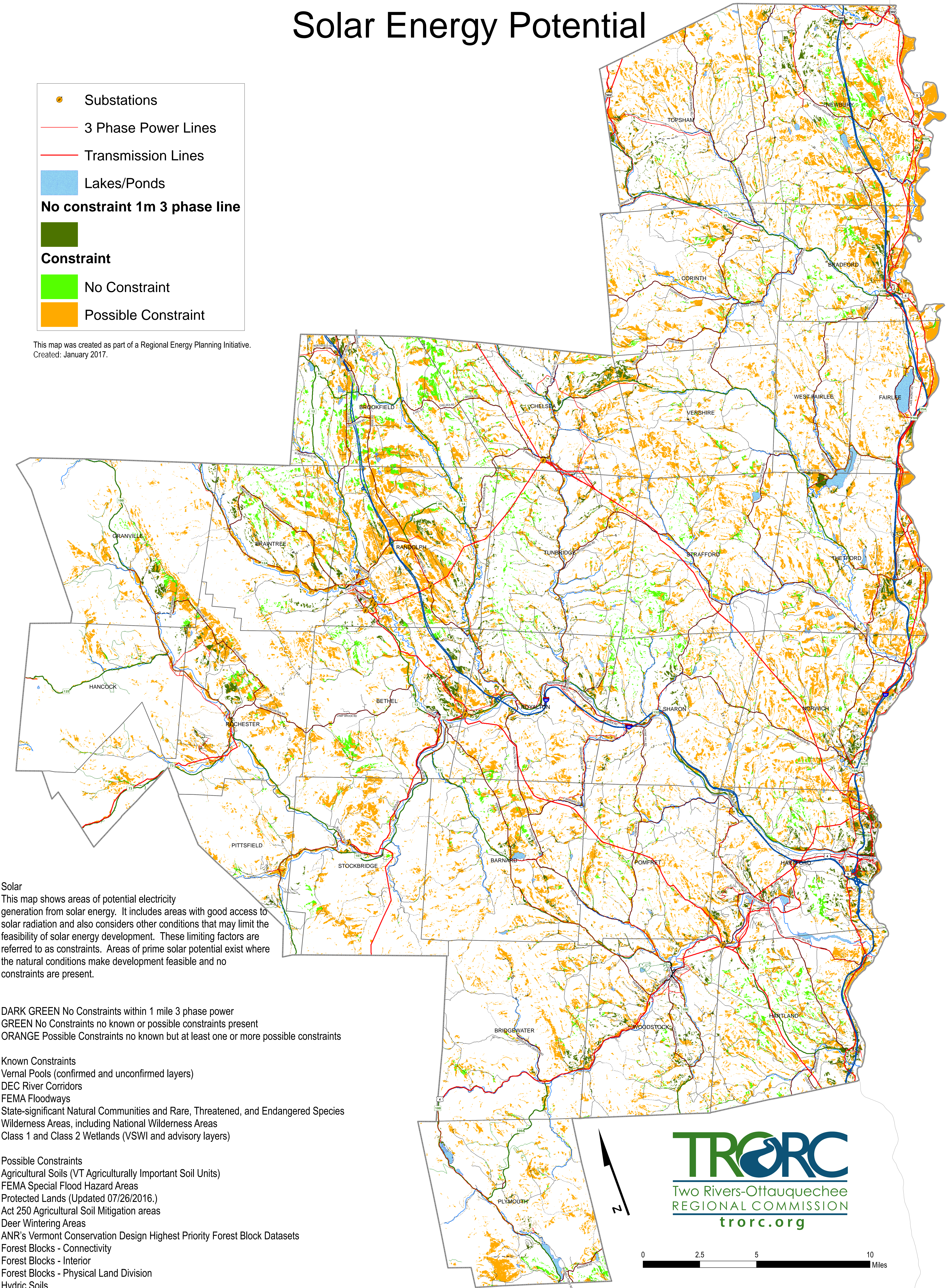


No Constraint



Possible Constraint

This map was created as part of a Regional Energy Planning Initiative.
Created: January 2017.



Wind Energy Potential

Substations

3 Phase Power Lines

Transmission Lines

Lakes/Ponds

Rivers/Streams

Structures w/1ac buffer

NO constraint 1m 3 phase line

TotalPrimeSecWINDTRTOWNS

Constraint, HubHeight

No Constraint, 50

No Constraint, 70

Possible Constraint, 50

Possible Constraint, 70

This map was created as part of a Regional Energy Planning Initiative.
Created: January 2017.

Wind
This map shows areas of potential wind energy development. It includes areas with good access to wind resources and also considers other conditions that may limit the feasibility of wind energy development. These limiting factors are referred to as constraints. Areas of prime wind potential exist where the natural conditions make development feasible and no constraints are present.

DARK GREEN No Constraints within 1 mile 3 phase power
GREEN No Constraints no known or possible constraints present
ORANGE Possible Constraints no known but at least one or more possible constraints

Known Constraints
Vernal Pools (confirmed and unconfirmed layers)
DEC River Corridors
FEMA Floodways
State-significant Natural Communities and Rare, Threatened, and Endangered Species
Wilderness Areas, including National Wilderness Areas
Class 1 and Class 2 Wetlands (VSWI and advisory layers)

Possible Constraints
Agricultural Soils (VT Agriculturally Important Soil Units)
FEMA Special Flood Hazard Areas
Protected Lands (Updated 07/26/2016.)
Act 250 Agricultural Soil Mitigation areas
Deer Wintering Areas
ANR's Vermont Conservation Design Highest Priority Forest Block Datasets
Forest Blocks - Connectivity
Forest Blocks - Interior
Forest Blocks - Physical Land Division
Hydric Soils

TRORC

Two Rivers-Ottawaquechee

REGIONAL COMMISSION

trorc.org

0


2.5

5


10

Miles


Biomass Energy Potential



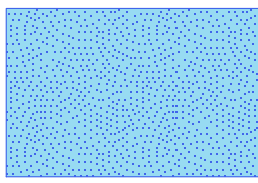
Substations




3 Phase Power Lines




Transmission Lines



Lakes/Ponds



Rivers/Streams



Woody Biomass

This map was created as part of a Regional Energy Planning Initiative being conducted by the Bennington County Regional Commission, Northwest Vermont Regional Planning Commission, Two Rivers-Ottawaquechee Regional Commission, and the Vermont Public Service Department.

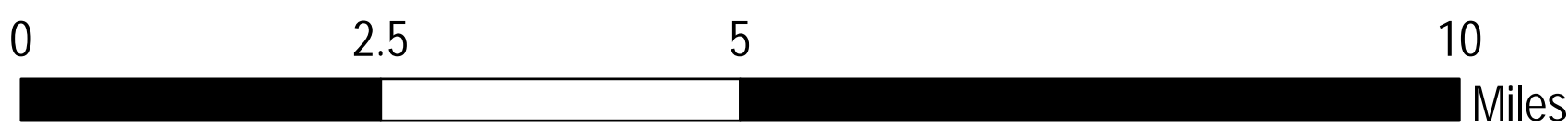
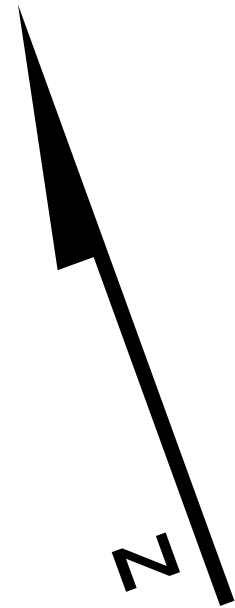
Created: June 2016.

Biomass
Methodology: This map shows areas of potential for woody biomass production and harvest. The map also illustrates other conditions that may limit the feasibility of extensive harvesting of wood for energy use. These limiting factors are referred to as constraints. The map does not show areas where other types of biomass, such as biomass from grasses or agricultural residue, could be grown/harvested.


Level 1 Constraints: Physical features or resources that make extensive harvesting infeasible are considered Level 1 constraints. Level 1 constraints include: FEMA floodways, river corridors, federal wilderness areas, rare and irreplaceable natural areas (RINAs), vernal pools, and class 1 and 2 wetlands. These areas have been removed and are not shown in any way on this map.





Two Rivers-Ottawaquechee
REGIONAL COMMISSION
trorc.org

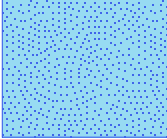



Hydroelectric Energy Potential

 Substations


 3 Phase Power Lines


 Transmission Lines


 Lakes/Ponds


 Operational Hydroelectric Facilities


Potential Hydroelectric Sites

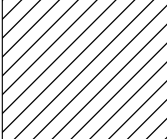
 < 50 kW Capacity

 > 50 kW Capacity

 High Hazard with < 50 kW Capacity

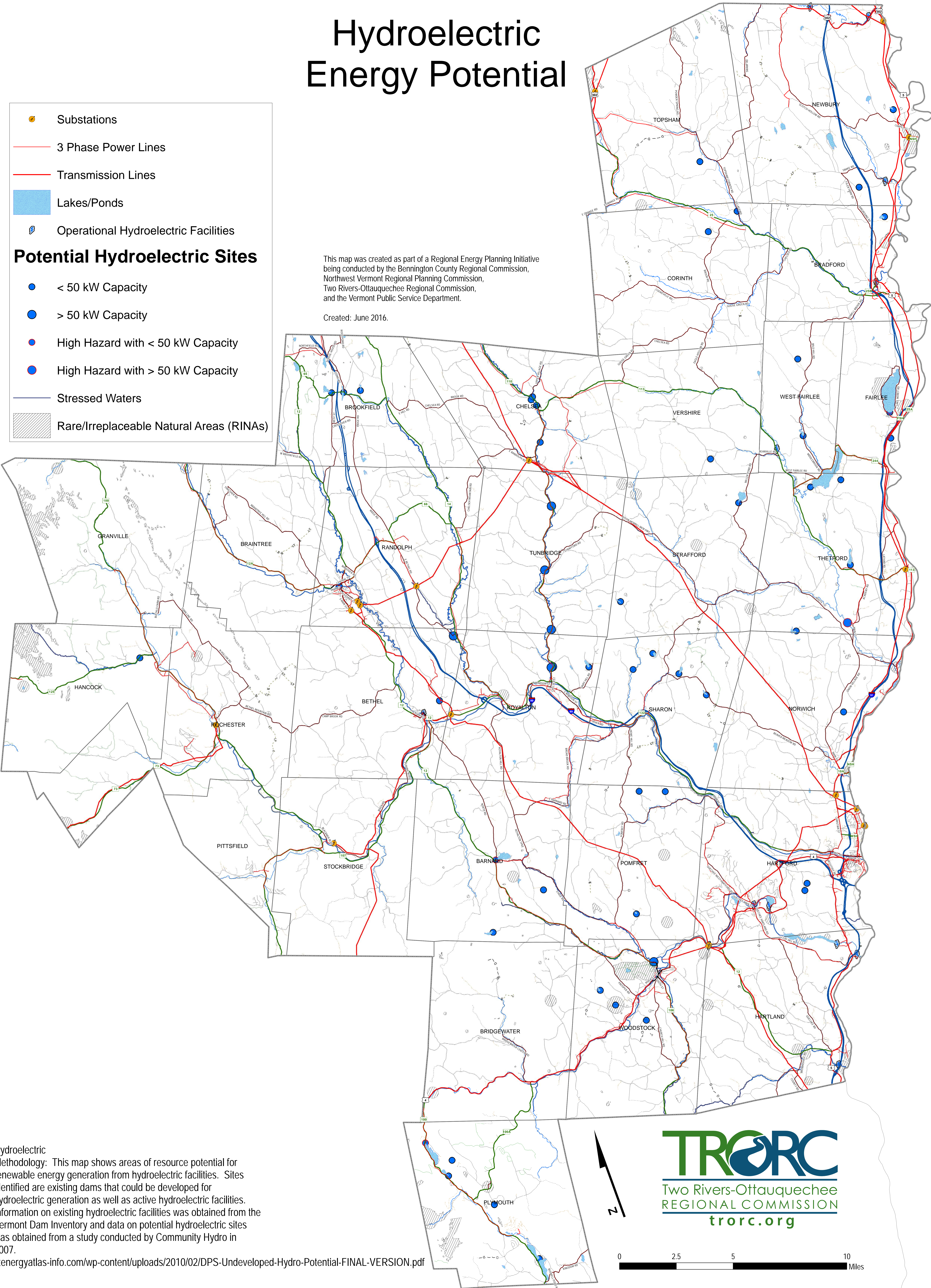
 High Hazard with > 50 kW Capacity

 Stressed Waters

 Rare/Irreplaceable Natural Areas (RINAs)

This map was created as part of a Regional Energy Planning Initiative being conducted by the Bennington County Regional Commission, Northwest Vermont Regional Planning Commission, Two Rivers-Ottawaquechee Regional Commission, and the Vermont Public Service Department.

Created: June 2016.



Hydroelectric
Methodology: This map shows areas of resource potential for renewable energy generation from hydroelectric facilities. Sites identified are existing dams that could be developed for hydroelectric generation as well as active hydroelectric facilities. Information on existing hydroelectric facilities was obtained from the Vermont Dam Inventory and data on potential hydroelectric sites was obtained from a study conducted by Community Hydro in 2007.

vtenergyatlas-info.com/wp-content/uploads/2010/02/DPS-Undeveloped-Hydro-Potential-FINAL-VERSION.pdf



Appendix C: Renewable Energy Targets

Municipal Energy Targets

The targets provided in this appendix represent the amount of new renewable energy capacity (solar, wind and hydro) that each community will need to develop in order to achieve the CEP's goal of 90% renewable by 2050 (based on the LEAP model).

Terminology

Capacity Target- This is the amount of new generation capacity needed by 2050.

Prime Potential- This is area where potential generation exists and is unencumbered by constraints. Most communities have significantly more potential, but those areas that are not considered prime may have a constraint (such as prime agricultural soils) that makes it a less desirable location for a new facility.

Prime Within 1-mile of 3 phase- Three-phase power is necessary for larger renewable energy generation facilities, making those areas with prime potential that are located within a mile of three-phase power the most suitable for new facilities.

Existing Hydro Facilities- Hydroelectric facilities that are currently operational.

Potential Hydro Facilities- Based on the 2008 community hydro report, this identifies potential hydro facilities based on existing dams. This data may include potential sites that are potentially hazardous to develop or challenging to permit. Most gains in hydro capacity will be made by improvements to existing systems.

Data Sources

For the purposes of this project, the Vermont Energy Investment Corp adapted the Total Energy Study's TREES scenarios (for more information, see Appendix A). Using this scenario, VEIC created and revised a model of the demand and supply of total energy in Vermont. Historic information was primarily drawn from the Public Service Department's Utility Facts 2013 and Energy Information Administration (EIA) data. Projections came from the Total Energy Study (TES), the utilities' Committed Supply, and stakeholder input.

Regional Energy Targets



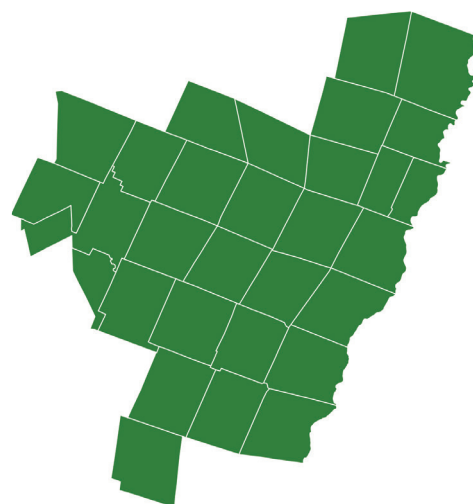
New Solar Capacity Target: 178 MW
Prime Solar Potential: 28,744 acres
Prime Solar within 1 mile of 3 phase: 13,473 acres



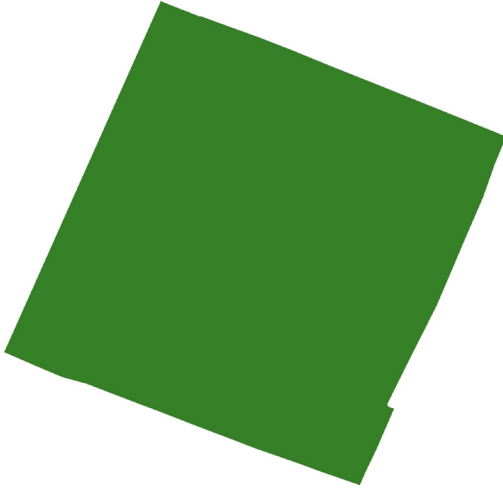
New Wind Capacity Target: 25 MW
Prime Wind Potential: 15,025 acres
Prime Wind within 1 mile of 3 phase: 4,722 acres



Existing Hydro Facilities: 12
Potential Hydro Facilities: 57



Barnard



New Solar Capacity Target: 3 MW
Prime Solar Potential: 613 acres
Prime Solar within 1 mile of 3 phase: 296 acres

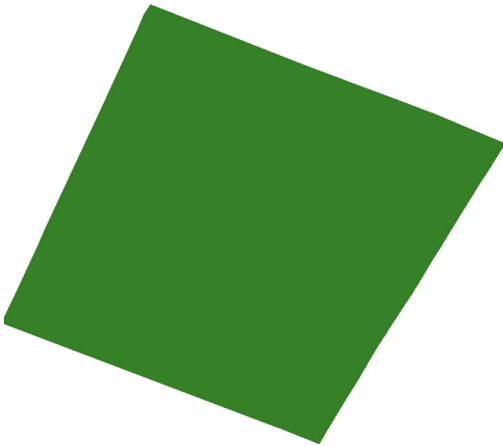


New Wind Capacity Target: .42 MW
Prime Wind Potential: 726 acres
Prime Wind within 1 mile of 3 phase: 303 acres



Existing Hydro Facilities: 0
Potential Hydro Facilities: 1

Bethel



New Solar Capacity Target: 6 MW
Prime Solar Potential: 1517 acres
Prime Solar within 1 mile of 3 phase: 798 acres



New Wind Capacity Target: .91 MW
Prime Wind Potential: 215 acres
Prime Wind within 1 mile of 3 phase: 0 acres



Existing Hydro Facilities: 0
Potential Hydro Facilities: 3

Bradford



New Solar Capacity Target: 9 MW
Prime Solar Potential: 960 acres
Prime Solar within 1 mile of 3 phase: 436 acres

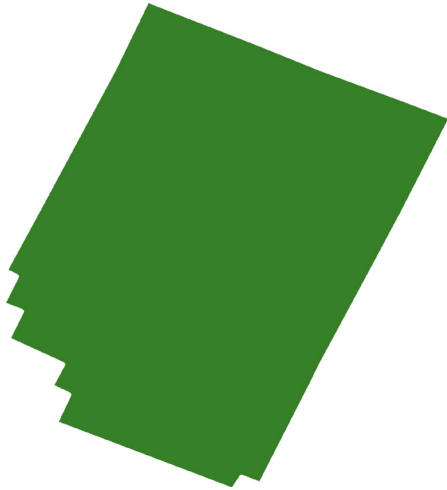


New Wind Capacity Target: 1.25 MW
Prime Wind Potential: 0 acres
Prime Wind within 1 mile of 3 phase: 0 acres



Existing Hydro Facilities: 1
Potential Hydro Facilities: 1

Braintree



New Solar Capacity Target: 4 MW
Prime Solar Potential: 1291 acres
Prime Solar within 1 mile of 3 phase: 441 acres

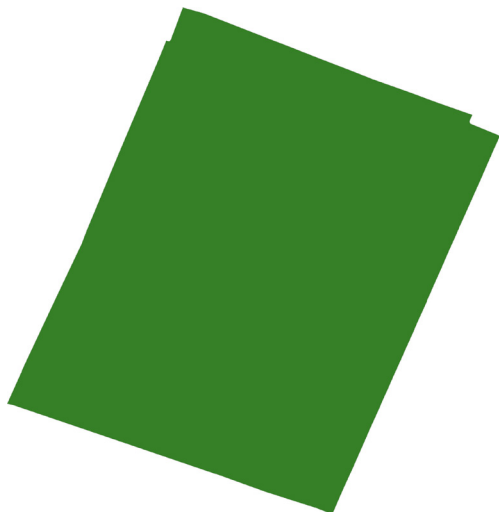


New Wind Capacity Target: .56 MW
Prime Wind Potential: 429 acres
Prime Wind within 1 mile of 3 phase: 10 acres



Existing Hydro Facilities: 0
Potential Hydro Facilities: 0

Bridgewater



New Solar Capacity Target: 3 MW
Prime Solar Potential: 410 acres
Prime Solar within 1 mile of 3 phase: 174 acres

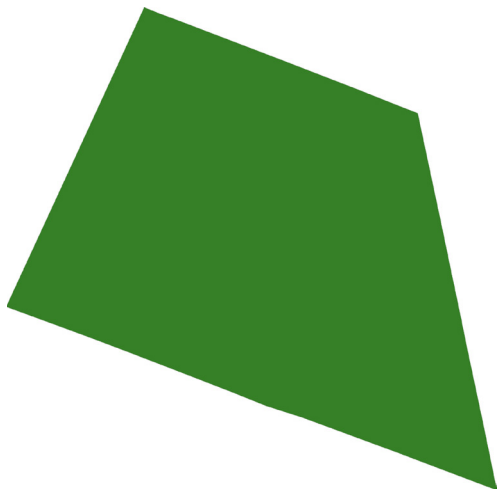


New Wind Capacity Target: .42 MW
Prime Wind Potential: 213 acres
Prime Wind within 1 mile of 3 phase: 30 acres



Existing Hydro Facilities: 0
Potential Hydro Facilities: 0

Brookfield



New Solar Capacity Target: 4 MW
Prime Solar Potential: 1936 acres
Prime Solar within 1 mile of 3 phase: 232 acres

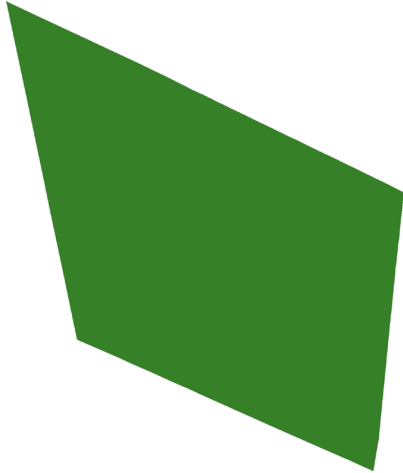


New Wind Capacity Target: .58 MW
Prime Wind Potential: 1030 acres
Prime Wind within 1 mile of 3 phase: 151 acres



Existing Hydro Facilities: 0
Potential Hydro Facilities: 2

Chelsea



New Solar Capacity Target: 4 MW
Prime Solar Potential: 1309 acres
Prime Solar within 1 mile of 3 phase: 649 acres

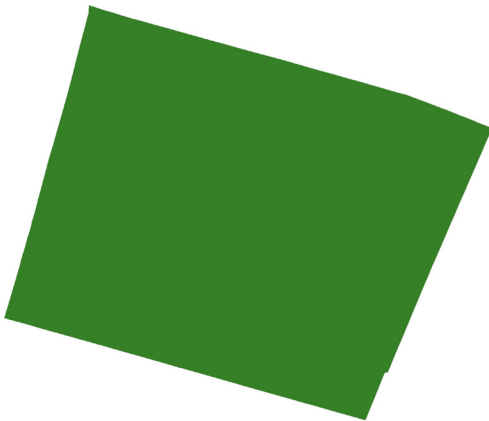


New Wind Capacity Target: .55 MW
Prime Wind Potential: 1702 acres
Prime Wind within 1 mile of 3 phase: 803 acres



Existing Hydro Facilities: 0
Potential Hydro Facilities: 4

Corinth



New Solar Capacity Target: 4 MW
Prime Solar Potential: 641 acres
Prime Solar within 1 mile of 3 phase: 139 acres



New Wind Capacity Target: .61 MW
Prime Wind Potential: 98 acres
Prime Wind within 1 mile of 3 phase: 1 acres



Existing Hydro Facilities: 0
Potential Hydro Facilities: 2

Fairlee



New Solar Capacity Target: 3 MW
Prime Solar Potential: 343 acres
Prime Solar within 1 mile of 3 phase: 240 acres

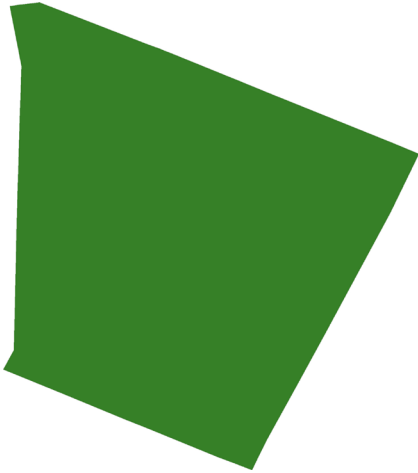


New Wind Capacity Target: .44 MW
Prime Wind Potential: 0 acres
Prime Wind within 1 mile of 3 phase: 0 acres



Existing Hydro Facilities: 0
Potential Hydro Facilities: 2

Granville



New Solar Capacity Target: 1 MW
Prime Solar Potential: 622 acres
Prime Solar within 1 mile of 3 phase: 315 acres



New Wind Capacity Target: .13 MW
Prime Wind Potential: 185 acres
Prime Wind within 1 mile of 3 phase: 75 acres



Existing Hydro Facilities: 0
Potential Hydro Facilities: 0

Hancock



New Solar Capacity Target: 1 MW
Prime Solar Potential: 111 acres
Prime Solar within 1 mile of 3 phase: 64 acres



New Wind Capacity Target: .14 MW
Prime Wind Potential: 116 acres
Prime Wind within 1 mile of 3 phase: 105 acres



Existing Hydro Facilities: 0
Potential Hydro Facilities: 1

Hartford



New Solar Capacity Target: 32 MW
Prime Solar Potential: 2468 acres
Prime Solar within 1 mile of 3 phase: 2004 acres

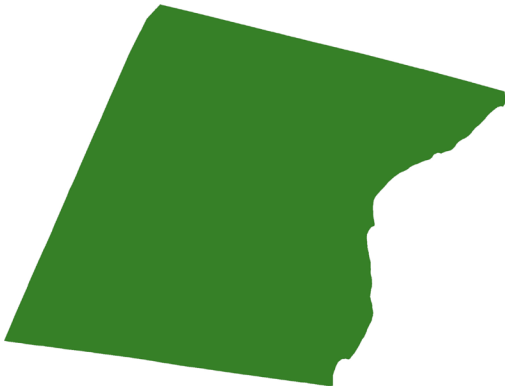


New Wind Capacity Target: 4.44 MW
Prime Wind Potential: 0 acres
Prime Wind within 1 mile of 3 phase: 0 acres



Existing Hydro Facilities: 2
Potential Hydro Facilities: 2

Hartland



New Solar Capacity Target: 11 MW
Prime Solar Potential: 1622 acres
Prime Solar within 1 mile of 3 phase: 542 acres



New Wind Capacity Target: 1.51 MW
Prime Wind Potential: 321 acres
Prime Wind within 1 mile of 3 phase: 103 acres



Existing Hydro Facilities: 3
Potential Hydro Facilities: 0

Newbury



New Solar Capacity Target: 7 MW
Prime Solar Potential: 2319 acres
Prime Solar within 1 mile of 3 phase: 938 acres



New Wind Capacity Target: .99 MW
Prime Wind Potential: 67 acres
Prime Wind within 1 mile of 3 phase: 65 acres



Existing Hydro Facilities: 3
Potential Hydro Facilities: 2

Norwich



New Solar Capacity Target: 11 MW
Prime Solar Potential: 1203 acres
Prime Solar within 1 mile of 3 phase: 620 acres



New Wind Capacity Target: 1.52 MW
Prime Wind Potential: 16.4 acres
Prime Wind within 1 mile of 3 phase: 0 acres



Existing Hydro Facilities: 0
Potential Hydro Facilities: 1

Pittsfield



New Solar Capacity Target: 2 MW
Prime Solar Potential: 148 acres
Prime Solar within 1 mile of 3 phase: 80 acres

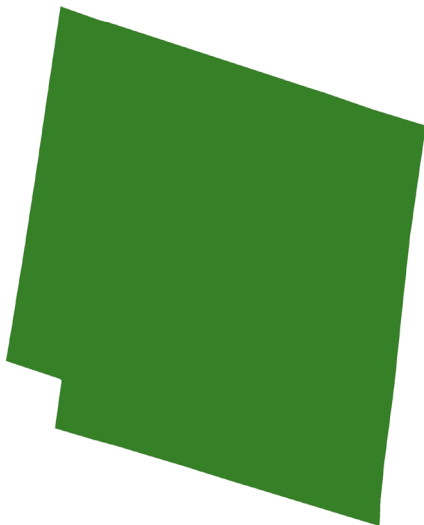


New Wind Capacity Target: .24 MW
Prime Wind Potential: 154 acres
Prime Wind within 1 mile of 3 phase: 18.1 acres



Existing Hydro Facilities: 0
Potential Hydro Facilities: 0

Plymouth



New Solar Capacity Target: 2 MW
Prime Solar Potential: 475 acres
Prime Solar within 1 mile of 3 phase: 126 acres

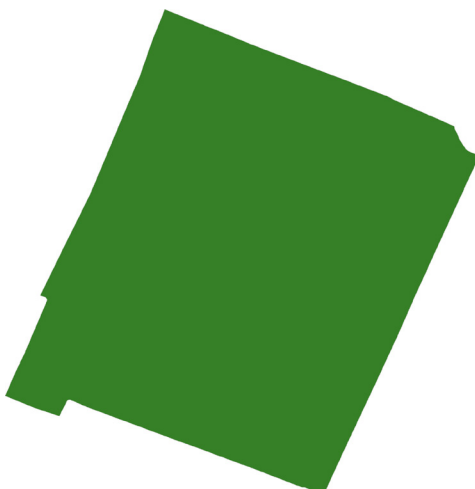


New Wind Capacity Target: .28 MW
Prime Wind Potential: 963 acres
Prime Wind within 1 mile of 3 phase: 202 acres



Existing Hydro Facilities: 0
Potential Hydro Facilities: 5

Pomfret



New Solar Capacity Target: 3 MW
Prime Solar Potential: 518 acres
Prime Solar within 1 mile of 3 phase: 131 acres

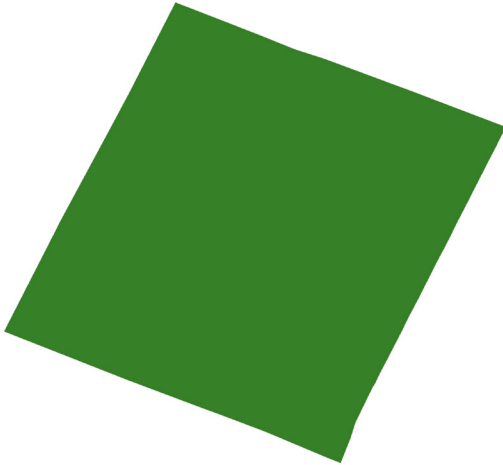


New Wind Capacity Target: .40 MW
Prime Wind Potential: 358 acres
Prime Wind within 1 mile of 3 phase: 59 acres



Existing Hydro Facilities: 0
Potential Hydro Facilities: 3

Randolph



New Solar Capacity Target: 15 MW
Prime Solar Potential: 1658 acres
Prime Solar within 1 mile of 3 phase: 973 acres

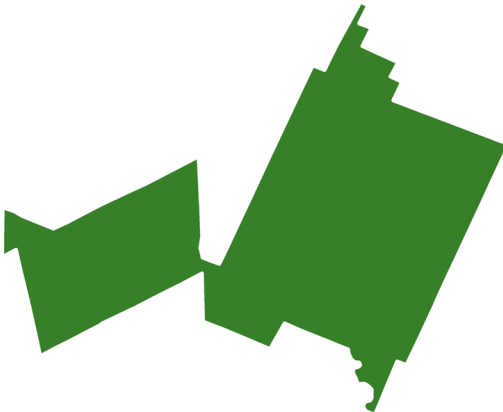


New Wind Capacity Target: 2.13 MW
Prime Wind Potential: 93 acres
Prime Wind within 1 mile of 3 phase: 20 acres



Existing Hydro Facilities: 0
Potential Hydro Facilities: 1

Rochester



New Solar Capacity Target: 4 MW
Prime Solar Potential: 833 acres
Prime Solar within 1 mile of 3 phase: 506 acres

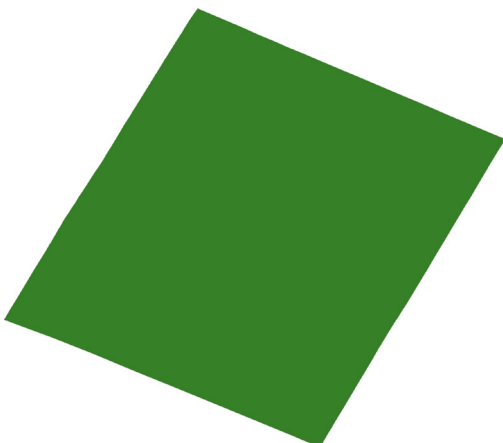


New Wind Capacity Target: .51 MW
Prime Wind Potential: 236 acres
Prime Wind within 1 mile of 3 phase: 163 acres



Existing Hydro Facilities: 0
Potential Hydro Facilities: 0

Royalton



New Solar Capacity Target: 9 MW
Prime Solar Potential: 974 acres
Prime Solar within 1 mile of 3 phase: 636 acres

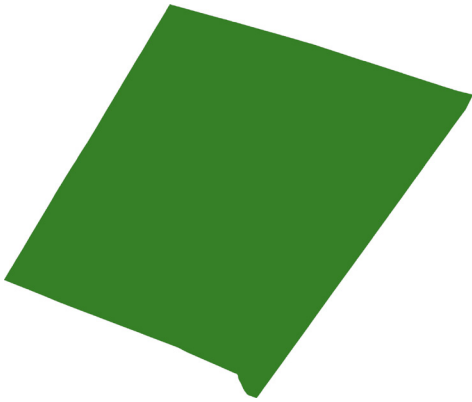


New Wind Capacity Target: 1.24 MW
Prime Wind Potential: 358 acres
Prime Wind within 1 mile of 3 phase: 43 acres



Existing Hydro Facilities: 0
Potential Hydro Facilities: 3

Sharon



New Solar Capacity Target: 5 MW
Prime Solar Potential: 784 acres
Prime Solar within 1 mile of 3 phase: 339 acres

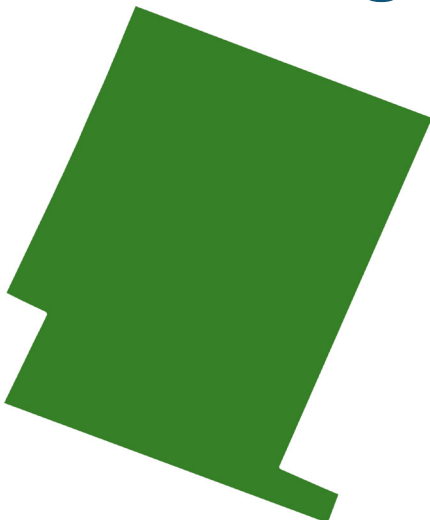


New Wind Capacity Target: .67 MW
Prime Wind Potential: 453 acres
Prime Wind within 1 mile of 3 phase: 66 acres



Existing Hydro Facilities: 0
Potential Hydro Facilities: 4

Stockbridge



New Solar Capacity Target: 2 MW
Prime Solar Potential: 287 acres
Prime Solar within 1 mile of 3 phase: 80 acres

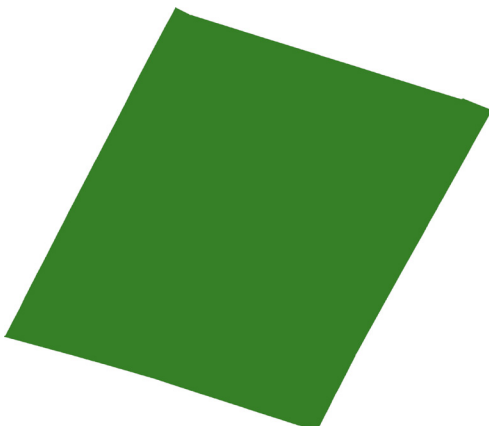


New Wind Capacity Target: .33 MW
Prime Wind Potential: 1169 acres
Prime Wind within 1 mile of 3 phase: 439 acres



Existing Hydro Facilities: 0
Potential Hydro Facilities: 0

Strafford



New Solar Capacity Target: 3 MW
Prime Solar Potential: 894 acres
Prime Solar within 1 mile of 3 phase: 0 acres



New Wind Capacity Target: .49 MW
Prime Wind Potential: 1644 acres
Prime Wind within 1 mile of 3 phase: 0 acres



Existing Hydro Facilities: 0
Potential Hydro Facilities: 2

Thetford



New Solar Capacity Target: 8 MW
Prime Solar Potential: 1148 acres
Prime Solar within 1 mile of 3 phase: 762 acres

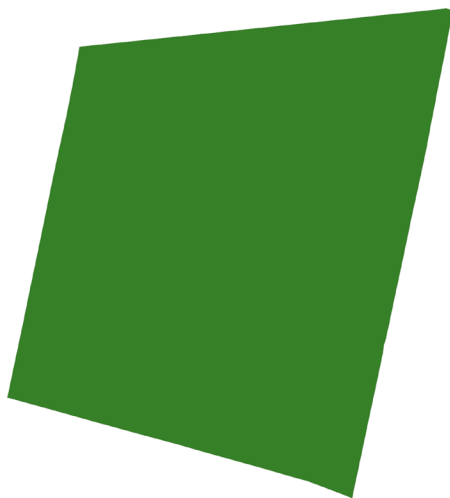


New Wind Capacity Target: 1.16 MW
Prime Wind Potential: 0 acres
Prime Wind within 1 mile of 3 phase: 0 acres



Existing Hydro Facilities: 0
Potential Hydro Facilities: 4

Topsham



New Solar Capacity Target: 4 MW
Prime Solar Potential: 800 acres
Prime Solar within 1 mile of 3 phase: 487 acres

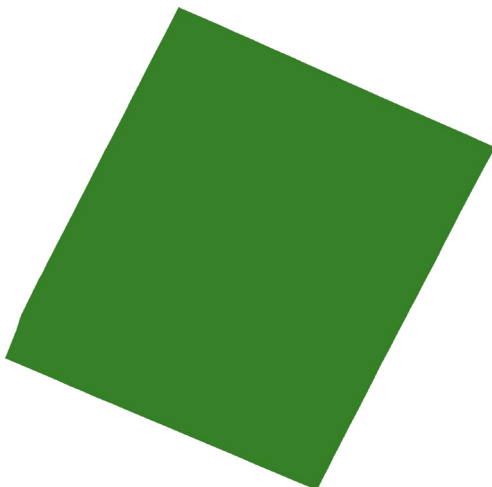


New Wind Capacity Target: .52 MW
Prime Wind Potential: 1305 acres
Prime Wind within 1 mile of 3 phase: 998 acres



Existing Hydro Facilities: 0
Potential Hydro Facilities: 1

Tunbridge



New Solar Capacity Target: 4 MW
Prime Solar Potential: 1196 acres
Prime Solar within 1 mile of 3 phase: 384 acres

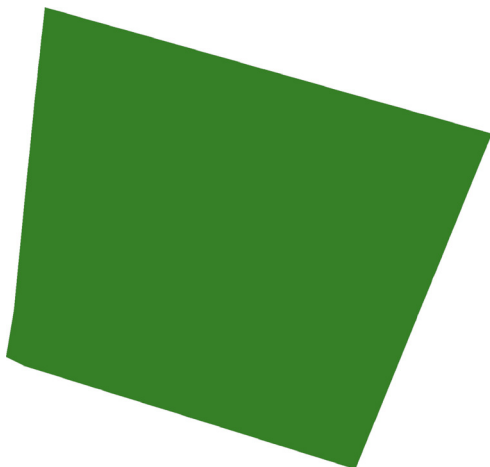


New Wind Capacity Target: .57 MW
Prime Wind Potential: 1847 acres
Prime Wind within 1 mile of 3 phase: 511 acres



Existing Hydro Facilities: 0
Potential Hydro Facilities: 3

Vershire



New Solar Capacity Target: 2 MW
Prime Solar Potential: 473 acres
Prime Solar within 1 mile of 3 phase: 199 acres

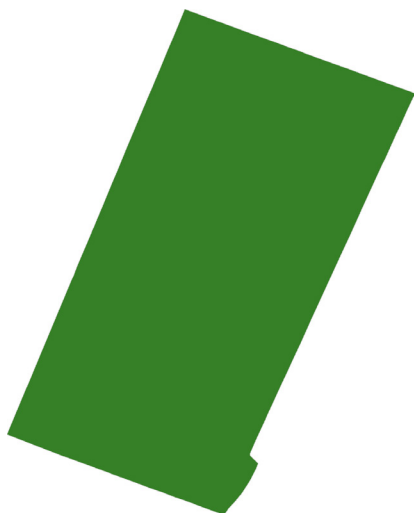


New Wind Capacity Target: .33 MW
Prime Wind Potential: 963 acres
Prime Wind within 1 mile of 3 phase: 401 acres



Existing Hydro Facilities: 0
Potential Hydro Facilities: 1

West Fairlee



New Solar Capacity Target: 2 MW
Prime Solar Potential: 179 acres
Prime Solar within 1 mile of 3 phase: 50 acres

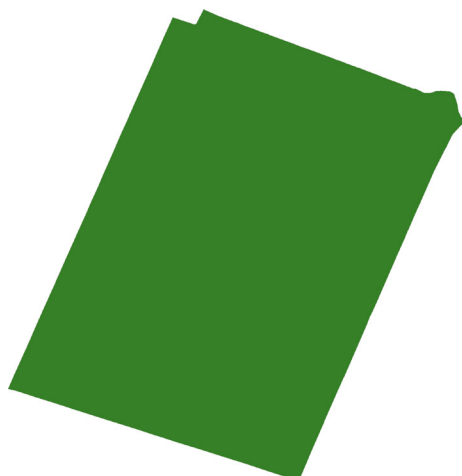


New Wind Capacity Target: .29 MW
Prime Wind Potential: 11.8 acres
Prime Wind within 1 mile of 3 phase: 0 acres



Existing Hydro Facilities: 0
Potential Hydro Facilities: 2

Woodstock



New Solar Capacity Target: 10 MW
Prime Solar Potential: 1010 acres
Prime Solar within 1 mile of 3 phase: 828 acres



New Wind Capacity Target: 1.36 MW
Prime Wind Potential: acres: 518 acres
Prime Wind within 1 mile of 3 phase: 157 acres



Existing Hydro Facilities: 0
Potential Hydro Facilities: 4

Appendix D: Guide to Farming Friendly Solar

With the proliferation of solar energy generation throughout Vermont, interest in on-farm solar generation has grown. For many communities, this has raised concerns about loss of valuable farm land and impacts to the visual landscape.

Local planners can protect primary agricultural soils (often referred to as “prime ag”) and the working landscape as a matter of town policy by acknowledging and promoting on-farm solar and active agricultural use on the same land.

For the farmer, a properly designed solar project can deliver electricity and/or income while supporting local efforts to preserve agriculture and move the state toward its energy goals.

Why Farm-Compatible Solar?

Farms use a significant amount of energy, including diesel fuel for tractors and trucks, heating oil and/or propane for buildings, water heaters, and greenhouses, and electricity for refrigeration, lighting, and ventilation. Dairy farms use a lot of electricity, especially for cooling the milk and for ventilation.

For farms seeking to reduce expenses, the generating electricity on the farm is appealing. Additionally, the possibility of a steady income stream for electricity generated beyond what the farm uses can be an important economic asset.

Important Consideration for Farmers

While solar can be an excellent opportunity to generate income, and reduce electricity costs, there may be more cost-effective efficiency improvements that should be considered a priority. For dairy farms,

collecting, cooling and shipping a high volume of product is energy-intensive. In addition, keeping barns lit and properly ventilated adds to energy use. Installing equipment that will reduce energy use, such as a plate cooler or a heat-recovery unit, can significantly reduce energy expenses.

Solar is not the only option available to farmers. Depending on location, a farm might find that wind generation is possible. Wind turbines have a smaller footprint than solar, for the same amount of energy generated. Farm-scale turbines come in a variety of sizes. On the small end, a wind turbine can generate enough electricity for the equivalent of two or three homes. A larger turbine can generate enough for a 100-cow farm.

More than Just Solar

This document focuses specifically on solar energy generation that's designed to be compatible with continued farming, whereby little or no land is taken out of production. Despite this focus, it should be recognized that there are other forms of on-farm generation that may be even more suitable for some agricultural operations. In addition, there are significant opportunities for on-farm efficiency improvements. Vermont Farm to Plate has analyzed food-system energy issues, including on-farm generation and efficiency. For more information go to

<http://www.vtfarmtoplate.com/plan/chapter/4-6-food-system-energy-issues>.



Anaerobic Digester, Vermont Technical College

Solar on Conserved Land

Conservation easement holders address solar in their guidelines. Generally, they support solar meeting up to 100% of the farm's usage, however they also provide guidance as to the footprint of the solar both as a percentage of the land base of the farm and as a total acreage. They may also recognize the potential for agricultural activity to occur within a solar facility. It stands to reason that the holder(s) of the farm's conservation easement would look more favorably on a proposal to amend the easement for solar if the agricultural usage was an inherent part of the proposal. Contact your easement holder to get their guidance document and to give them an idea of your potential project.

For larger farms, a methane digester may also be a viable option, although the financial investment in the equipment needed for generation using manure can be significant.

Before considering solar, farmers should check the ramifications of where a facility is sited. First, if the farm is located on conserved property, the land trust that holds the easement will need to confirm that renewable energy generation is allowed under the easement, particularly if over an acre of land is being dedicated to generation.

Second, the Current Use Program, has specific criteria (see inset on next page) regarding solar on lands enrolled in the program.

Important Considerations for Local Planners

When considering specific policy related to on-farm solar installations, the obvious focus is on soil types. Primary agricultural soils are those defined as having the best combination of physical and chemical characteristics for producing food, feed, forage, fiber and oilseed crops¹. Because of the value of these soils from a productivity standpoint, it is generally desirable to protect them from uses that would otherwise remove them from agricultural use.

Preference should be given to solar installations that utilize existing structures (such as the rooftop solar installation at the Ayers Brook Goat Dairy in Randolph – pictured on previous page). Rooftop solar is only viable on a south-facing roof when the structure can bear the weight of the system. For ground-mounted solar projects, local planners should understand that not all land being actively farmed includes primary agricultural soils. Communities developing policy around solar projects may want to identify a preference for ground mounted systems to be located on low quality soils when possible.

Finally, as is illustrated in the case studies on the next few pages, farming-friendly solar is possible. In our examples, several



A 150kW system with 572 solar panels, utilizing a south facing roof on the Ayers Brook Goat Dairy in Randolph, VT. Photo Source: Aegis Renewable Energy

¹ These soils are protected in Vermont statute, where they are defined in Title 10 (10 V.S.A. § 6001) as “An important farmland soils map unit that the Natural Resources Conservation Service of the U.S. Department of Agriculture (NRCS) has identified and determined to have a rating of prime, statewide, or local importance...” The USDA NRCS provides maps on-line via the “Web Soil Survey.” Soil maps are also found in the Vermont Agency of Natural Resources on-line maps.

farms have married on-farm solar with rotational grazing of livestock. Another has located their solar system in a buffer area required as part of their organic certification. As planners, it is important that we do not simply reject the concept of solar on farms or farmland out of hand. Instead, we need to consider how these

Solar and Eligibility for Current-use Taxation

To be eligible for use-value appraisal (the “current use program”), a solar array must be owned or leased by the farmer, with half or more of the electricity used on the farm. The land on which a solar array is placed cannot be enrolled in current use unless the facility itself is eligible – to be eligible, the solar facility must qualify as a “farm improvement,” as defined in Vermont law (32 V.S.A. § 3752(14)) – essentially the two criteria stated above. By the same token, a solar facility that is not eligible cannot be located on land enrolled in the current use program. If the land is in current use prior to the installation of a solar project, and the solar facility will not qualify as a farm improvement, the landowner must pay the land-use change tax to take the land out of the program.

The overlapping requirements of the solar property tax exemption and the current use program provide a twist – please review the details on page 2 of the Tax Department’s Technical Bulletin TB-69. It can be found here: <http://tax.vermont.gov/research-and-reports/legal-library/technical-bulletins>, and more general information on the current use program can be found here: <http://tax.vermont.gov/property-owners/current-use>, including removing your property from current use and paying the land-use-change tax.



Solar array in the buffer zone at the McKnight Farm

systems can benefit our farmers and how they can be utilized in conjunction with active farming to achieve our energy goals and protect the viability of agriculture in our communities.

On Farm Solar: Case Studies

Seth Gardner – McKnight Farm, East Montpelier

Medium sized organic dairy farm

A solar array of 416 panels provides 120,000 kilowatt-hours (kWh) electricity annually – which supplies nearly all he needs for the farm –the primary purpose for choosing to install the structures.

Seth chose to take advantage of his location and the incentives provided at the time for putting up a solar array on his farm. Catamount Solar built the array on 1.5 acres of land that is a buffer zone between his fields and a non-organic neighbors’ field. The land is rough with large areas of exposed bedrock.

“I was fortunate to have this spot – I needed a buffer between me and the next farm as I am organic and he is not. I was lucky in that it was close to the existing power line. It was a good use of land that I could not use otherwise” explains Seth.

Seth believes it is a good idea to combine solar panel arrays and farms – if there is good thoughtful planning beforehand. Siting is the biggest challenge he says, and it doesn’t make sense to put these on the prime farmland, but rather to seek out the least intrusive places that can reasonably support the structures and are near three-phase power lines. He points to a barn or building roof as ideal if the structure is adequate and the roof is well-exposed to sunlight. In Seth’s case, utilizing land that cannot be part of the farm production, is also an ideal spot. He is adamant that the farmer be involved with all stages of the project, including siting, construction, and payback schedules and receive full benefit of hosting a solar array on their farm.

Anna and Ben Freund – Open View Farm, New Haven

Diversified farm – maple, organic sheep and vegetables

Anna and Ben Freund lease the Open View farm from Burlington-based Cross-Pollination (Wayne Nelson and Paul Lekstutdis), which owns the farm and solar array that sits on 17 acres in the middle of what had been a cornfield along US Route 7 in New Haven. The array generates approximately 2.7 million kWh annually, enough for approximately 400 homes.



Sheep hanging out, using the solar array as a refuge from the heat on a hot day- Open View Farm

From the beginning the owners had intended to incorporate grazing sheep into their operation and advertised for a farmer to lease the site before the solar array was built. Original designs had the array on 40 acres with the intention of leaving enough space for haying equipment to pass around them. That plan was later deemed impractical and revised, and groSolar built the array on 17 acres, with the rows closer together. Once construction was completed, a 12-foot wire mesh fence was placed around the entire array.

The ground beneath was seeded with a sheep-grazing mix, with some additional birdsfoot trefoil and clovers added as it is a clay type soil that dries out quickly in late summer if there is no precipitation and those plants will perform in those conditions.

The array has worked well for the sheep operation, providing adequate forage and shade for the sheep in the heat of summer. Sheep are too small to be destructive to the panels and they keep the forage beneath them mowed down. Anna and Ben



Forage and shade opportunities are good under Open
View Farm's Solar Panels

partition the acreage inside the fence for a rotational grazing system, aligning their fences with the rows of solar panels. Anna says the greatest bonus for them has been the extra protection from predators the fence provides, such as during times when they have taken a vacation.

“It makes everything much simpler for a farm-sitter. We can put the animals inside the enclosure, and set up the electronet partitions, and all the person has to do is take one down as the animals need more forage. But they are inside the 12-foot fence, so we are relaxed when we are away knowing they are in a secure place.”

Anna feels there are a lot of positives for having solar panels on farms – such as the clean renewable energy source it provides, and farmers getting the benefit of rental fees or some other form of payment for hosting the panels - but has the same cautionary feelings expressed by others. The siting process must be thoughtful and deliberative to be most practical, and useful – and allowing farmers the input to the process. Each site has variables to

contend with, and each will need careful consideration.

Greg Hathaway – Maple Ridge Meats, Benson

Beef and Solar Enterprise

Hathaway Farm formerly operated as a dairy. Greg Hathaway, grandson, decided he wasn't interested in dairy, but wanted to raise beef cattle and has created a commercial slaughterhouse at the farm. As Maple Ridge Meats, the Hathaway's raise 250 head of beef cattle on their 650-acre farm. They process their own beef and provide the same services to producers from all over New England.

Greg thought it prudent to include alternative power generation as second revenue source for the farm. He investigated several solar developers and decided on the Green Lantern Group, based in Waterbury, VT. Working with Sam Carlson of Green Lantern Group, a 150-kW ground-mounted, group-net-metered solar array was installed over five acres, on a portion of land that has a Vermont Land Trust easement. Maple Ridge Meats will receive a monthly rental fee from Green Lantern.

This is first instance of grazing beef cattle under solar panels in Vermont. Greg says “Since [the array] has to be fenced, if that area was not grazed, it would be wasteland. So it really makes sense to have animals graze beneath the panels.”

Greg plans to use the area with panels for cows during calving season. It's close to the barn and provides some shelter – yet open air for animals. Then once they are moved



Still to be seeded down before cows come- Maple Ridge Meat

on, he will use the area for yearlings to graze. The animals are smaller, so that will help in handling them while learning how to manage cattle within the solar array.

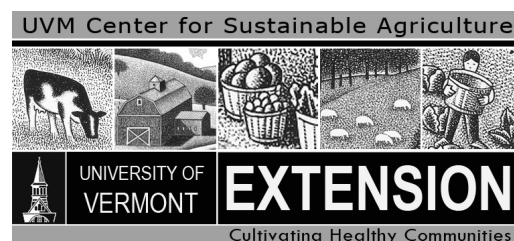
Greg feels very strongly that all ideas should be thought through and discussed before embarking on a solar array project. “The farmer knows the land and probably has a good idea of how they want it used. You also have to think about whether the income from this will offset the loss of that land. And whether the array is to be set up for machinery to pass through too or clustered closer together – but then losing some ability for vegetation to grow beneath due to being shaded out. Lots to think about.”

Conclusion

All of these farmers were pleased with the arrangement they had made for the dual purposes of grazing and providing land space for solar panel arrays. Yet each one of them also mentioned a deep commitment to preserving the best agricultural land for agricultural uses

first – and thus the common refrain of thinking it all through before any breaking of ground.

The structures are large and change how the land is used. All encouraged the idea of using lower-impact places such as a roof or land that cannot be used for agricultural purposes, first. And secondly, the importance of a revenue source to the farm/farmer for the use of that land supporting the solar array.



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