Putney Green Acres Solar LLC

Aesthetics, Orderly Development and

Above-Ground Historic Sites Assessment Report

January 25, 2021

I. Introduction

This report was prepared by Norwich Technologies on behalf of Putney Green Acres Solar LLC ("Applicant") to assess the proposed 500kW solar net-metered project to be installed off River Road South in Putney, Vermont (the "Project"). This report assesses the Project's potential impacts under the aesthetics, above-ground historic sites, and orderly development review criteria of 30 VSA § 248(b)(1) & (b)(5) and Vermont Public Utility Commission Rule 5.100.

II. Project Description

The Project is typical of an installation of its type and size, comprising of photovoltaic modules on fixed-tilt ground mounted racks, anchored to the ground using purpose-built post foundations.

The principal Project components include:

- multiple rows of solar panels[1] mounted on a racking system anchored to the ground;
- ten (10) string inverters each having a capacity of 50 kW (AC), for an aggregate nameplate capacity of 500 kW (AC) mounted on the racking system;
- electrical lines enclosed in conduit connecting the panel rows, string inverters, AC combiner panel and AC disconnect pedestal;
- three (3) 167 kVA pole-mounted transformers on a GMP distribution pole
- a GMP line extension to connect to the existing GMP distribution system
- energized equipment rated for outdoor use, securely shielded by locked enclosure covers and otherwise compliant with NEC code "Guarding of Live Parts."
- Access off an existing drive from River Road South.

III. Landscape & General Viewshed Character

The Project site area is in the north-western portion of the 20± acre parcel. The property is the site of the Putney Paper capped landfill and is predominantly open with wooded areas along the east, south and west boundaries. Other than monitoring wells throughout the parcel, no structures are present on the parcel. The parcel is located between the Connecticut River to the south and the New England Central Railroad tracks and Interstate 91 corridor to the north. The array is proposed on the level terrain which is approximately 60 ft above the Connecticut River. Access to the project site will be from the northeast, immediately south of the River Road South /Interstate 91 underpass at the existing road between Interstate 91 and the railroad tracks. This area of Putney south or east of Interstate 91 consists of predominately level terrain adjacent to the Connecticut River with a mix of agricultural and industrial development. The Interstate, railroad and accompanying roadside vegetation dissect the parcel from offsite views into the property. The site is not identified as a scenic resource in the Putney Town Plan.

IV. Aesthetics Analysis

A. The Quechee Test

PUC Rule 5.112(A) provides that in determining whether a net-metering system satisfies the aesthetics criterion contained in 30 V.S.A. § 248(b)(5), the Commission applies the so-called "*Quechee* Test" as described in *In Re Halnon*, 174 Vt. 515 (2002):

> (1) Step one: Determine whether the project would have an adverse impact on aesthetics and the scenic and natural beauty of an area because it would not be in harmony with its surroundings. If the answer is no, then the project satisfies the aesthetics criterion. If yes, move on to step two.

[1] The exact number and wattage will be determined at time of procurement.

(2) Step two: The adverse impact will be found to be undue if any one of the three following questions is answered affirmatively:

(a) Would the project violate a clear, written community standard intended to preserve the aesthetics or scenic, natural beauty of the area?

(b) Would the project offend the sensibilities of the average person?

(c) Have the applicants failed to take generally available mitigating steps that a reasonable person would take to improve the harmony of the proposed project with its surroundings?

Under PUC Rule 5.112(B), in order to determine that a project would have an adverse impact on aesthetics and the scenic and natural beauty, the project must be found to be out of character with its surroundings. Specific factors used in making this evaluation include the nature of the project's surroundings, the compatibility of the project's design with those surroundings, the suitability of the project's colors and materials with the immediate environment, the visibility of the project, and the impact of the project on open space.

B. General Viewshed Characterization

The Project site has been examined using aerial photographs, online topographic data, and in-person site visits. The Project's viewshed will be limited to areas within proximity of the array, as documented in the Photographs from River Road South and the surrounding area. The photo locations are identified on Figure 1, a Google Earth presentation of the area surrounding the Project.

Photo 1- View from within the array area to the southwest. Background ridgeline view is across the Connecticut River in New Hampshire.

Photo 2– At the site entrance from River Road South, view is west. Interstate overpass is north of the Project array. The Project site is 1340+ feet generally west of this location, completely out of view.

Photo 3 – From along existing access road and railroad crossing into the site, view is south where the array will be in the background. Existing vegetation

along this northern boundary will minimize visibility of the array from the railroad and the Interstate corridor.

Photo 4 – A screen capture from Google Maps Streetview from Interstate 91, view is to the southeast towards the Project site approximately 350 feet south, behind the roadside vegetation. The existing vegetation along Interstate 91 as well as on-site vegetation along the northern property boundary will screen visibility of the Project.

Figure 1 – Google Map representation of the photograph locations illustrating the solar project location between the Interstate 91 and railroad to the north and Connecticut River to the south.

C. <u>Aesthetic Impact Assessment</u>

Based on the design of the Project, the low-profile of the array and the characteristics of the surrounding landscape in the area, the array viewshed is expected to be very limited and primarily from areas within proximity of the array. The viewshed is highly constrained by the Interstate 91 and property existing vegetation and the on-site level terrain. Views from other public vantage points are shielded by topography, mature forests, and vegetation and tree lines along the roads.

The Project elements are consistent with other renewable energy solar arrays commonplace in and around Vermont and compatible with its surroundings. The footprint, relative to the surrounding landscape, is localized and will not adversely impact open space in the area. The Project site is on property of a closed landfill. Along the northern boundary of the property, the array will be set back approximately 215 feet from Interstate 91, the nearest public road which is 10± feet higher in ground elevation. Views along Interstate 91 will be almost entirely screened by existing roadside vegetation and northern property boundary existing vegetation. The array will not be a dominant element in this landscape.

Because the Project is compatible with its surroundings and there will be very limited views of the array, its potential visual impacts are not found to be adverse. Additionally, the Project has been certified by the Agency of Natural Resources Solid Waste Management Program (SWMP) certifies that the former Putney Paper (Green Acres) closed landfill is a sanitary landfill as designed in 10 V.S.A. § 6602 and is suitable for the development of a photovoltaic project, qualifying it under the PUC Net Metering Rule 5.103 as a preferred site. While the conclusion is that the Project will not have an adverse impact, nevertheless the *Quechee* Analysis is continued under its second prong to ascertain whether any potential adverse impacts are undue.

1. Is the Project shocking or offensive to an average person?

No. "[T]he Quechee test did not guarantee that the aesthetic qualities of an area would not change."[2] As used in *Quechee*, the average person means "the average member of the viewing public who would see a particular project from the vantage point of the public" and "from an objective, as opposed to subjective and neighborly, perspective."[3] To reach the threshold of being "shocking or offensive," the size or scale of the project would need to be "overwhelming."[4] The factors considered when addressing this question include the form of the project, its presence in the landscape, how it might be observed and the characteristics of those observers.

The proposed Project will not be shocking or offensive to the average person. Visibility potential of the Project is very limited. The scale of the Project is not overwhelming or excessive. Its low-profile presence in the lower section of landscape is compatible with its surroundings. The Project will connect to the existing electric distribution system along River Road South. New GMP transformers mounted on a GMP distribution pole, typical of pole/transformers used in the Green Mountain Power service area around the state will be used. Neither the size or scale of the installation would be shocking or offensive to the average person.

2. Does the Project violate any clearly written community standard?

The Project will not violate any clear community standard or land conservation measures contained in the Putney Town Plan (the "Town Plan") or the Windham Regional Plan (the "Regional Plan") or Windham Regional Energy Plan (the "Regional Energy Plan"). In fact, the Project will further the goals of each plan to encourage the development of renewable energy sources. Relevant excerpts of each plan are included as Appendices A through C to this Report.

[2] *In re Amended Petition of UPC Wind*, 2009 VT 19, ¶ 27.
[3] *In re Petition of Rutland Renewable Energy, LLC. for Certificate of Public Good Pursuant to 30 V.S.A. § 248*, 2016 Vt. 50, ¶ 22.
[4] *Id.*

Putney Town Plan (Adopted December 16, 2015)(Excerpts included in Appendix A):

The Town Plan acknowledges that global climate change has been the direct result of human created greenhouse gas emissions and to curb the worst impacts of climate change, the state of Vermont has adopted a 90 by 50 energy goal. The Town Plan states, "Renewable energy is one of the most important tools we have to combat a changing climate…" (Town Plan p.86). Further, the Town Plan specifies that photovoltaic solar electric generation systems are the preferred method of increasing new renewable energy generation within Putney.

> Solar Photovoltaic (PV) or Solar Electric systems yield electric power directly from sunlight exposure. These systems emit no noise or air pollution, and can be installed on businesses, homes, or schools with a minimum of disruption. Systems can help lower electric usage and significantly reduce greenhouse gas emissions. (Town Plan p.88)
>
> PV is clearly a wise energy investment with great environmental benefits. (Town Plan p.89)

The Town Plan goes further to encourage the growth of local renewable energy by concluding the energy section with the following statement:

> In sum, Putney must take action to create a more sustainable energy future: one that minimizes environmental impact, emphasizes energy efficiency and conservation, and supports our local economy by using regional renewable energy and food sources. (Town Plan p.93)

To detail the Town's commitment to this statement, the town established two goals related to renewable energy.

> Goal 2: To use local renewable energy resources that have been developed in a sustainable manner. (Town Plan p.94)
>
> Goal 3: To reduce Putney's dependence on nonrenewable and imported energy sources. (Town Plan p.94)

These goals are clarified and further specified by the following energy policies:

> 2.1 Encourage the sustainable development and use of local energy resources. (Town Plan p.94)
>
> 2.2 Ensure ongoing access to sources of renewable energy production, including solar, wind, and biomass, wherever feasible and consistent with the Town's planning goals. (Town Plan p.94)
>
> 3.2 Promote use of renewable energy sources. (Town Plan p.95)

The Project does not violate any clear written community standard and indeed supports community goals and policies related to fulfilling Putney's energy goals and policies as described in the Town Plan.

Windham Regional Plan (September 30, 2014 and Windham Regional Energy Plan (Amended April 24, 2018)(Excerpts included in Appendix B and Appendix C):

The Regional Plan and Regional Energy Plan pay considerable attention to the growing urgency for energy resiliency in conjunction with the reduction of greenhouse gas emissions (Regional Plan at 17-18):

> Dependence on both external sources of energy and large-scale infrastructure places the region in a vulnerable position with regards to energy security. While it is acknowledged that these sources are integral parts of a much larger and complex energy system, it is prudent for the region to consider options to increase energy security and stability during times of shortages and outages. **The WRC will support diversification of energy sources in the region, redundancy of systems to support critical functions in times of supply interruptions as well as net-metering, off-grid, and community-scaled, distributed generation projects to enhance self-sufficiency and resiliency.**
>
> The combustion of carbon-based fuels releases greenhouse gas (GHG) emissions into the atmosphere contributing to alteration of the climate. The region's current energy demand relies heavily upon fuel combustion. Energy consumed for transportation, space heating, and electricity generation accounts for more than 80 percent of Vermont's annual statewide GHG emissions. Increases in energy conservation and efficiency in the region, coupled with a greater reliance on low GHG-emitting energy sources and renewable energy, will help reduce overall GHG emissions.
>
> Renewable energy is generally defined as any energy resource that is naturally regenerated over a human time-scale, including sources derived directly from the sun (such as thermal, photochemical, and photoelectric), indirectly from the sun (such as wind, hydropower, and photosynthetic energy stored in biomass), or from other natural movements and mechanisms of the environment (such as geothermal and tidal energy). The "renewable" characteristic of these energy resources means that they are not as vulnerable to supply disruptions and the increasing costs and volatility associated with a finite fuel source like fossil fuels. Although all energy sources create negative environmental impacts, renewable energy technologies are comparatively clean sources of energy that can have a much lower environmental impact than conventional energy technologies. **The WRC will support the development and use of renewable energy resources that enhance energy system capacity and security, promote cleaner, more affordable energy technologies, increase the energy options available locally, and avoid undue adverse impacts of energy development on the local community and environment.**

The Regional Plan goes even further to support the continued integration of net metered electrical projects by unequivocally stating:

> Support the State in achieving its Total Renewable Energy and Comprehensive Energy Plan goals through avenues that maintain an adequate, reliable, and economical energy supply without causing undue adverse impacts to humans and the environment.
>
> Support the continued availability and use of net metering electrical systems, including both individual and group net metering installations.
>
> Support sound energy facility siting practices by ensuring that new developments give adequate attention to facility siting requirements, development constraints, natural resource protection, and land use compatibility.
>
> With regard to all energy generation, transmission, and distribution projects:
> a. Adhere to a high environmental standard that includes avoiding negative environmental impacts to the extent possible and adequately minimizing and mitigating those that cannot be avoided;
> b. Conduct thorough and proper studies and analyses of all anticipated socioeconomic and environmental impacts, both positive and negative;
> c. Adequately address all areas of concern regarding proposed developments; and
> d. Effectively and adequately address all issues related to facility operation and reliability.

(Regional Plan at 19-20)

The Project does not impact natural resources as evidenced in Exhibit PBF DB 2, the Natural Resource Assessment and aligns with, and progresses the goals in the Regional Plan, as demonstrated by the materials included with the net metering CPG application submitted.

The Regional Energy Plan meets the requirements for enhanced energy planning (24 VSA § 4352). Excerpts are included in Appendix C to this Report. Like the Town Plan, the Regional Energy Plan promotes the region's diversification of energy sources and development and use of renewable energy systems.

> The WRC will support diversification of energy sources in the Region, redundancy of systems to support critical functions in times of supply interruptions as well as net-metering, off-grid, and community-scaled, distributed generation projects to enhance self-sufficiency and resiliency. (Regional Energy Plan p.9)

> The WRC will support the development and use of renewable energy resources that enhance energy system capacity and security, promote cleaner, more affordable energy technologies, increase the energy options available locally, and avoid undue adverse impacts of energy development on the local community and environment. (Regional Energy Plan p.10)

To qualify for enhanced energy planning, the Regional Energy Plan works to accomplish the goals set by the state of Vermont to achieve its 90 by 50 goal. The Regional Energy Plan details that "In order to achieve the 90x50 goal, a targeted total for the Region is 58,493MWh, or 45 MW capacity needed in new renewable energy generation." (Regional Energy Plan p.28). To achieve this increase in new regional renewable energy generation the WRC states:

> This generation target can be met with a variety of different technologies, though solar and wind generation have the highest capacity in both the Region and State. Although local energy generation siting concerns are real and are addressed below, 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, nuclear waste, oil spills, and devastating climate impacts. (Regional Energy Plan p.28)

The Regional Energy Plan discusses the variety of technologies which can be used to accomplish this renewable energy goal. The WRC concludes that "the capacity for energy generation through sources other than wind and solar are limited. Therefore, the bulk of the generation targets will need to be met by wind or solar as their generation capacity is much greater." (Regional Energy Plan p.32) The Project will further the goals of the Regional Energy Plan using one of the technologies outlined as preferred by the WRC. To achieve the targets set out in the Regional Energy Plan, the WRC established a list of Land Use policies and goals related to energy. Three of these goals are specific to renewable energy development and achieving the state of Vermont's 90 by 50 goal.

> Energy Goal 1: Ensure that all energy generation, transmission, and distribution projects further the regional goals for providing a reliable, sufficient, and economical energy supply to the region, promoting energy conservation and efficiency, and furthering the development of energy sources that have zero or low GHG emissions (Regional Energy Plan p.57)

> Energy Goal 3: Support the State in achieving its Total Renewable Energy and Comprehensive Energy Plan goals. (Regional Energy Plan p.57)

> Energy Goal 11: Support the continued availability and use of net metering electrical systems, including both individual and group net metering installations. (Regional Energy Plan p.58)

To accomplish these goals, each of the towns within the WRC planning area is assigned a portion of the regional energy target. The Regional Energy Plan established Putney's goal is 2,701 MWh which equates to approximately 2.08 MW of new renewable energy capacity according to the ratio established on page 28 of the Regional Energy Plan. The Project will contribute to achieve this goal by adding 150 kW additional renewable energy capacity from one of the technologies listed as preferred by the Regional Energy Plan.

In consideration of both the local and regional plans, the Project will not violate any clear, written community standards and indeed helps to further the goals outlined in these plans.

3. Has the Applicant taken reasonably available mitigating steps to reduce the Project'svisual impacts?

Yes. As noted above, the low-profile array and careful site selection will largely shield off-site views of the Project. As well, existing topographic changes and roadside vegetation within the property will add to mitigation of potential visual impacts.

D. Aesthetics Conclusion

The Project will not have an undue adverse impact with respect to the aesthetics or scenic beauty of the area.

V. Orderly Development of the Region

30 V.S.A. § 248(b)(1) requires that a project not unduly interfere with the orderly development of the region, with due consideration to the recommendations of the town and regional planning commissions, town selectboards, and the land conservation measures contained in the plan of any affected municipality." This criterion "relates to the orderly development of the region, not to a particular municipality within the region."[5],

On a regional basis, the Project's impacts are localized and minimal. The array has a low profile in the landscape and the character and components of the array and associated equipment is visually consistent with similar solar projects seen throughout Vermont and is suitable for the context in which the array will be located.

Section 248(b)(1)(C) also provides that, with respect to an in-state electric generation facility, the Commission shall give substantial deference to the land conservation measures and specific policies contained in a duly adopted regional and municipal plan that has received an affirmative determination of energy compliance. As noted previously, the Windham Regional Commission has adopted an Enhanced Energy Plan. The Town of Putney has not received certification for an Enhanced Energy Plan. Notwithstanding, we confirm that the Project will not unduly interfere with the orderly development of the region, with both the due consideration and substantial deference standards in mind.

As demonstrated by the prior section of this report, the Project is compatible with applicable policies and goals in both the Putney Town Plan, the Windham Regional Plan and Windham Regional Energy Plan, and in fact will further the renewable energy policies and goals stated in both plans.

Review of the Project results in the conclusion that the Project will not unduly interfere with the orderly development of the region.

[5] *In re Petition of Rutland Renewable Energy, LLC for Certificate of Public Good Pursuant to 30 V.S.A. § 248, 2016 Vt. 50, 9.*

VI Above-Ground Historic Resources

The Commission utilizes the three-part test articulated by the Environmental Board in its *Middlebury College decision* to evaluate impacts on historic sites.[6] The first issue is whether any resources, including the proposed Project site, are historic sites. The second issue is whether the proposed Project will adversely impact the historic sites. Adverse impacts include effects on the setting and landscape, "which are incongruous or incompatible with the site's historic qualities, including but not limited to . . . new visual, audible or atmospheric elements."[7] The final issue is whether the proposed Project's adverse impacts on the historic sites are undue. Much like the *Quechee* Test, adverse impacts for historic properties are considered undue when one of the following conditions is met:

> (a) The failure of an applicant to take generally available mitigating steps which a reasonable person would take to preserve the character of the historic site;
>
> (b) Interference on the part of the proposed project with the ability of the public to interpret or appreciate the historic qualities of the site;
>
> (c) Cumulative effects on the historic qualities of the site by the various components of a proposed project which, when taken together, are so significant that they create an unacceptable impact; and
>
> (d) Violation of a clear, written community standard which is intended to preserve the historic qualities of the site.[8]

The Project has been reviewed for potential impacts in accordance with these standards. There is one historic site within a half-mile radius of the Project site. This site is the Taylor House (State Historic Survey Number 1313-18). The Taylor House is located approximately 890 feet northwest of the Project.

The solar array will not be visible from the Taylor House. There are existing mature trees on the south side of River Road South, on both sides of the interstate corridor and the railroad, as well as along the northern boundary of the parcel on which the Project is sited. Therefore, the Project will have no impact on visitors interpreting this historic site.

Phase I and Phase II archaeological surveys were conducted in 1994 and in May 1995 the Division of Historic Preservation concurred with the recommendations of the Phase II study that "…no further archaeological work needs to be conducted on the site". (May 15, 1995 letter to Turk Ellis Putney Paper Co from VDHP Eric Gilbertson).

The Project will not create an adverse impact on the Taylor House or any other historic structures.

[6] *Petition of Rutland Renewable Energy, LLC,* Dkt. 8818, Order of 3/11/15 at 57 (citing *Petition of Green Mountain Power Corp. et al*., Docket 7628, Order of 5/31/11 at 107; *Petition of Georgia Mountain Community Wind*, Docket 7508, Order of 6/11/10 at 62; *Amended Petition of UPC Vermont Wind, LLC,* Docket 7156, Order of 8/8/07 at 78; *In re Middlebury College*, No. 9A0177-EB (V.E.B. Jan 26, 1990)).
[7] *Petition of Rutland Renewable Energy, LLC,* Dkt. 8818, Order of 3/11/15 at 58
[8] *Id.*

Appendix A

TOWN OF PUTNEY, VERMONT

Town Plan

Adopted December 16, 2015

TABLE OF CONTENTS

Solar

Globally, the potential of solar energy is several hundred times the amount of energy we will ever need.[107] The total solar power potential received by the earth is 10,000 times as much energy as the current world population uses. Putney has much of its settlement open to southern sun exposure that allows capture of solar energy. Solar energy comes in many forms, briefly summarized below:

Solar thermal: Solar thermal devices use direct heat from the sun, collecting the heat and transferring it to the domestic hot water supply. Solar thermal energy can displace electricity, oil and propane as fuel sources to heat domestic hot water or water used for heating. This is the simplest way to use free renewable energy to heat your home or water.

Residential Solar Hot-water Heating

Active solar heating: There are two types of active solar heating systems: liquid and air. These systems collect and absorb solar radiation, then transfer the solar heat directly to the interior space or to a storage system, from which the heat is distributed, much like an oil-fired boiler An auxiliary or back-up system can provide additional heat if necessary. Liquid systems are well suited for radiant heating systems and boilers with hot water radiators.

Passive solar design: Passive solar design uses the sun's direct energy for the heating and cooling of living spaces. In this approach, the building itself, or some element of it, takes advantage of natural characteristics (convection and thermal mass) in materials and air created by exposure to the sun. Passive systems are simple, have few moving parts, and require minimal maintenance and no electrical input.

Passive design is practiced throughout the world and has been shown to produce buildings with lower energy costs, reduced maintenance, and superior comfort. Most of the literature pertaining to passive solar technology addresses heating concerns. This information is useful and relevant in our area; however, cooling issues, which are equally important in Vermont, are less well documented. Key aspects of passive design include appropriate solar orientation, the use of thermal mass, appropriate ventilation, and window placement. Daylighting and the use of light tubes are a great way to augment the interior lighting for a dwelling or business.

Photovoltaic or solar electric: Solar Photovoltaic (PV) or Solar Electric systems yield electric power directly from sunlight exposure. These systems emit no noise or air pollution, and can be installed on businesses, homes, or schools with a minimum of disruption. Systems can help lower electric usage and significantly reduce greenhouse gas emissions. On average, producing 1000 kWh of electricity with solar power instead of a fossil fuel source reduces emissions by

[107] AmericanEnergyIndependence.com

nearly 8 pounds of sulfur dioxide, 5 pounds of nitrogen oxides, and more than 1,400 pounds of carbon dioxide. PV is clearly a wise energy investment with great environmental benefits. The solar capacity currently installed in the United States can expected to offset 16.8 million metric tons of CO2 per year.[108] PV systems are expected to last 30 to 50 years with very little maintenance.

Community Solar: More people are opting to purchase into community solar programs, where a solar electric systems are installed in central locations. These are connected to the existing electric grid, and offer several benefits; optimal location for power generation, 30 year warranties, no onsite equipment or new roof required, view shed preservation, and the ability to move to a new home or business location and still receive the benefits of renewable energy generation.

Ground Source Heat Pumps (sometimes referred to as Geothermal Energy)
The earth is a great reservoir of heat and moderator of temperatures. The temperature at about ten feet underground remains a steady 45 to 50 degrees Fahrenheit throughout the year. This is cold enough to cool housing in summer and warm enough to use with a heat pump (reverse cycle air conditioner) in winter to supply heating. Geothermal heat pumps (GHPs) use 25 – 50% less energy than conventional heating systems. GHPs also improve humidity control by maintaining about 50% relative indoor humidity, making them very effective in humid areas. There are two types of systems typically used: closed loop pumping of deep-water wells, and tubing grids laid in excavated trenches. Putney has geothermal resources in many locations. GHPs can be installed on any parcel that has adequate room for trenches or a deep unused well. An example of a geothermal heat pump system is in place at the West Hill Shop. There, groundwater is circulated from a deep well through the heat-pumps using a closed loop. Latent heat is extracted from the groundwater through a water-to-water heat exchange process during the heat-pump operation, adding to the heat generated by the heat-pumps. The combined heat from the heat pumps is then used to heat water for the building heating system through the use of a heat-conduction tubing within the concrete floor.

Air Source Heat Pumps
These are relatively new, and less expensive than ground source pumps, because no trenching or water pumping is required. Air sourced heat pumps and mini splits work under the principles of vapor compression refrigeration, an ASHP uses a refrigerant system involving a compressor and a condenser to absorb heat at one place and release it at another. New units are very efficient and can be installed on a small footing outside the home. When properly installed, an air-source heat pump can deliver one-and-a-half to three times more heat energy to a home than the electrical energy it consumes.

Heat Pump Water Heaters
There is a new breed of heat pump based water heaters which use the same compressor technology as all heat pump systems to heat water from the surrounding air. The added

[108] http://www.seia.org/research-resources/cutting-carbon-emissions-under-111d-case-expanding-solar-energy-america

advantage is that installing one of these systems into your basement also helps de-humidify the air. Some systems are of hybrid design with electric coils as a backup, or with a second fluid coil to allow external heat sources for alternative heating of the tank.

Note - heat pumps are not an energy source, heat pumps use electricity to more efficiently provide heating and cooling needs. It makes no difference if you use the grounds latent energy, or extract from the air you still move it with electricity.

Conservation and Efficiency

Any energy plan must include the most abundant local energy "source" available to us: ***conservation and efficiency***. Every kilowatt of electricity not used, and every dollar saved on reduced heating costs, is that much more money in our pockets and in the local economy. Increased efficiency can mean more viable businesses and greater economic security. This is available to us with no reduction in the quality of service or the standard of living, and with no degradation to our natural environment. Vermont's energy efficiency utility, Efficiency Vermont, promotes programs based on this principle. It has focused primarily on electrical efficiency and conservation, but is branching out into thermal efficiency programs, which focus on making buildings more efficient through techniques like weatherization. https://www.efficiencyvermont.com/ offers homeowners and businesses, information on rebates, weatherization professionals, best practices and a whole range of services that can help you save energy.

Conservation is reducing the use of existing in-place technology, like turning the light off when you leave the room, or installing occupancy sensors that work to turn off lights when not needed.

Efficiency is replacing the incandescent bulb with a fluorescent or better yet an LED bulb, or replacing your aging car with a new hybrid or full plugin electric. Conservation is behavioral: it is low cost, but has to be learned and reinforced over time. Efficiency requires expenditures for new or improved infrastructure: it has an up-front cost, but with a quick return on the investment. Both conservation and energy efficiency should be employed to reduce energy use.

In order for us to make the most out of renewable and other energy sources, we must start by making every home and building, (new and old), energy efficient. Putney, like most Vermont towns, has an aging housing stock in need of weatherization upgrades. A key first step to heating using any type of energy source efficiently, whether renewable or otherwise, is retrofitting buildings with air sealing, insulation, programmable thermostats, and energy efficient doors and windows, which all reduce energy use. Installing energy efficient appliances and lighting conserves electrical energy. Much of this is done as part of periodic building upgrades or by owners who are concerned about energy use.

Certified energy audits are an important first step to analyzing how to spend energy efficiency dollars wisely. Audits are conducted by several local businesses, and local non-profit SEVCA (Southeastern Vermont Community Action), which has a weatherization program.

The Vermont Residential Building Energy Code established technical requirements for energy efficient home construction. The Code promotes tight construction methods, high levels of

building insulation, and new for 2005, requirements for automatic ventilation systems. Upon completion of home building, builders and some owner-builders are required to file with the Vermont Department of Public Service and the local Town Clerk. Compliance is mandatory, but certification is through a self-certification process. There is currently no enforcement at the state or local levels.

The level of energy efficiency Putney can achieve in the future will depend partly on the level of incentives offered by the state and federal governments. The development of newer and even more efficient technologies and appliances will make incentives even more important. The Town can make sure that everyone is aware of both new energy efficient products and the incentives available for them. As mentioned previously, because incentives may be limited over time, developing financing mechanisms is an important step for long-term energy efficiency.

Even simple self-controlled activities such as recycling, and monitoring hot water use can positively affect energy conservation. Establishing ride-share lots and improving pedestrian and bicycle infrastructure can serve as incentives to modify automobile behavior.

On a municipal level; the municipality has received weatherization grants for the town hall and has implemented a timeline for weatherizing other municipal buildings, like the fire station. The Town has a Green Energy Fund that it set up for energy and weatherization improvements to municipal buildings. This funds LED lighting, and upgrades to the building envelope and weatherization upgrades.

Land Use and Transportation

Effective land use planning, subdivision design, building orientation, construction, and landscaping provide opportunities at every scale for energy savings in new construction. More energy is consumed by a widely dispersed population, both in transportation and in greater electric use, to compensate for electric transmission losses over longer power lines required to service dispersed housing. At the parcel level, the siting, design, and construction of buildings can strongly influence the amount of energy needed for heating as well as the amount of electricity needed for lighting.

Building Siting

New development located close to the major roads and existing settlements will minimize the energy consumed by residents commuting and will reduce the energy required to deliver essential services to residents and businesses. Clustering, which sites houses closer together in order to preserve open space, and other energy efficient development patterns can reduce overall energy consumption while also preserving open space.

Encouraging mixed-use development in the village center and close to roads can reduce reliance on the automobile, miles traveled by vehicles, and inherent system energy costs; including costs associated with maintaining roads and related infrastructure. Targeting growth within areas most suitable to concentrated development (such as Putney Village, which is a designated village center) allows residents to walk or bike to their destinations. It also improves the feasibility of public transit between areas of higher population density.

Zoning revisions should consider the energy impact of future development and should encourage settlement patterns that reduce this impact.

Vehicle Idling

In June 2007, the Selectboard passed a "no idling" resolution, which limits idling to two minutes. (Exceptions were included for refrigeration trucks, idling when required to repair the vehicle, idling required to operate equipment, or idling for health and safety, as some emergency vehicles require). The motivation for a no idling policy was to help reduce CO_2 emissions, protect respiratory health, and reduce noise. The Putney Energy Committee posted signs throughout the Village to educate drivers about the resolution. In May of 2013, Vermont Gov. Peter Shumlin signed into law S.150, which includes a provision prohibiting idling of motor vehicles. The law became effective May 5, 2014; it limits the idling of all motor vehicles while parked to five minutes in any 60-minute period, with exceptions.[109]

Future energy needs and possibilities

As the region continues to warm in the coming decades, dramatic changes are projected - changes that have the potential to alter many aspects of our region's climate that are vital to its economy, ecosystems, character, and quality of life. These changes are expected to grow in the future.[110] Since the effects of the heat trapping emissions responsible for climate change have consequences that reach far beyond their sources, we cannot control them at our local level. But we can work toward independence from fossil fuels, promote renewable energy sources, and increase energy conservation and efficiency on local and regional levels.

Rising fuel energy prices and disruptions of petroleum supplies demonstrate that we cannot rely on finite energy sources indefinitely. Furthermore, experts predict that oil prices will become volatile as supplies decline in the future.[111] The predicted pace of rising prices and declining supplies vary; in fact, new supplies of natural gas in North America *may* provide an affordable fuel source in coming years. Still, decreasing or eliminating dependence on petroleum resources is necessary for a long-term, reliable, and affordable energy future that minimizes climate change.

Putney's energy security depends on finding ways to reduce and mitigate our dependence on non-renewable energy sources. The era of consistently affordable fossil fuel energy is over. Homes and business must weatherize their structures to economize fuel use, and consider heating with more sustainable technologies that utilize naturally available energy sources. Putney must have more alterative transportation options, ranging from more park and ride facilities to bike share programs to passenger rail service in Putney. Putney's future regulations must be written to

[109] 23 V.S.A. § 1110. Prohibited idling of motor vehicles

[110] Climate Change in the US Northeast, A Report on the Northeast Climate Impacts Assessment Union of Concerned Scientists October 2006

[111] Peaking of World Oil Production: Impacts, Mitigation, &Risk Management. Robert L. Hirsch, SAIC, Roger Bezdek, MISI, Robert Wendling, MISI. US Dept of Energy publications February 2005.

allow (and where necessary, regulate) renewable energy production, maximizing the benefits of distributed generation while respecting property rights and the towns' character.

As part of planning for a secure energy future Putney should consider developing an Energy Descent Action Plan (EDAP) as a path toward eliminating dependence on fossil fuels. An EDAP is a local plan for creating an economy that is not reliant on fossil fuels, it encompasses all aspects of the town, from local business and farmers to the road crew and EMT personnel. This is a true multi-disciplinary effort

In sum, Putney must take action to create a more sustainable energy future: one that minimizes environmental impact, emphasizes energy efficiency and conservation, and supports our local economy by using regional renewable energy and food sources.

Goal 1: To reduce energy consumption in Putney

Policies

1.1 Support programs for energy auditing, retrofitting, and weatherizing existing dwellings, especially for low and moderate-income households.

1.2 Encourage use of energy efficient electrical devices, lighting, and appliances in municipal buildings.

1.3 Ensure that new construction in Putney is in compliance with Vermont's building energy codes.

1.4 Continue to support and encourage greater resident and business participation in recycling.

1.5 Revise the town's no-idling policy for all vehicles to support and match the state policy, adding further restrictions as needed to preserve village noise and safety standards, unless doing so is determined to be infeasible.

1.6 Support educational programs and workshops designed to help people reduce energy usage.

Priorities for action

1.1 The Putney Energy Committee shall assist the Putney Planning Commission analyze existing zoning bylaws for barriers to efficiency and conservation efforts.

1.2 Replace incandescent lamps and older design fluorescent fixtures with new high efficiency LED models in all municipal buildings, both interior and exterior locations.

1.3 Research ways to ensure that homeowners and businesses adhere to the energy code, possibly including shared building inspectors, incentives for participating in voluntary inspection programs, and educational materials. Begin by researching the extent to which the code is or is not followed in Putney.

1.4 Develop and carry out a plan to implement the recommendations of energy audits in all municipal buildings. Audit other municipal buildings and create a timeline for needed work

1.5 Work with organizations receiving funding from the Town to obtain and implement the recommendations of a certified energy audit.

1.6 The Putney Energy Committee shall develop and collect educational materials to include with building permits that encourage the use of ENERGY STAR® building certification by builders.

1.7 The Putney Energy Committee shall work with the town to implement a dual battery system that can be installed to evaluate one EMT vehicle. Based on the results of this trial run the committee would make a recommendation on installing dual battery systems in municipal/ fire/ emergency vehicles to allow uninterrupted operation of lighting, radio or EMT equipment without idling. Funding to acquire at least one dual battery system to use as a pilot project to determine feasibility would come from the town's Green Energy fund.

1.8 Putney Energy Committee shall review the local no-idling policy to match or exceed State law. As part of the proposed change, explore local enforcement options and cooperatively develop parameters under which the law applies to public vehicles (school buses, police cruisers, town maintenance vehicles) in non-emergency situations. Create opportunity for public input on proposed changes.

Goal 2: To use local renewable energy resources that have been developed in a sustainable manner.

Policies

2.1 Encourage the sustainable development and use of local energy resources.

2.2 Ensure ongoing access to sources of renewable energy production, including solar, wind, and biomass, wherever feasible and consistent with the Town's planning goals.

Priorities for action

2.1 The Putney Energy Committee shall work with the Selectboard and Planning Commission to develop a procedure for evaluation and comment on Act 248 filings, including public input.

2.2 The Putney Energy Committee and Planning Commission shall review Putney's Zoning and Subdivision ordinances and provide recommendations to address renewable energy and create an environment that is favorable to both renewable energy production and the health, safety, and welfare of the Town.

Goal 3: To reduce Putney's dependence on nonrenewable and imported energy sources

Policies

3.1 Support town and regional initiatives for energy conservation, efficiency, and renewable resource development.

3.2 Promote use of renewable energy sources.

Priorities for action

3.1 The Putney Energy Committee shall meet with Town officials and Board members (Selectboard, Planning Commission, Conservation Commission, Fire Department, and other groups, etc.) to present details about an Energy Descent Action Plan and the process of the plan's development.

3.2 The Putney Energy Committee shall coordinate the development and implementation of a long-range energy plan for Putney's municipal buildings.

3.3 The Putney Energy Committee shall present information to Town Officials and the public about exempting alternate energy sources from property taxation, per 32 VSA Ch. 125 §3845.

Goal 4: To promote awareness of energy conservation and efficiency through education.

Policies

4.1 Encourage development that supports energy conservation that concentrates growth near the village center, clusters development, sites buildings for solar gains, and minimizes road construction.

4.2 Encourage all new residential and commercial construction to follow standards specified by the Vermont Residential Building Energy Code or higher standard (such as ENERGY STAR® or LEED, where applicable and feasible) of energy efficient construction. Examples of possible techniques include:

a. Automated lighting controls (called occupancy sensors and motion sensors for outdoor use), which turn on and off lights if there is motion, and or not enough ambient light.

b. Day-lighting (the practice of placing windows and skylights, light tubes with reflective surfaces, so that during the day, natural light provides effective internal illumination) to bring in the natural sunlight, even to lower floors, and back rooms.

c. Solar thermal and electric to offset energy used in the building, lowering energy costs over the life of the building.

d. Co-generation where feasible (the combined use of heat and electrical generation, typically found in larger installations such as a campus or village-wide heating systems that also generate electricity).

e. Solar hot water systems and, where practical, on-demand hot water systems for units not serviced by solar hot water systems.

4.3 Higher than standard amounts of insulation in walls and ceiling spaces.

4.4 Encourage the use of energy conservation measures.

Priorities for action

4.1 The Putney Energy Committee should develop methods to educate businesses and residents about energy conservation and efficiency issues.

4.2 The Putney Energy Committee should investigate methods of providing incentives for green building and performance standards that would encourage energy conservation. Present recommendations to Town officials, Boards and the public.

4.3 The Putney Energy Committee shall coordinate with other interested groups to educate the public on energy issues.

4.4 Support and continue to expand the relationship with the Windham Regional Commission and other regional and state forums as they may relate to energy issues.

4.5 The Putney Energy Committee shall coordinate the study of the utilization of unused waste energy sources such as; waste water from the water treatment plant, wastewater effluent from Putney Paper, and other industrial process waste in town.

4.6 The Putney Energy Committee shall coordinate a plan to implement a solar PV backup solution to both offset the cost of running the pumps for the town's water supply and to supply power during the day time for periods when there is no grid power, should that ever happen. This would allow residents on the water system to have water during an extended blackout, while offsetting the energy used to run the system, with clean renewable energy.

Photo courtesy of Roger Turner

WINDHAM REGIONAL PLAN

Adopted September 30, 2014

WINDHAM REGIONAL COMMISSION

Windham Regional Commission
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WINDHAM REGIONAL COMMISSION

RESOLUTION

WINDHAM REGIONAL PLAN ADOPTION

Whereas, 24 VSA Chapter 117 provides that regional planning commissions shall adopt regional plans and sets standards for the content and adoption of regional plans; and

Whereas, the Windham Regional Commission (WRC) has continuously operated with a duly updated Regional Plan; and

Whereas, the Commission in its Annual Work Program for FY2014 and 2015 directed that an updated regional plan be prepared; and

Whereas, the Regional Plan Update Committee and staff have prepared drafts of the Windham Regional Plan for public review; and

Whereas, the Commission has held three duly warned public hearings and four informal community meetings to discuss and consider comments and recommendations; and

Whereas, additional comments and recommendations have been received by WRC staff through direct communication by local officials and interested citizens, and have been accorded the same due consideration; and

Whereas, the Regional Plan Update Committee has found that the testimony offered improves the Plan and helps to ensure that it best reflects the needs of the Region and desires of the Commission's member towns; and

Whereas, the Regional Plan Update Committee now recommends modifications based on testimony received;

Now, Therefore, Be It Resolved that the Windham Regional Commission adopts the Windham Regional Plan as presented on September 30, 2014; and

Be It Further Resolved that amendments to this Plan may be considered by the Windham Regional Commission as appropriate to reflect further needed revisions.

Adopted by a majority vote in excess of 60% of the town representatives to the Windham Regional Commission on the 30th day of September, 2014.

Jodi French, Chair

Tom Consolino, Secretary

Acknowledgements

Countless individuals, including citizens, businesses, non-profits, and government representatives from throughout the Windham Region and State of Vermont made important contributions to updating this Regional Plan. Over a two-year period, these individuals generously offered their time to review drafts, to attend meetings, to address public concerns, and to propose and discuss document changes that respond to the region's changing conditions. This process is essential to creating a Regional Plan that accurately reflects the needs and opportunities of the region, while providing a vision for the region's future. *We extend a sincere thank you to all of the many individuals who made contributions to the completion of the Windham Regional Plan.*

Each of the Windham Regional Commission's Committees made significant contributions to the review of chapters related to their topic areas. The Regional Plan Update Committee was particularly involved in the update process by reviewing each chapter, addressing concerns, and editing the completed draft. *We are sincerely grateful for the dedicated efforts demonstrated by these individuals:*

Greg Brown	Dummerston
Tom Consolino	Wilmington
Rod Francis	Brattleboro

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TABLE OF CONTENTS

Note: **Transportation** is addressed in the Transportation Synopsis & Policies and the Windham Regional Transportation Plan. These two documents are addenda to this plan and the information and policies contained therein have the same standing as all other elements of the Windham Regional Plan, but are provided as separate documents.

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LIST OF FIGURES

INTRODUCTION

WINDHAM REGION PROFILE INSERT

The Windham Region Profile Insert begins on page 65.

CHAPTER 2: LAND USE

CHAPTER 3: ENERGY

CHAPTER 5: NATURAL RESOURCES

CHAPTER 6: HOUSING

CHAPTER 8: UTILITIES, FACILITIES, AND TECHNOLOGY

LIST OF TABLES

WINDHAM REGION PROFILE INSERT

The Windham Region Profile Insert begins on page 65.

CHAPTER 3: ENERGY

CHAPTER 5: NATURAL RESOURCES

CHAPTER 6: HOUSING

CHAPTER 7: EDUCATIONAL, CULTURAL, AND RECREATIONAL RESOURCES

CHAPTER 8: UTILITIES, FACILITIES, AND TECHNOLOGY

LIST OF MAPS

The map section insert begins on page 60.

LAND USE

NATURAL RESOURCES

EDUCATIONAL, CULTURAL, AND RECREATIONAL RESOURCES

UTILITIES, FACILITIES, AND TECHNOLOGY

TRANSPORTATION

ENERGY SUMMARY & POLICIES

A reliable and affordable supply of energy is critical to our society and to our way of life. The continuing theme of this Regional Plan is energy: the diversity and reliability of the energy supply, the short and long-term financial costs to obtain it, and the broad-scale environmental impacts and mitigation considerations related to its generation and use. While energy issues are often national or global in reach, local land use decisions have a direct, lasting impact on the energy requirements needed to sustain the function of development. The Windham Region can lead by example by increasing the efficiency of its energy-dependent systems, identifying critical areas of improvement, and supporting local energy options that benefit its communities. The Windham Region actively supports partnerships, strategies, and state and federal legislation that will ensure the affordable and reliable production and delivery of energy to the region, in conformance with regional goals and objectives. It is our intent to work with the State, utility providers, our member towns, and neighboring regions to plan for energy demand and future shifts in primary energy sources.

Support data for this section:
Page 85
Energy Chapter

Planning for the region's future energy needs requires an understanding of both current and projected demand. Most readily available energy information is collected on a statewide basis, and is not regionally specific. **The WRC will continue to work with the State, utility companies, and other energy suppliers to gain a better understanding of the region's complete energy portfolio (transportation, heating, electricity, etc.) so as to adequately plan for the region's future energy needs and to provide better guidance to our member towns.**

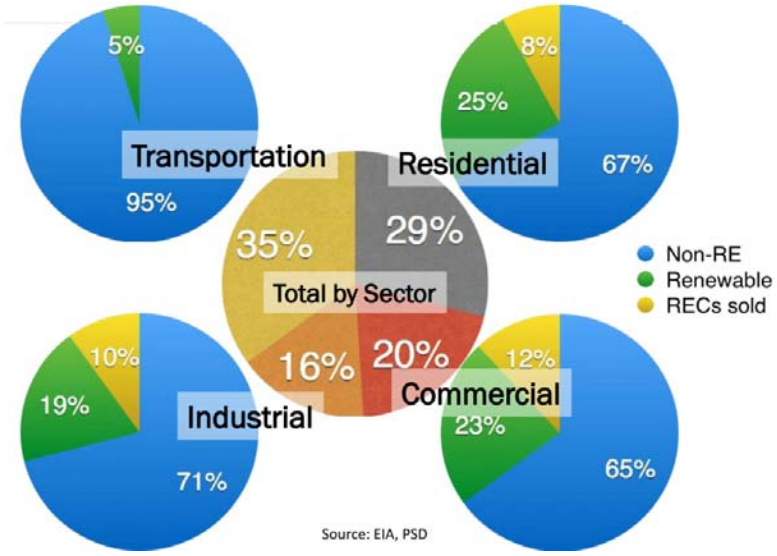
In terms of statewide end-use energy consumption (Figure 2), the transportation sector accounted for an estimated 34 percent of the energy used in 2011, followed by the residential sector (31 percent), commercial sector (20 percent), and industrial sector (16 percent).[1] Estimates[2] indicate that fossil fuel-based energy sources account for approximately 57.9 percent of the energy used in the State. Renewable energy sources accounted for 26.8 percent, while nuclear and market energy sources accounted for 15.3 percent.[3] These percentages vary from year-to-year based on a number of factors, such as winter and summer temperatures, building weatherization, pace of natural gas adoption, and economic growth.

[1] U.S. Energy Information Administration, *Table 30: Total Energy Consumption, Price, and Expenditure Estimates, 2011.* Accessed March 24, 2014. http://www.eia.gov/state/seds/data.cfm?incfile=/state/seds/sep_fuel/html/fuel_te.html&sid=VT

[2] Estimates are based on 2011 non-electric consumption and 2016 projected electric consumption estimates. This combination offers a good overview of the near-future energy mix for planning purposes.

[3] Vermont Public Service Department and U.S. Energy Information Administration

FIGURE 0-3: VERMONT END-USE ENERGY CONSUMPTION BY SECTOR



NOTE: Figure identifies non-renewable (Non-RE), renewable, and renewable energy credits (RECs) sold. See Figure 3-1 in the Energy Chapter for a breakdown of Vermont energy consumption by fuel source.

Energy conditions are rapidly changing in Vermont, in part due to volatile energy prices, regular and significant legislative changes to the State energy bill, new technologies, and the anticipated 2014 closure of Vermont Yankee Nuclear Power Station. Such conditions make it difficult to predict the region's energy conditions and needs in the years to come. The State has adopted aggressive goals to create a renewable energy future. During the 2011-2012 legislative session, the State of Vermont amended the Sustainably Priced Energy Economic Development (SPEED) goal (adopted in 2005) with the Total Renewable Energy Goal which states that starting in 2017, 55 percent of each retail electric utility's annual sales must be met by renewable sources, increasing by 4 percent every third year until 2032, when 75 percent of sales must be met by renewables (see Act 170). Additionally, in 2011, the Public Service Department (PSD) promulgated the Comprehensive Energy Plan (CEP) with a goal to satisfy 90 percent of energy needs across all sectors from renewable resources by 2050.[4] **The WRC will support state energy goals provided they comport with the provisions contained within this plan, including the protection of significant natural and cultural resources and human health and welfare.**

Energy conservation[5] and energy efficiency[6] are among the best energy investments, providing opportunities for significant reductions in energy use and costs. While there are social and ecological impacts associated with all energy production, energy conservation and energy efficiency help reduce

[4] Public Service Department http://publicservice.vermont.gov/topics/renewable_energy/state_goals

[5] Reducing energy use. This applies to measures such as building weatherization and changes in personal habits (e.g., turning off lights, driving less) that reduce the amount of energy consumed.

[6] Using less energy to perform the same functions and tasks. This applies to measures, such as the use of new technologies (e.g., LED lights, more energy efficient appliances) that use energy more efficiently and reduce waste.

these impacts by reducing demand. Lowering demand makes energy more affordable for all by reducing infrastructure requirements. In October 2011, The State of Vermont adopted Residential Building Energy Standards (RBES) and Commercial Building Energy Standards (CBES), which establish a minimum standard of energy efficiency for nearly all new residential construction, including building additions, renovations, and repairs statewide. Meanwhile, utility companies are actively installing Smart Grid technology, which allows consumers to monitor and to make more informed choices about their daily energy use. **The WRC supports improved energy conservation and efficiency strategies as a preferred alternative to the construction of new energy generation and transmission capacity.**

Energy conservation and efficiency should be a primary consideration in all development projects, with a primary land use goal of locating significant projects adjacent to or within existing developed areas. Scattered development increases the need for vehicular traffic, requires further extension of public infrastructure and utilities, and consumes a higher percentage of open space, all of which increases the overall energy demand of the project. There is also a direct relationship between development patterns and the subsequent transportation energy needed to sustain that development, which is especially significant in this State where the greatest end-use consumption of energy occurs in the transportation sector. **The WRC will encourage development in the region that meets the highest State and regional standards and exhibits best practices in terms of energy conservation and energy efficiency.**

The cost of energy in Vermont, across all sectors, is the third highest in the nation, averaging $27.77 per million BTUs.[7] Only Hawaii and Connecticut have higher average costs.[8] The high cost of energy in the state and in the region means that residents and businesses are paying more for the energy they use relative to the surrounding States and the country on a per-unit basis. This is partly due to the fact that natural gas prices nationwide have fallen to historic lows, allowing many residents and businesses across the country to take advantage of this economically priced fuel source. However, there is no natural gas pipeline currently serving the Windham Region, and delivery of compressed natural gas is only available to industrial users. In order to remain economically competitive, the region will need to look for diverse options to reduce energy costs. **The WRC will continue to provide educational materials and workshops to inform towns, businesses, and residents how to reduce their overall energy costs, and will support development of energy facilities and sources that will provide competitively priced energy to the region.**

Dependence on both external sources of energy and large-scale infrastructure places the region in a vulnerable position with regards to energy security. While it is acknowledged that these sources are

[7] A BTU is the amount of heat required to raise the temperature of 1 pound (0.454 kg) of liquid water by 1 °F (0.56 °C) at a constant pressure of one atmosphere. It is the common unit used to compare energy use across the various types of energy use (heat, electricity, etc).

[8] U.S. Energy Information Administration, 2011 Estimates, http://www.eia.gov/state/seds/data.cfm?incfile=/state/seds/sep_fuel/html/fuel_te.html&sid=VT

integral parts of a much larger and complex energy system, it is prudent for the region to consider options to increase energy security and stability during times of shortages and outages. **The WRC will support diversification of energy sources in the region, redundancy of systems to support critical functions in times of supply interruptions as well as net-metering, off-grid, and community-scaled, distributed generation projects to enhance self-sufficiency and resiliency.**

The combustion of carbon-based fuels releases greenhouse gas (GHG) emissions into the atmosphere contributing to alteration of the climate. The region's current energy demand relies heavily upon fuel combustion. Energy consumed for transportation, space heating, and electricity generation accounts for more than 80 percent of Vermont's annual statewide GHG emissions. Increases in energy conservation and efficiency in the region, coupled with a greater reliance on low GHG-emitting energy sources and renewable energy, will help reduce overall GHG emissions. Methane is both a valuable renewable energy source as well as a potent GHG that is 21 times stronger than carbon dioxide when released directly into the atmosphere. In this region, methane is primarily a byproduct of the livestock industry, particularly from dairies. Methane digesters have been developed to burn methane to create useful electricity. **The WRC will encourage a shift away from GHG–intensive energy sources and towards socially and ecologically sensitive energy sources that have zero or low GHG emissions. The WRC will encourage the deployment of methane digesters.**

Renewable energy is generally defined as any energy resource that is naturally regenerated over a human time-scale, including sources derived directly from the sun (such as thermal, photochemical, and photoelectric), indirectly from the sun (such as wind, hydropower, and photosynthetic energy stored in biomass), or from other natural movements and mechanisms of the environment (such as geothermal and tidal energy). The "renewable" characteristic of these energy resources means that they are not as vulnerable to supply disruptions and the increasing costs and volatility associated with a finite fuel source like fossil fuels. Although all energy sources create negative environmental impacts, renewable energy technologies are comparatively clean sources of energy that can have a much lower environmental impact than conventional energy technologies. **The WRC will support the development and use of renewable energy resources that enhance energy system capacity and security, promote cleaner, more affordable energy technologies, increase the energy options available locally, and avoid undue adverse impacts of energy development on the local community and environment.**

Every energy facility, including renewable energy systems, has varying social, economic, and environmental implications, some of which may impact the greater community. As with any development project, there are a variety of public perspectives and values leading to differences in opinion regarding how the region is best served. In some cases, concerns have been raised regarding location suitability and installation practices of energy generation. **The WRC will encourage developers to use sound siting practices when installing energy facilities, support opportunities for public participation, and will facilitate inter-town conversations where differences exist. The WRC expects projects to comport with the vision and intent articulated in this plan and those of municipalities.**

POLICIES

1. Ensure that all energy generation, transmission, and distribution projects further the regional goals for providing a reliable, sufficient, and economical energy supply to the region, promoting energy conservation and efficiency, and furthering the development of energy sources that have zero or low GHG emissions.

2. Work with the State, utility companies, and other energy suppliers to create a regional energy profile as a foundation for planning to meet future regional energy needs and to provide guidance on energy development in our member towns.

3. Support the State in achieving its Total Renewable Energy and Comprehensive Energy Plan goals through avenues that maintain an adequate, reliable, and economical energy supply without causing undue adverse impacts to humans and the environment.

4. Support cost-effective energy efficiency and energy conservation measures, and programs such as Efficiency Vermont to help reduce energy costs in the region.

5. Support incorporation of high-efficiency energy systems, sized appropriately to the energy need, and located in close proximity to the user base.

6. Support the advancement of Smart Grid technology to allow businesses and residents to make informed choices about their energy usage and expenditures by monitoring when they are using energy, how much they are using, and how much it costs.

7. Require that new development and renovations, at minimum, meet State commercial and residential energy building codes. Encourage development to utilize strategies to increase the energy efficiency, including consideration of transportation energy use, on-site generation and heating systems, and reuse/repurposing of existing structures.

8. Provide and distribute educational information on:

    a. Energy conservation techniques;

    b. Energy-efficient products and weatherization programs;

    c. Available energy options and their respective impacts and costs; and

    d. Opportunities for energy diversification and locally based energy sources.

9. Encourage an economically competitive energy supply through increased operation efficiencies, technology upgrades, and availability of low-cost fuels, including natural gas.

10. Balance improved efficiency and conservation measures with the need for new generation and transmission infrastructure to ensure adequate future energy supplies. Support requirements that

Appendix C

Windham Regional Energy Plan

Adopted April 24th, 2018

Windham Regional Commission
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WINDHAM REGIONAL COMMISSION

utilities improve the efficiency of procedures and infrastructure and assist customers to conserve energy and reduce costs.

11. Support the continued availability and use of net metering electrical systems, including both individual and group net metering installations.

12. Encourage a shift toward zero and low-GHG emission energy sources, including the capture of methane gas and its conversion to useful energy.

13. Require sustainable sources and practices for all biomass and bio-fuel projects to ensure that projects create a net reduction in GHG emissions, protect the working landscape, capture and reuse waste heat, and follow verifiable stewardship practices.

14. Support sound energy facility siting practices by ensuring that new developments give adequate attention to facility siting requirements, development constraints, natural resource protection, and land use compatibility.

15. With regard to all energy generation, transmission, and distribution projects:

    a. Adhere to a high environmental standard that includes avoiding negative environmental impacts to the extent possible and adequately minimizing and mitigating those that cannot be avoided;

    b. Conduct thorough and proper studies and analyses of all anticipated socioeconomic and environmental impacts, both positive and negative;

    c. Adequately address all areas of concern regarding proposed developments; and

    d. Effectively and adequately address all issues related to facility operation and reliability.

16. Facilitate public participation as an integral part of the decision-making process for siting, evaluating, and relicensing energy generation, transmission, and distribution facilities and for electric utility deregulation.

17. Facilitate inter-town conversations about appropriately scaled and sited generation sources, which include consideration of the wishes of residents regarding the meaning of “appropriate” as expressed in their town plans. The WRC recognizes that host towns and abutting towns may have different goals in this area, and will use its best efforts to gain consensus and/or cooperation among them.

TABLE OF CONTENTS

WINDHAM REGIONAL ENERGY PLAN

that lead to soil erosion, the management of woodlands on a sustainable basis, and the sensitive treatment of scenic resources. Mineral extraction should have minimal adverse effects on aesthetics, water quality, air quality, and special community resources (such as historic sites, recreation, or scenic areas), and effective site rehabilitation plans should be provided and implemented;

- To plan for, and to educate the public about, natural and other hazards in the Region, the prevention and mitigation of these hazards, and for preparedness, response, recovery, and resilience;
- To educate the public about the inherent risk to life and property associated with development within river and stream corridors, including fluvial erosion hazard areas, and to continue to develop actions and policies that prevent and mitigate these risks wherever possible;
- To promote the development of housing suitable to the needs of the Region and to ensure the availability of safe and affordable housing for all citizens;
- To broaden access to education and training for all citizens;
- To maintain and enhance recreational opportunities for both residents and visitors in keeping with the carrying capacity of natural resources and public facilities;
- To plan for, finance, and provide an efficient system of public facilities and services (such as schools, water and wastewater facilities, highways and bridges) to meet future local, regional, and state needs; and
- To support affordable access to high-quality health care services for all citizens.

The following action steps are adopted steps specific to energy within the Windham Regional Plan:

- Energy conditions are rapidly changing in Vermont, in part due to volatile energy prices, new technologies, and the 2014 closure of Vermont Yankee Nuclear Power Station. The State has adopted aggressive goals to create a renewable energy future including the CEP's 90x50 Goal. During the 2011-2012 legislative session, the State of Vermont amended the Sustainably Priced Energy Economic Development (SPEED) goal (adopted in 2005) with the Total Renewable Energy Goal, which states that starting in 2017, 55 percent of each retail electric utility's annual sales must be met by renewable sources, increasing by 4 percent every third year until 2032, when 75 percent of sales must be met by renewables (see Act 170). **The WRC will support state energy goals provided they comport with the provisions contained within this plan, including the protection of significant natural and cultural resources and human health and welfare.**

- Energy conservation and energy efficiency are among the best energy investments, providing opportunities for significant reductions in energy use and costs.[2,3] While there are social and ecological impacts associated with all energy production, energy conservation and energy efficiency help reduce these impacts by reducing demand. Lowering demand makes energy more affordable for all by reducing infrastructure requirements. Reducing energy demand reduces the impacts associated with all forms of energy, both renewable and non-renewable. In October 2011, the State of Vermont adopted Residential Building Energy Standards (RBES) and Commercial Building Energy Standards (CBES), which establish a minimum standard of energy efficiency for nearly all new residential construction, including building additions, renovations, and repairs statewide. Meanwhile, utility companies are actively installing Smart Grid technology, which allows consumers to monitor and to make more informed choices about their daily energy use. **The WRC supports improved energy conservation and efficiency strategies as a preferred alternative to the construction of new energy generation and transmission capacity.**

- Energy conservation and efficiency should be a primary consideration in all development projects, with a primary land use goal of locating significant projects adjacent to or within existing developed areas. Scattered development increases the need for vehicular traffic, requires further extension of public infrastructure and utilities, and consumes a higher percentage of open space, all of which increases the overall energy demand of the project. There is also a direct relationship between development patterns and the subsequent transportation energy needed to sustain that development, which is especially significant in this State where the greatest end-use consumption of energy occurs in the transportation sector. **The WRC will encourage development in the Region that meets the highest State and regional standards and exhibits best practices in terms of energy conservation and energy efficiency.**

- The cost of energy in Vermont, across all sectors, is the third highest in the nation, averaging $27.77 per million BTU.[4] Only Hawaii and Connecticut have higher average costs.[5] The high cost of energy in the state and in the Region means that residents and businesses are paying more for the energy they use relative to the surrounding States and the country on a per-unit basis. This is partly due to the fact that natural gas prices nationwide have fallen to historic lows, allowing many residents and businesses across the country to take advantage of this economically priced fuel source. However, there is no natural gas pipeline currently serving the Windham Region, and delivery of compressed natural gas is only available to industrial users. In order to remain economically competitive, the Region will need to look for diverse options to reduce energy costs. **The WRC will continue to provide educational materials and workshops to inform towns, businesses, and residents how to reduce their overall energy costs, and will support development of energy facilities and sources that will provide competitively priced energy to the Region.**

- Dependence on both external sources of energy and large-scale infrastructure places the Region in a vulnerable position with regard to energy security. While it is acknowledged that these sources are integral parts of a much larger and complex energy system, it is prudent for the Region to consider options to increase energy security and stability during times of shortages and outages. **The WRC will support diversification of energy sources in the Region, redundancy of systems to support critical functions in times of supply interruptions as well as net-metering, off-grid, and community-scaled, distributed generation projects to enhance self-sufficiency and**

2 "Energy efficiency" - Using less energy to perform the same functions and tasks. This applies to measures such as the use of new technologies (e.g., LED lights, more energy-efficient appliances) that use energy more efficiently and reduce waste.

3 "Energy conservation" - Reducing energy use. This applies to measures such as building weatherization and changes in personal habits (e.g., turning off lights, driving less) that reduce the amount of energy consumed.

4 A BTU is the amount of heat required to raise the temperature of 1 pound (0.454 kg) of liquid water by 1.0 °F (0.56 °C) at a constant pressure of one atmosphere. It is the common unit used to compare energy use across the various types of energy sectors (heat, electricity, etc).

5 U.S. Energy Information Administration, 2011 Estimates, http://www.eia.gov/state/seds/data.cfm?incfile=/state/seds/sep_fuel/html/fuel_te.html&sid=VT.

resiliency.

- The combustion of carbon-based fuels releases greenhouse gas (GHG) emissions into the atmosphere contributing to alteration of the climate. The region's current energy demand relies heavily upon fuel combustion. Energy consumed for transportation, space heating, and electricity generation accounts for more than 80 percent of Vermont's annual statewide GHG emissions. Increases in energy conservation and efficiency in the region, coupled with a greater reliance on low GHG-emitting energy sources and renewable energy, will help reduce overall GHG emissions. **The WRC will encourage a shift away from GHG-intensive energy sources and towards socially and ecologically sensitive energy sources that have zero or low GHG emissions.**

- Methane is both a valuable renewable energy source as well as a potent GHG that is 21 times stronger than carbon dioxide when released directly into the atmosphere. In this region, methane is primarily a by-product of the livestock industry, particularly from dairies. Methane digesters have been developed to burn methane to create useful electricity. **The WRC will encourage the deployment of methane digesters.**

- Renewable energy is generally defined as any energy resource that is naturally regenerated over a human timescale, including sources derived directly from the sun (such as thermal, photochemical, and photoelectric), indirectly from the sun (such as wind, hydropower, and photosynthetic energy stored in biomass), or from other natural movements and mechanisms of the environment (such as geothermal and tidal energy). The "renewable" characteristic of these energy resources means that they are not as vulnerable to supply disruptions and the increasing costs and volatility associated with a finite fuel source like fossil fuels. Although all energy sources create negative environmental impacts, renewable energy technologies are comparatively clean sources of energy that can have a much lower environmental impact than conventional energy technologies. **The WRC will support the development and use of renewable energy resources that enhance energy system capacity and security, promote cleaner, more affordable energy technologies, increase the energy options available locally, and avoid undue adverse impacts of energy development on the local community and environment.**

- Every energy facility, including renewable energy systems, has varying social, economic, and environmental implications, some of which may impact the greater community. As with any development project, there are a variety of public perspectives and values leading to differences in opinion regarding how the Region is best served. In some cases, concerns have been raised regarding location suitability and installation practices of energy generation. **The WRC will encourage developers to use sound siting practices when installing energy facilities, support opportunities for public participation, and will facilitate inter-town conversations where differences exist. The WRC expects projects to comport with the vision and intent articulated in this plan and those of municipalities.**

NOTE ON ENERGY TERMINOLOGY

A significant technical note should be made here, and that is the distinction between energy measured at the point of consumption, called "end-use," and energy measured as generated, called "primary-use." End energy use is measured at the point of use, as it enters—or is delivered to—the consumer's home, building, or vehicle. Primary energy use includes the delivered energy plus the energy that is lost in generation, transmission, and distribution.
This is especially important in the case of electric generation because thermal power plants can shed up to two units of heat energy for every one unit of electric energy that is produced. End-use consumption is the measure most often used in reports of energy use because it provides a better baseline for comparison. It will be referenced here when that data is available.

The Windham Regional Plan also incorporates the Windham Regional Transportation Plan that was adopted in 2013. The Transportation Plan also speaks to energy consumption, protection and improvement of air quality, and reduction of greenhouse gas emissions. The following is excerpted from the Transportation Plan (page 13):

The transportation sector's contribution to GHG emissions must also be considered when evaluating air quality because of climate change concerns. In 2015, the transportation sector accounted for 54.6% of Vermont's GHG emissions. Suggested measures for reducing mobile source emissions have been recommended by the Federal Highway Administration (FHWA) and are included in the Regional Transportation Plan, Chapter 2: *Energy and Air Quality*. Among the suggested improvements, the most relevant to this Region are the following:

- Improved public transit;
- Park and ride/fringe parking;
- Ride-sharing programs;
- Pedestrian and bicycle facilities;
- Programs to promote non-automobile travel to major activity centers such as shopping centers, special events, and other centers of vehicle activity; and,
- Programs for new construction and major reconstruction of paths or areas solely for use of pedestrian or other non-motorized means of transportation.

The Regional Transportation Plan included the following energy-related policies:

- Support emissions standards that reduce regionally generated air pollutants from transportation-related activities.
- Promote alternative fuel vehicles and the infrastructure necessary to fuel those vehicles.
- Require all development projects to incorporate elements that reduce reliance on single occupant vehicles, such as providing access to public transit, installing pedestrian and bicycle network links, or providing access to ride-sharing programs.
- Support efforts to minimize energy consumption, especially non-renewable energy resources, and explore expanded use of alternative fuels.
- Integrate traffic designs in designated downtowns and village centers that limit idling and calm traffic.

The Windham Region has a strong history of generating energy and supporting renewable energy, conservation and efficiency, and reducing greenhouse gas emissions through adopting policies and goals encouraging these on a regional level. This comprehensive energy plan applies these goals to the data of current use and projected use and explores the implementable steps to achieve the state goal of 90% renewable energy by 2050. In this plan, energy is divided into three sectors: electricity, transportation, and

Electricity Targets

In these targets, electricity cannot be neatly separated out as its own category. For instance, transportation and heating rely heavily on an increase in electricity as a fuel source. The targets within these sectors focus on the savings from energy efficiency in appliances and equipment. Based on an average savings per residence, the Region has ambitious targets to meet with 96% of residences upgrading their electric appliances and equipment by 2050 (Table 16). This equates to a total regional savings of 98,000 MWh of electricity. This mirrors the weatherization targets previously discussed. We note that these goals in efficiencies are incredibly ambitious. The funding and programs to support this level of efficiency upgrades are not robust enough at this time. Organizations like Efficiency Vermont work towards these targets; however, more support will be necessary to reach these targets.

ENERGY GENERATION TARGETS

The Windham Region has long been home to energy projects. European settlement of the state was largely organized around the ability to harness water power for industry. Hydropower was developed in the early 1900s on the Connecticut and Deerfield Rivers. The 620-megawatt Vermont Yankee Nuclear Power Station located in Vernon began operation in 1972 and ceased operation in 2014. This plant was a significant source of earned income and employment for the Region and is now the focus of decommissioning, site restoration, and spent fuel and high-level nuclear waste storage discussions.

The Region is now a leader in diverse renewable energy generation, with:

- 531 solar sites generating 11,071,442 kWh,
- 13 installed and active wind sites generating 128,773 kWh (several more sites are permitted and currently under construction– discussed below),
- 2 anaerobic digesters generating 2,706,840 kWh,
- 1 landfill site generating 3,679,200 kWh, and
- major hydropower facilities on the Connecticut and Deerfield Rivers (and smaller facilities elsewhere), produce 549,405,000 kWh.

The Windham Region currently has 36.06 mega-watt (MW) capacity of permitted wind projects, and 15.70 MW of installed solar capacity. This includes a number of large-scale projects permitted and being developed in the area, notably the Deerfield Wind Project (at 30 MW capacity). The Region currently generates 566,991,255 kWh of electricity. To see energy generation data by municipality, see Appendix D: Energy Data for Windham Region Municipalities, page 72. In order to achieve the 90x50 goal, a targeted total for the Region is 58,493MWh, or 45 MW capacity needed in new renewable energy generation. This generation target can be met with a variety of different technologies, though solar and wind generation have the highest capacity in both the Region and State. Although local energy generation siting concerns are real and are addressed below, 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, nuclear waste, oil spills, and devastating climate impacts.

However, as will be discussed below, the Windham Regional Commission is adopting a policy that restricts additional utility-scale wind energy generation in Resource Lands (see land use policy definition on page 34), and that the new capacity be developed through primarily solar generation and appropriately scaled biomass generation (digesters and combined heat-power generators as well as wood fuel production), small hydro (run-of-river facilities on existing safe and stable dams), and residential- or community-serving (owned by municipality with generated credits allocated to community buildings) wind.

Generation Capacity and Regional Resources

Table 2 below shows the calculated statewide capacity of new renewable energy technologies aside from wind and solar. The table represents the capacity of new units (not yet installed or permitted) across the state and highlights the megawatt hours the technologies are capable of producing, given the average installation size. As our Region has a goal of 45 MW of new renewable energy to generate, these technologies will likely be only a limited portion of the renewable energy portfolio by 2050.

Farm Digesters:	20 to 25 MW	capable of producing:	125,000 to 150,000 MWh per year
Food Digesters:	2 to 5 MW	capable of producing:	5,000 to 25,000 MWh per year
Small Hydro:	100 to 200 MW	capable of producing:	400,000 to 900,000 MWh per year
Biomass:	100 to 200 MW	capable of producing:	600,000 to 125,000 MWh per year

Table 2: Average capacity of renewable energy technologies, statewide.

BIOMASS ENERGY

Biomass along with farm and food digesters are different from the other renewable energy generation technologies as the generation capacity is not inextricably linked to the site. Biomass resource is harvested from a location, and then transported to a generation facility.

Approximately 516,000 acres (86%) of the Windham Region is forested (see Figure 19). The area's forestry industry is one of the state's leading producers, especially of high-quality northern hardwoods and white pine. Windham County also has the most standing timber, 3.46 billion board feet, in the State. This yields well over 100,000 green tons of low-grade wood material. With the forests producing significantly more than what is being harvested, this number is projected to increase in the future. Seventy-two percent of the Region's forests are in private, non-industrial ownership, with industrial forestry operations and Federal, State, and local governments sharing the rest.

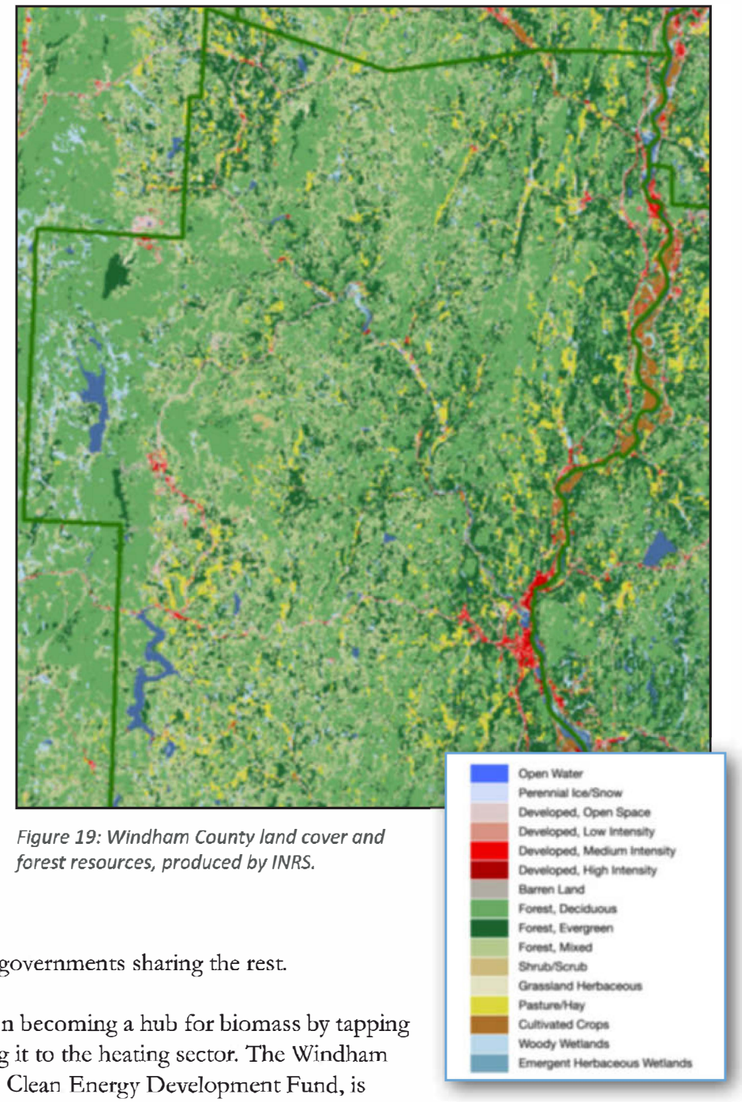


Figure 19: Windham County land cover and forest resources, produced by INRS.

The Region is already working on becoming a hub for biomass by tapping into this abundant resource and applying it to the heating sector. The Windham Wood Heat project, funded through the Clean Energy Development Fund, is

According to ANR, the hydro resource is already heavily developed in Vermont. Further development would likely result in intermittent manipulation of stream flows and water levels, a possible increase in flood hazards resulting from the disruption of natural river processes, some loss of riverine aquatic habitat, and barriers to movement of fish and other aquatic life. ANR's 2008 Report *The Development of Small Hydroelectric Projects in Vermont* identified the following criteria as necessary for any new hydroelectric generator to have acceptable environmental impacts:

- No new dam or other barrier to aquatic organism movement and sediment transport.
- Run-of-river operation.
- Bypass flows necessary to protect aquatic habitat, provide for aquatic organism passage, and support aesthetics.
- Fish passage where appropriate.
- No change in the elevation of an existing impoundment or in water level management.
- No degradation of water quality, particularly with respect to dissolved oxygen, temperature, and turbidity.
- No change in the upstream or downstream flood profile or fluvial erosion hazard.

Because there are few undeveloped sites that are candidates for new hydroelectric plants, three effective ways to increase capacity by improving efficiency and output at existing hydroelectric facilities include: installing more efficient turbines, installing small turbines at the dams that utilize bypass flows, and installing new turbines that can operate efficiently over a wider range of flows. These upgrades are often possible without changing current operating requirements, i.e., power production can be increased without additional environmental impacts. In addition, existing municipal water supply and wastewater treatment pipelines could capture the energy in these systems by installing hydro turbines to the pipelines without otherwise altering the regular operation of the system. Such in-pipe hydroelectric systems have minimal environmental impact.

SOLAR ENERGY

Solar has become prominent throughout the Windham Region, with at least 709 installed sites totaling to 9,491.7 kW capacity (the Windham Region ranks fifth in the state for this installed capacity). As discussed above and illustrated in Table 2 (page 29), the capacity for energy generation through sources other than wind and solar are limited. Therefore, the bulk of the generation targets will need to be met by wind or solar as their generation capacity is much greater. As discussed in greater detail below in the Renewable Energy Generation Policy section (page 35), and due to the political climate and local concerns with the impacts of wind turbines, solar energy generation will be the leading energy source to meet the generation targets. This will equal a total of 362,943 MWh, with only 58,493 MWh of that being new installations. Using the methodology outlined by the Bennington County Regional Commission detailed in the 2016 Bennington County Regional Energy Plan, 45% of this capacity can be met with rooftop solar alone, thus preventing any adverse impacts on land-based natural resources (this is based on conservative estimates of commercial and residential rooftop availability).

To meet the Region's generation targets, adequate acreage for solar energy arrays must be planned for. It is estimated that per megawatt of capacity, an eight-acre footprint is needed. This equals 360 acres of new installation acreage, if none of the generation is met by rooftop solar. As no site is perfect (irregular lot shapes, landowner preferences, slopes and azimuth, and adjacent shading), a footprint rate of 60 acres per megawatt is used as the contingency estimate for planning purposes (this figure was created by the VT Department of Public Service, and is based on statewide averages for installation sizes and generation capacity). Therefore, order to prudently reach the generation target, 2,700 acres should be identified as having potential for solar development.

Vermont Center for Geographic Information (VCGI) developed the raw data for Vermont's regional planning commissions to analyze in GIS the land in the respective regions where renewable energy generation would be possible. Two layers of constraints, "known" and "possible," were layered onto the raw solar data (where the sun shines) to portray where energy generation may be possible (see Appendix C: Regional Energy Planning Maps, page 66).

It is crucial to note that these maps developed by the Windham Regional Commission are not energy generation siting maps. They are planning tools for analyzing the generation possibilities in the Region. The WRC did not add any Region-specific constraints beyond those specified in Act 174. Municipalities can add their own local constraints to municipal maps associated with their enhanced energy elements. In a GIS analysis of the Region, given slope and sun exposure, there are 37,043 acres of prime solar land where there is solar generation potential.

While there is relatively little controversy about solar energy as a source of power, potential conflicts arise with the siting of solar installations. Ground-mounted systems tend to be larger in scale that roof-mounted systems, and generally are sited on undeveloped or agricultural land. More recently, there have been concerns about large utility-scale installations being built on land zoned as industrial or commercial use. This is a legitimate concern in the Windham Region, as geography significantly limits the availability of land that is appropriate for such intensive use. This plan defers to the towns to identify preferred sites for solar generation on a local level.

Solar systems are generally benign once installed; however, the Region has relatively little prime agricultural soil. Installations covering large acreage should provide mitigation in the form of retained agricultural soils on site, or conserved agricultural land of equal value elsewhere in the Region. Rooftop array systems have the advantage of requiring zero additional development of open land, though conflicts can arise if these systems are installed in areas with historic district overlays, or where neighboring trees may shade out the system for a substantial period of the day. Towns should consider these issues and address them in their plans and zoning codes.

WIND ENERGY

The Windham Region has 36.06 megawatts (MW) of permitted and/or installed capacity in wind development with the Deerfield Wind Development in Readsboro and Searsburg attributing 30 MW to that total. The GIS analysis of the Windham Region for wind shows there are 40,726 acres of prime land in the Region. This equates to 10,181.5 MW of capacity using the assumption of 4 acres per MW capacity. The generation target equates to 19 MW of installed capacity. 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 have the potential to operate 24 hours a day. Additionally, they are able to produce energy during the 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). Given the topography of the Region, however, much of the wind energy generation potential falls within designated Resource Lands (see Box 1 on the following page for Resource Lands policy definition).

Energy generated from wind power is clean and renewable, but turbine placement can be difficult and controversial because of natural resource impacts, aesthetics, noise, and the need for turbine placement elevations between 2,500 and 3,300 feet, locations in Vermont that tend to have sensitive, thin soils and steep slopes. The windiest areas in the Region are most often on the higher-elevation ridgelines that are sensitive habitats for plants and wildlife, and are the source of the area's most pristine headwaters. In areas where road access does not exist, new permanent roads must be built to service the wind facility. Other potentially negative environmental impacts include bird and bat mortality, habitat disruption and

WINDHAM REGIONAL ENERGY PLAN

connections between rail, air, bus, car, bike, and pedestrian.

16. Integrate the use of energy-efficient and alternative modes of transportation into community plans and development.

17. Establish effective and efficient public transit services to meet the needs of transit dependent populations and to better serve the general public.

18. Establish a safe and convenient regional system of park and ride lots to encourage ride-sharing.

19. Include transit oriented development in any proposed project.

20. Incorporate public transportation into planned transportation improvements for resort centers.

21. Create new and expand existing public transit services to fulfill intercity and intra-regional demand.

Active Transportation

22. Incorporate ADA regulations and guidelines into all pedestrian projects.

23. Require provision of appropriate pedestrian and bicycle facilities in new development projects.

24. Review and accommodate for non-motorized transportation, such as bicycle lanes, wider shoulders and sidewalks in roadway and bridge projects.

25. Preserve and encourage creation of Rights-of-Way for future linkages between communities, neighborhoods services, and other destinations.

LAND USE

1. Direct new growth, such as jobs, housing, commerce, public infrastructure, industry, community facilities, into appropriate development types (regional centers, commercial/industrial areas, rural commercial, resort centers, and villages). New growth should give attention to the type and scale of the existing form, in order to keep these centers culturally, socially, and economically viable. Infill development and "brownfield" redevelopment are encouraged in these areas.

2. Utilize strategies that increase the energy efficiency of new and existing development. All major projects reviewed under Act 250 shall provide evidence demonstrating how the development is energy efficient from a regional land use perspective, including projected transportation, heating, and electricity needs.

3. Preserve the historic and architectural character of the Region. Support the reuse and repurposing of viable existing structures to retain historic development patterns, densities, and character in the Region, especially within regional centers, villages, and hamlets.

4. Consider current and future housing requirements when evaluating business development and expansion projects. Encourage measures that will establish and maintain an adequate housing stock for area workers that satisfy a diversity of needs and income levels.

5. Develop master plans for the transformation of existing rural commercial areas, as identified on the Proposed Land Use Map, into areas serving a mix of uses, offering diversified transportation options and planned infill locations, while also conforming to traditional historic development patterns.

6. Where strip development has already occurred beyond villages and growth centers, promote redevelopment that reflects the historic development patterns of existing hamlets and villages. Strip development in known floodplains and fluvial erosion hazard areas that has experienced past damage should be considered for floodplain restoration and hazard mitigation opportunities.

7. Concentrate ski resort expansion and secondary growth to minimize the trend toward dispersed/sprawl development. All ski resort development shall be reviewed and approved as part of a development master plan before any individual development projects are approved in order to assess cumulative impacts of the potential growth of the development.

8. Plan for and develop public infrastructure, including water and sewer systems, that promotes and enables greater densities in development centers, including regional centers, villages, resort centers, commercial/industrial sites, and growth areas as identified by town plans.

9. Develop and expand hamlets in a form that maintains traditional density and residential settlement pattern within the Windham Region. Encourage towns to enable this pattern of development in town land use regulations.

10. Provide guidance and training on regulatory and non-regulatory tools for open space and resource protection available to towns for use in town plans and regulations. Encourage implementation of tools such as conservation subdivision, clustered development, and variable lot size in all subdivision development, and especially within rural residential and productive rural lands.

11. Use open space plans and resource protection techniques to protect agriculture, forest, mineral, and Resource Lands from development and fragmentation. Encourage town open space planning and help coordinate those planning efforts through the development of a regional Open Space Plan.

12. Require all major projects reviewed under Act 250 to mitigate any loss of prime agricultural and/or forest land as a result of the development.

13. Promote critical resource areas by educating towns and the public on the importance of preserving exceptional natural resources. Preserve critical resource areas by identifying key sites and by assisting towns in incorporating provisions in their town plans and land use regulations to protect them (and, as appropriate, restore them).

14. Strongly discourage all development in Resource Lands for purposes other than forestry and agriculture. Any development proposed within critical resource areas shall provide evidence as to why the development cannot be avoided, and shall provide mitigation for natural resources impacted by the development.

15. Require that the benefits of any mitigation occurring as a result of a proposed development within the Windham Region be directed to the Windham Region.

Energy

1. Ensure that all energy generation, transmission, and distribution projects further the regional goals for providing a reliable, sufficient, and economical energy supply to the region, promoting energy conservation and efficiency, and furthering the development of energy sources that have zero or low GHG emissions.

2. Work with the State, utility companies, and other energy suppliers to create a regional energy profile as a foundation for planning to meet future regional energy needs and to provide guidance on energy development in our member towns.

3. Support the State in achieving its Total Renewable Energy and Comprehensive Energy Plan goals through avenues that maintain an adequate, reliable, and economical energy supply without causing undue adverse impacts to humans and the environment.

4. Support cost-effective energy efficiency and energy conservation measures, and programs such as Efficiency Vermont to help reduce energy costs in the region.

5. Support incorporation of high-efficiency energy systems, sized appropriately to the energy need, and located in close proximity to the user base.

6. Support the advancement of Smart Grid technology to allow businesses and residents to make informed choices about their energy usage and expenditures by monitoring when they are using energy, how much they are using, and how much it costs.

7. Require that new development and renovations, at minimum, meet State commercial and residential energy building codes. Encourage development to utilize strategies to increase energy efficiency, including consideration of transportation energy use, on-site generation and heating systems, and reuse/repurposing of existing structures.

8. Provide and distribute educational information on:

    a. Energy conservation techniques;

b. Energy-efficient products and weatherization programs;
c. Available energy options and their respective impacts and costs; and
d. Opportunities for energy diversification and locally based energy sources.

9. Encourage an economically competitive energy supply through increased operation efficiencies, technology upgrades, and availability of low-cost fuels, including natural gas.
10. Balance improved efficiency and conservation measures with the need for new generation and transmission infrastructure to ensure adequate future energy supplies. Support requirements that utilities improve the efficiency of procedures and infrastructure and assist customers to conserve energy and reduce costs.
11. Support the continued availability and use of net metering electrical systems, including both individual and group net metering installations.
12. Encourage a shift toward zero and low-GHG emission energy sources, including the capture of methane gas and its conversion to useful energy.
13. Require sustainable sources and practices for all biomass and biofuel projects to ensure that projects create a net reduction in GHG emissions, protect the working landscape, capture and reuse waste heat, and follow verifiable stewardship practices.
14. Support sound energy facility siting practices by ensuring that new developments give adequate attention to facility siting requirements, development constraints, natural resource protection, and land use compatibility.
15. With regard to all energy generation, transmission, and distribution projects:
a. Adhere to a high environmental standard that includes avoiding negative environmental impacts to the extent possible and adequately minimizing and mitigating those that cannot be avoided;
b. Conduct thorough and proper studies and analyses of all anticipated socioeconomic and environmental impacts, both positive and negative;
c. Adequately address all areas of concern regarding proposed developments; and
d. Effectively and adequately address all issues related to facility operation and reliability.
16. Facilitate public participation as an integral part of the decision-making process for siting, evaluating, and relicensing energy generation, transmission, and distribution facilities and for electric utility deregulation.
17. Facilitate inter-town conversations about appropriately scaled and sited generation sources, which include consideration of the wishes of residents regarding the meaning of "appropriate" as expressed in their town plans. The WRC recognizes that host towns and abutting towns may have different goals in this area, and will use its best efforts to gain consensus and/or cooperation among them.

REGIONAL ECONOMY

1. Work with BDCC and other organizations to attract and retain youth in the Region by identifying and addressing barriers to their settling here, by providing targeted educational and skill training opportunities, and by creating meaningful career options with livable wages.
2. Promote activities and development that contribute to a strong and diverse economy, providing satisfying and rewarding job opportunities for citizens in all parts of the Region and supporting a strong municipal tax base, while maintaining environmental standards and promoting environmental justice.
3. Generate a variety of stable, year-round jobs with wages and other compensation that provide a livable income, and that include skills training programs and other benefits that contribute to the personal development and quality of life for all workers, particularly in areas with high unemployment or high numbers of workers earning less than a livable wage.
4. Utilize existing financial, physical, and technical resources to facilitate economic development, including the creative use and revitalization of suitable existing space for manufacturing and industrial activities, commerce, housing, and the arts.

5. Develop and assist the growth of small businesses including home businesses and entrepreneurial ventures that help preserve and revitalize communities.
6. Support educational programs in technical and trade skills, as well as basic skills such as math and communications, in order to improve the value of opportunities for the Region's workforce, both entry-level and advanced.
7. Support the transition of Vermont Yankee employees into new jobs and industries through the development of specific job re-training programs, and entrepreneurial support strategies.
8. Encourage development of land-based industries, focusing on the production, distribution, and marketing of agricultural and forestry products and programs from within the Region in a manner that maximizes the sustainable use of these resources, minimizes and repurposes waste, and promotes the economic, physical, and environmental well-being of our communities and their residents.
9. Promote the economy through tourism activities that emphasize the character of the Region itself: its beauty, culture, history, wildlife, and outdoor recreation.
10. Support the arts and culture industry by encouraging increased use of community resources, improved cultural opportunities for all residents, and enhanced year-round tourism.

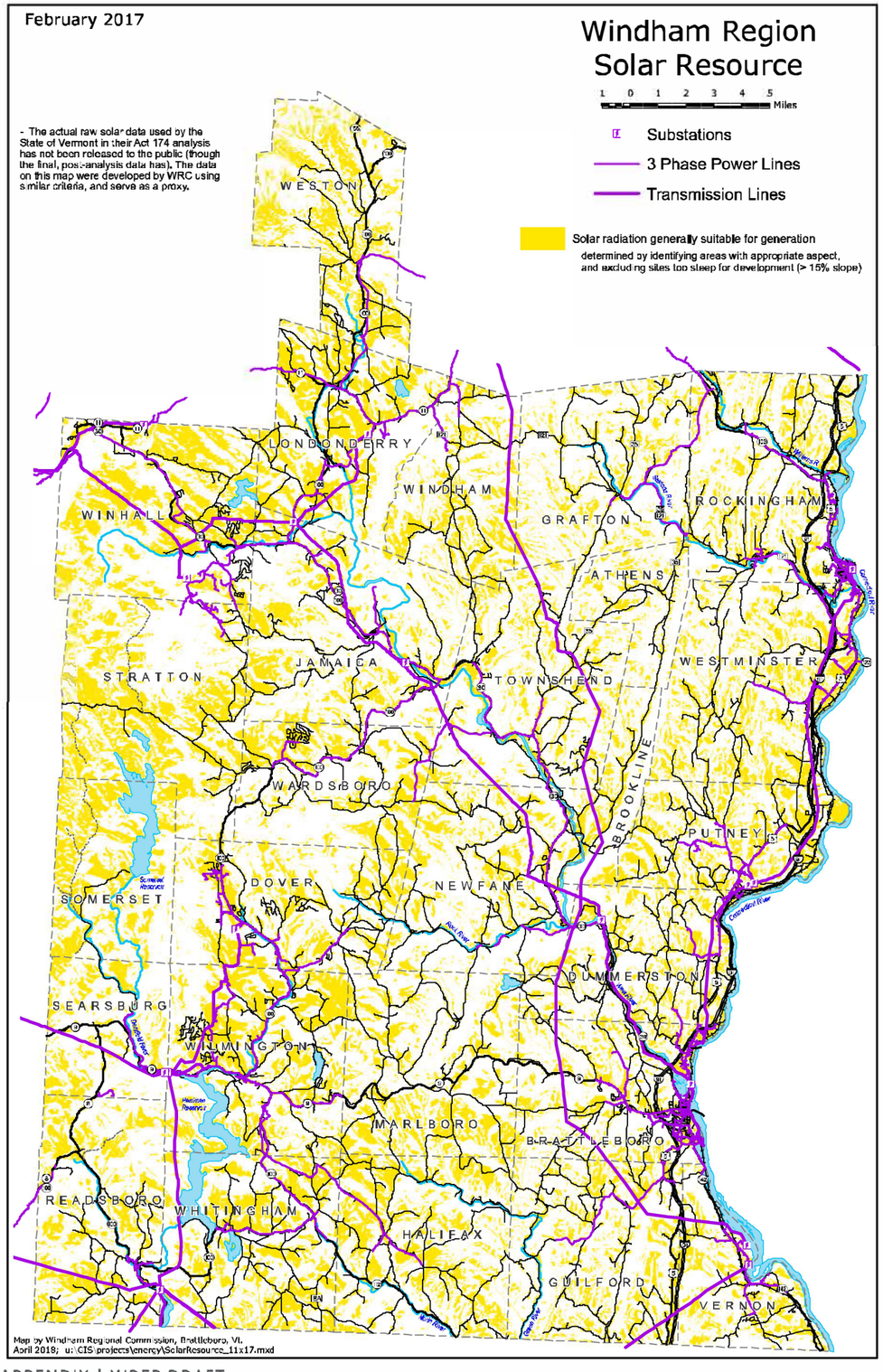
NATURAL RESOURCES

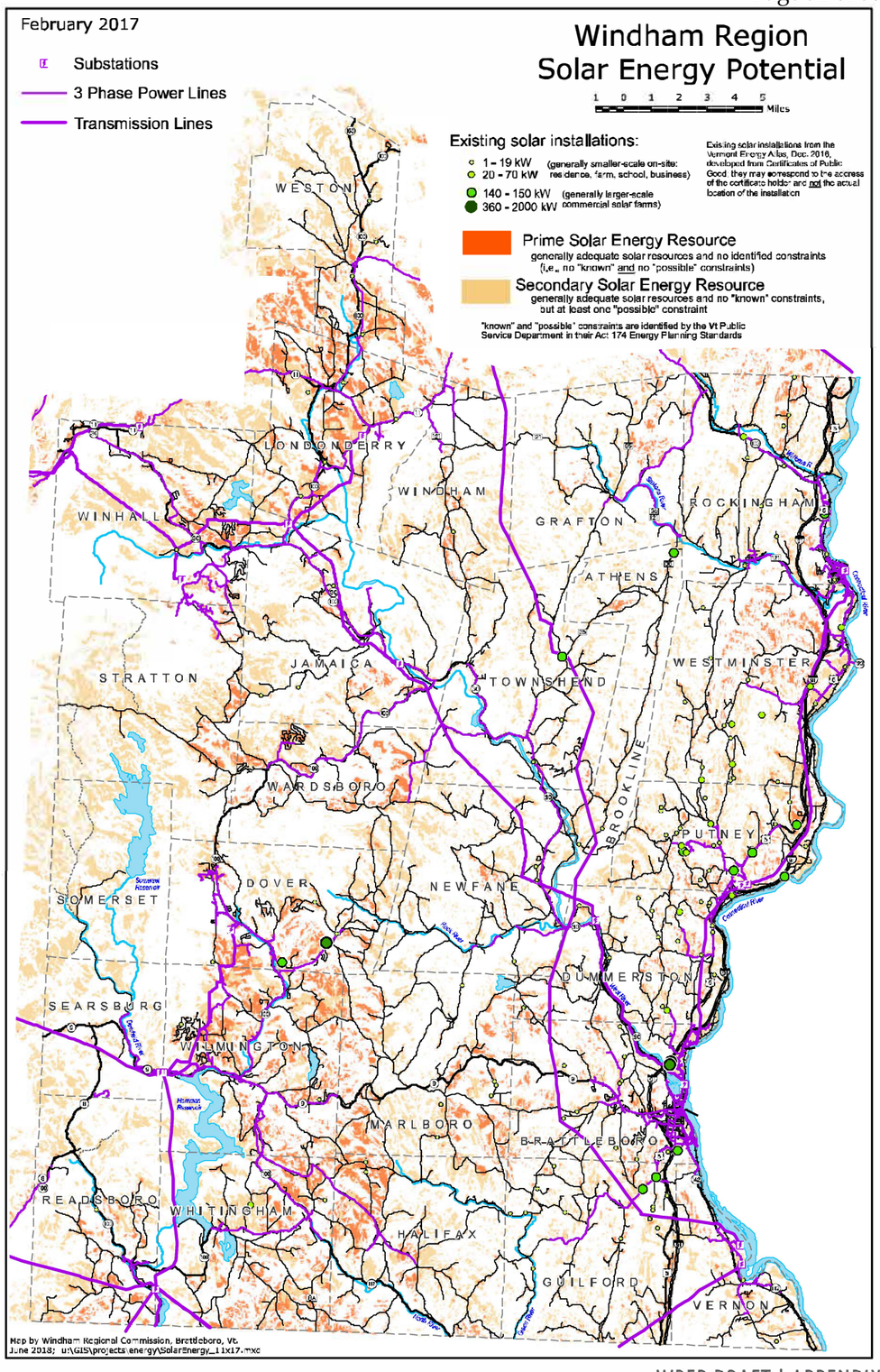
Forest Resources

1. Maintain a high-value, forested landscape in the Region composed of large, contiguous parcels by supporting programs such as Use Value Appraisal and encouraging the use of conservation subdivision models, conservation easements, and purchase and ownership of lands for conservation purposes by land trusts, state and local government, or other similar organizations.
2. Support the harvest and use of lower grade timber to ensure full use of the forest resource and help protect the Region from the threat of wildfire destruction.
3. Encourage public, industrial, and private landowners to maintain and enhance forest resources on their lands, and to follow sustainable forest management practices that provide habitat for diverse natural species, avoid high grading of timberlands, and follow Acceptable Management Practices.
4. Support the management and eventual eradication of invasive species in the Region through activities such as provision of education materials, sponsorship of workshops on best management practices, encouraging the involvement of community organizations, and requiring the eradication or mitigation of invasive species as a condition on permits for development where the introduction or spread of invasive species is likely.
5. Maintain the Vermont tradition of public access to forested lands by encouraging preservation of historic access points and promoting public access connections in development proposals.
6. Continue to support the Vermont Use Value Appraisal (Current Use) Program—a program critical to the forest resource in the region—on a fully funded basis.
7. Support organizations and educational programs that teach or demonstrate sustainable forestry and Acceptable Management Practices, to facilitate understanding and appreciation of the environmental, economic, and recreational benefits offered by the Region's forest resource.

Surface Waters

8. Maintain and restore the chemical, biological, and physical quality of the Region's surface water per the objective in State water regulations.
9. Maintain undisturbed buffers of vegetation along watercourses, lakes, ponds, wetlands, and vernal pools consistent with State regulations and the highest precedent established by the District Environmental Commission and State Environmental Court in order to protect shorelines, provide shading to prevent


February 2017
Windham Region
Solar Resource
1 0 1 2 3 4 5
Miles
- The actual raw solar data used by the State of Vermont in their Act 174 analysis has not been released to the public (though the final, post-analysis data has). The data on this map were developed by WRC using similar criteria, and serve as a proxy.
Substations
3 Phase Power Lines
Transmission Lines
Solar radiation generally suitable for generation
determined by identifying areas with appropriate aspect, and excluding sites too steep for development (> 15% slope)
WESTON
LONDONDERRY
WINDHAM
GRAFTON
ROCKINGHAM
WINHALL
ATHENS
STRATTON
JAMAICA
TOWNSHEND
WESTMINSTER
WARDSBORO
BROOKLINE
PUTNEY
SOMERSET
DOVER
NEWFANE
DUMMERSTON
SEARSBURG
WILMINGTON
MARLBORO
BRATTLEBORO
READSBORO
WHITINGHAM
HALIFAX
GUILFORD
VERNON
Map by Windham Regional Commission, Brattleboro, Vt.
April 2018; u:\GIS\projects\energy\SolarResource_11x17.mxd


February 2017
Windham Region
Solar Energy Potential
1 0 1 2 3 4 5
Miles
Substations
3 Phase Power Lines
Transmission Lines
Existing solar installations:
1 - 19 kW (generally smaller-scale on-site: residence, farm, school, business)
20 - 70 kW
140 - 150 kW (generally larger-scale commercial solar farms)
360 - 2000 kW
Existing solar installations from the Vermont Energy Atlas, Dec. 2016, developed from Certificates of Public Good; they may correspond to the address of the certificate holder and not the actual location of the installation
Prime Solar Energy Resource
generally adequate solar resources and no identified constraints (i.e., no "known" and no "possible" constraints)
Secondary Solar Energy Resource
generally adequate solar resources and no "known" constraints, but at least one "possible" constraint
"known" and "possible" constraints are identified by the Vt Public Service Department in their Act 174 Energy Planning Standards
WESTON
LONDONDERRY
WINDHAM
GRAFTON
ROCKINGHAM
WINHALL
ATHENS
STRATTON
JAMAICA
TOWNSHEND
WESTMINSTER
WARDSBORO
BROOKLINE
PUTNEY
SOMERSET
DOVER
NEWFANE
DUMMERSTON
SEARSBURG
WILMINGTON
MARLBORO
BRATTLEBORO
READSBORO
WHITINGHAM
HALIFAX
GUILFORD
VERNON
Map by Windham Regional Commission, Brattleboro, Vt.
June 2018; u:\GIS\projects\energy\SolarEnergy_11x17.mxd

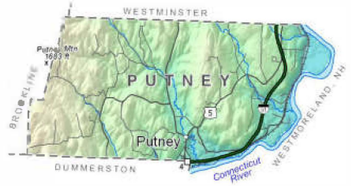
PUTNEY

POPULATION, HOUSEHOLDS, & BUSINESSES

Total population *(2014)*: **2,687**

Total households *(2014)*: **1,146**

Total businesses *(2015)*: **103**



CURRENT ENERGY USE & EXPENDITURES

Transportation

Number of vehicles *(2014)*: **1,719**

Estimated miles traveled annually: **19,517,750**

Estimated gallons of fuel used: **888,655**

Estimated total transportation costs: **$2,081,940**

Heating

Total estimated residential heating use: **110,110**

Total heating cost of primary residences: **$1,962,500**

Total estimated commercial heating use: **63,392**

Total heating energy use: **116,197 MMBtu**

Estimated total heating cost: **$3,926,948**

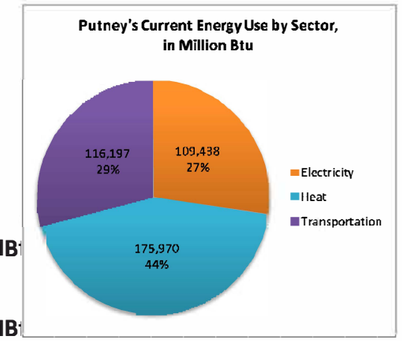
Electricity

Residential usage *(2016, KWh)*: **8,016,125**

Commericial/Industrial usage *(2016, KWh)*: **27,393,657**

Total electricity usage *(2016, KWh)*: **35,409,782**

Estimated total electricity cost: $**4,602,476**



ENERGY GENERATION TARGETS

For the 90x50 State goal, target renewable energy generation by 2050: **2,701 MWh***

**In addition to the renewable energy currently being generated.*

EXISTING GENERATION & CONSERVATION PROJECTS

Existing renewable energy generation in Putney *(2016)*: **1,808 MWh**

Total residential energy conservation projects (includes Home Performance with ENERGY STAR® projects)...

...in 2014: **34**

...in 2015: **59**

...in 2016: **59**

READSBORO

POPULATION, HOUSEHOLDS, & BUSINESSES

Total population *(2014)*: **763**

Total households *(2014)*: **496**

Total businesses *(2015)*: **21**

CURRENT ENERGY USE & EXPENDITURES

Transportation

Number of vehicles *(2014)*: **577**

Estimated miles traveled annually: **6,551,413**

Estimated gallons of fuel used: **298,290**

Estimated total transportation costs: **$698,833**

Heating

Total estimated residential heating use: **36,960 MMBtu**

Total heating cost of primary residences: **$832,085**

Total estimated commercial heating use: **19,505**

Total heating energy use: **59,074 MMBtu**

Estimated total heating cost: **$1,318,291**

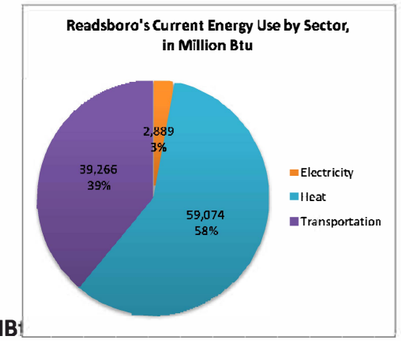
Electricity

Residential usage *(2016, KWh)*: **2,690,837**

Commericial/Industrial usage *(2016, KWh)*: **547,800**

Total electricity usage *(2016, KWh)*: **3,238,636**

Estimated total electricity cost: **$121,480**



ENERGY GENERATION TARGETS

For the 90x50 State goal, target renewable energy generation by 2050: **1,410 MWh***

**In addition to the renewable energy currently being generated.*

EXISTING GENERATION & CONSERVATION PROJECTS

Existing renewable energy generation in Readsboro *(2016)*: **41 MWh**

Total residential energy conservation projects (includes Home Performance with ENERGY STAR® projects)...

...in 2014: **9**

...in 2015: **18**

...in 2016: **24**