1. Importance of Enhanced Energy Planning

Introduction

Though Vermont's energy transformation overall may take years to implement, it will enhance the vitality of the state and local economy by reducing money spent on fuels pumped, mined or generated elsewhere, improve our health through reduced emissions and increased bicycle and pedestrian mobility options, and improve the quality of our local and global environment through reduced greenhouse gas emissions. This robust energy plan is used as a tool to advance the economic and environmental well-being of the Town of Londonderry, thereby improving the quality of life for its residents. Furthermore, these energy goals will reduce Londonderry's vulnerability to energy-related economic pressures and, in the long-term, climate change-related natural disasters, and promote long-term community resiliency in a variety of contexts.

The estimated energy consumption in Londonderry, including residential, commercial and governmental use (for heating, electricity, transportation, etc.) is estimated to be just over 335,000 MMBtu per year (see *Energy Costs & Expenditures* section below for a break-down of this figure). Because a large majority of this energy is imported from outside of the town and Windham Region, most of the money spent on energy does not directly benefit the local economy. Efforts to reduce the use of energy sources from outside the Town, or shift reliance to locally produced energy, can improve household financial security and strengthen the local economy.

From an environmental perspective, petroleum and other hydrocarbon-dependent energy is a significant cause of localized environmental damage where those fuels are produced and refined, and the emissions from their use is responsible for human-induced climate change, related climate-change disasters, and ecological degradation. Any efforts to reduce the use of non-renewable energy and shift to more environmentally-sound energy sources will benefit the town's environment.

While Londonderry can do little to shift the broader state or federal policies, we can influence energy use and production on a local level. In this energy plan, we hope to address Londonderry's local actions for increasing our energy efficiency and promoting renewable energy generation, and overall pathways to become more resilient.

Long-Term Vision & Petroleum Dependence

There is a trend toward factoring the "societal costs" into the price of energy; society pays for health costs associated with pollution, environmental cleanup, military protection of petroleum sources, and the continued failure of the Federal government to address the disposal of radioactive wastes. And in the long-term, communities who depend on fossil fuels are vulnerable to risks associated with their price and production volatility.

These challenges may significantly increase the cost of conventional energy sources within the next ten to twenty years. As a result, Londonderry will seek to establish reliable energy resources for townspeople and municipal operations, to hedge against the increasing volatility of hydrocarbon prices, and to reduce the environmental impact of our energy use. The role of clean, alternative energy sources will be expanded and supported.

2. Londonderry's Current Energy Use

The following paragraphs describe Londonderry's current estimated energy demand in detail. These current use estimations provide a starting point from which the town can develop informed energy policies that directly address its current context and opportunities going forward.

In order to provide a more accurate picture of the energy planning requirements in Londonderry, energy consumption, generation targets, and efficiency targets need to be broken down into three distinct energy sectors. Those sectors are *electricity*, *transportation*, and *heating*.

Figure 1 below shows how energy consumed in the town is divided between these sectors. The sections below break down the calculations and describe the assumptions made to arrive at these final demand figures.

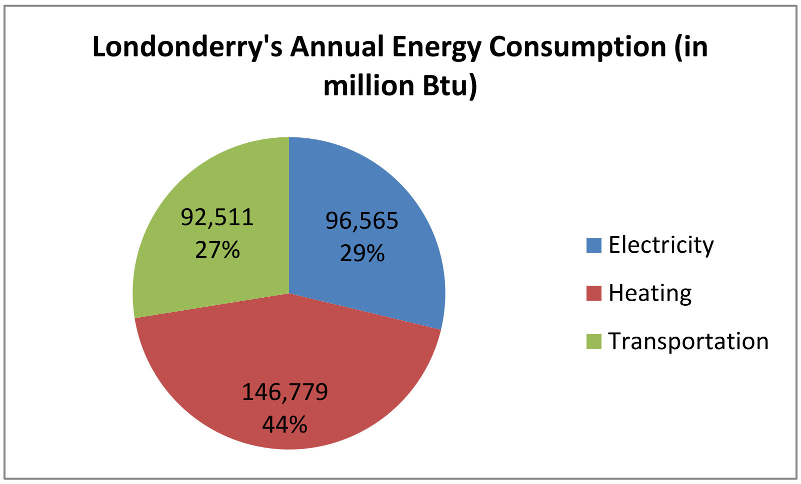


Figure 1: Annual estimated energy consumption across three sectors.

Current Electricity Demand

The following estimates of electricity consumption data is from Efficiency Vermont, and was produced for each zip code in the state. This data set combines the energy supplied from all potential electricity providers to that town. It also separates the usage for both the *residential* and *commercial or industrial* sectors (see Figure 2 below).

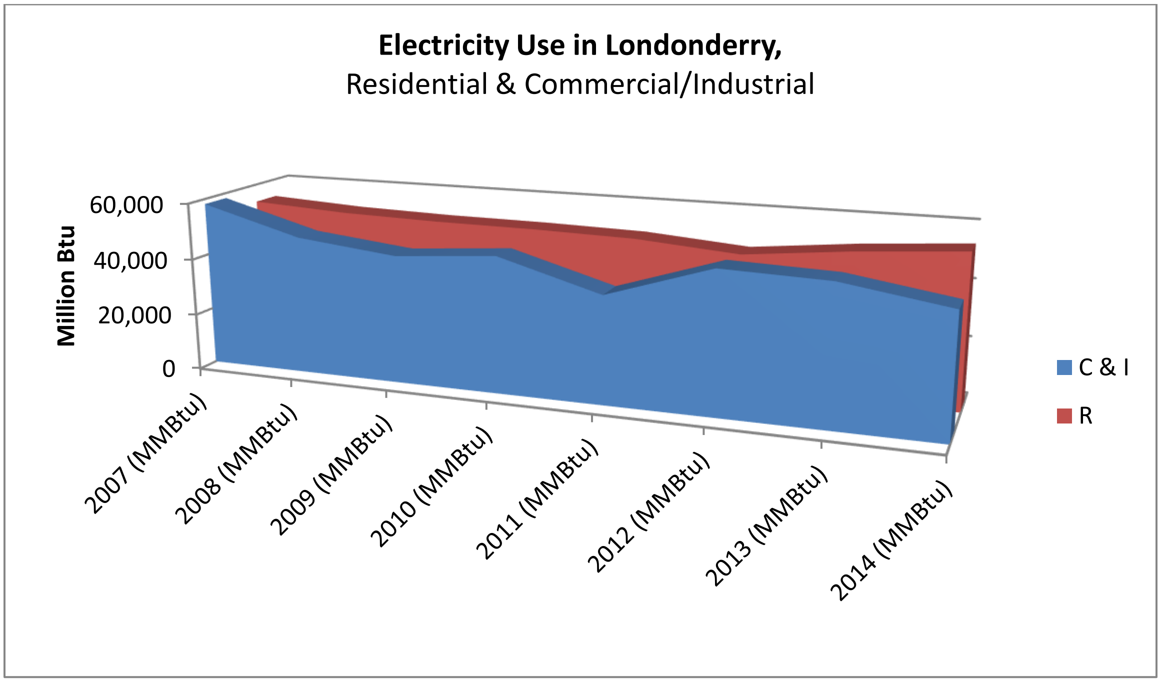


Figure 2: Electricity use data from Efficiency Vermont, 2007-2014.

To translate this energy demand into dollar amounts, we can estimate a cost of $0.1435 per kilowatt-hour (Vermont state average for electricity costs across all sectors in 2015). Based on the above data, residences in town paid almost $2,260,000 in 2014 for 15,748,450 kWh. Commercial and industrial facilities paid just over $1,800,000 for their 12,551,856 kWh of electricity.

Current Transportation Use

According to 2010 U.S. Census Bureau data, Londonderry has 790 primary housing units, (not vacant or used for seasonal/recreational purposes). Based on that number of households, it can be estimated that there are 1,359 light-duty vehicles on Londonderry's roads, which consume an estimated 701,336 gallons of fossil fuel each year. Below is a table summarizing the averages and estimates used to arrive at those figures.

790	Number of primary housing units.
1,356	Number of fossil-fuel burning light-duty vehicles (LDV).
12,500	Estimate of the average annual number of miles travelled by an LDV in the area (for Vermont as a whole, total vehicle miles traveled per registered vehicle was around 12,500. The vast majority of LDV in Vermont can safely be assumed to drive between 9,000 and 15,000 miles annually).
22	Estimate of the average fuel economy of fossil-fuel burning LDV fleet in the area, in miles per gallon (state-wide average fuel economy).
701,336	Estimated number of gallons of fossil fuel consumed annually, calculated from the values above.
84,710	Number of Btu in a gallon of fossil fuel, computed as a weighted average of the individual heat contents of gasoline (95%) and diesel (5%).
90,919	This is the estimated total annual energy consumption of internal combustion vehicles in the area, in millions of Btu.

To estimate the cost of this consumed energy, we assumed a cost of $2.34 per gallon (Vermont state average in 2015). In Londonderry, consumers spent over $1,640,000 on transportation related fuel costs alone.

Current Heating Demand

To account for the different building types and their respective uses, the following estimates divide thermal energy demand by either residential or commercial use (industrial building thermal demand is not included).

For residential buildings, it was assumed that average annual heating load of area residences is 110 million Btu, for both space and water heating (Vermont state average). With 790 primary housing units in the town, this arrives at an estimated 86,900 MMBtu annual total heat consumption. This translates to an estimated total of just over $2,000,000 was spent in home heating (roughly $1.7 million from home owners and $0.3 million from renters).

In Londonderry, there is also a high percentage of seasonal homes (54% of housing units are primary/"occupied" homes, while 46% are seasonal/"vacant" homes). Based on the energy model projections from the state (created by the LEAP, or Long-Range Energy Alternatives Planning model), it can be assumed that seasonal homes only use about 15% of the energy of a primary home, due to more occasional use and a presumed higher energy efficiency. As such, seasonal homes in town are estimated to consume about 11,000 MMBtu annually (compared to the 86,900 MMBtu for primary residences).

For commercial establishments, it is estimated that the total heating load is about 48,800 MMBtu each year. For the state, the average is in the range of 700 MMBtu to 750 MMBtu per year but the average for any given area is very likely to be significantly higher or lower, as the mix of businesses from region to region is highly variable. Based on the types of commercial buildings in Londonderry, the heating load was calculated to be less than state average. With an estimated 75 commercial establishments accounting for this energy consumption, there is an average thermal energy demand of 650 MMBtu.

Total Energy Costs

In sum, Londonderry pays a staggering amount in energy across the three use sectors. The total estimated cost to the town for electricity, heating, and transportation is over $8,900,000 each year (see Figure 3 below). There are real financial incentives for the town to move toward energy efficiency, on behalf of both the residents and its business owners (see section "*4. Londonderry's Energy Targets and Conservation Challenges*" of this plan for more detail about energy efficiency and conversion targets).

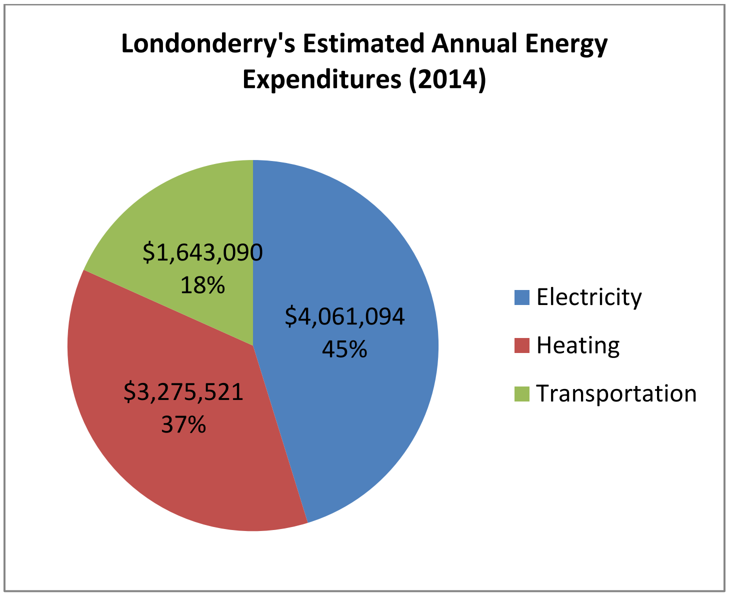


Figure 3: Estimated annual energy expenditures across three sectors.

3. Londonderry's Resources, Constraints, & Potential for Energy Generation

Energy resources within Londonderry are all renewable resources: wood, solar, hydro, and wind. In order to reduce dependence on conventional energy sources, of which the costs and availability are outside residents' control (see the section above), the use and generation of alternative energy sources is encouraged.

Resource Mapping Process and Policy Tool

The suite of maps included with this Enhanced Energy Element were developed using state-wide GIS data that modeled resource potential for solar and wind energy, identified potential constraints on renewable energy development, and created an energy potential map.

This energy potential map provides energy planners and developers with a "coarse screen" method to roughly identify areas in Londonderry that may have energy generation potential. These maps are not siting maps, and further site analysis would need to be done to determine if a proposed generation facility is appropriate and comports with Londonderry's Town Plan policies. Instead, these maps provide Londonderry planners with tools to develop sound and informed energy generation policies within this Enhanced Energy Element.

Solar Energy Potential Maps

The Town of Londonderry has good modeled solar resource availability as compared to other towns in the region. The Town supports solar facilities that are properly sited, the where the development conforms with the siting policies outlined in this Town Plan. Refer to the "*Energy Goals, Policies, and Action Steps"* section below for policy statements regarding solar generation.

Wind Energy Potential Maps

While the Town will not explicitly prohibit wind turbines, the modeled wind resource area is predominantly atop Glebe Mountain, along with other small and unconsolidated areas of potential wind resource on smaller topographic highs. Glebe Mountain is currently protected from energy development under the Resource Conservation Overlay District, and so is not available for this type of generation. Therefore, the Town will emphasize solar and biomass energy generation as more viable and feasible renewable energy technologies.

Residential or small-scale wind turbines may be acceptable, so long as they conform with zoning bylaw regulations for that respective land use, and do not adversely affect the surrounding landscape or communities. Refer to the "*Energy Goals, Policies, and Action Steps"* section below for policy statements regarding wind generation.

Londonderry's Preferred Locations

The Town of Londonderry supports locally sourced and renewable energy generation facilities in a manner that supports existing and proposed land use designations, does not adversely affect the landscape pattern or character of the Town, and supports positive community development.

Generally, the Town promotes energy generation development in locations that are previously disturbed and do not offer significant opportunities for future development. These areas may include former gravel pits, former and existing parking lots, landfills, etc. Extra consideration should be given to these under-utilized and previously disturbed areas that exist within the areas modeled to have prime resource potential (see Energy Maps), and do not conflict with existing and proposed designated land uses. Refer to the "*Energy Goals, Policies, and Action Steps"* section below for policy statements regarding preferred generation sites.

Areas Unsuitable for Renewable Energy Siting

As shown in the Known Constraints map, there is a suite of geographic characteristic that are deemed to exclude any energy generation development. They are mapped vernal pools, Class 1 and 2 wetlands, DEC River Corridors and/or FEMA floodways, National Wilderness Areas, and State-significant Natural Communities and Rare, Threatened, and Endangered species.

The Possible Constraints are a set of data layers that don't necessarily exclude energy development, but give a signal to potential developers and planners that more site analysis may be required. These layers include hydric soils, FEMA Special Flood Hazard Areas, Protected lands, deer wintering areas, Vermont Conservation design highest priority forest blocks, and agricultural soils. If generation facilities are proposed in these areas, due diligence is required in the siting of those facilities to ensure there are no adverse effects on the landscape.

Aside from these state-identified constraints, the Town of Londonderry determined that energy generation facilities are generally not compatible with the Resource Overlay Districts outlined in the Land Use chapter of the Londonderry Town Plan, and include Resource Conservation, Shore Land and Flood Hazard Overlays. These areas are delineated as containing fragile natural areas that should be protected.

Similarly, energy generation within Village centers (both Village Residential and Village Commercial), should be very carefully sited so as not to conflict with the policies outlined within those land use districts.
Finally, the Solar Resource map shows an abundance of modeled solar availability within the boundaries of Green Mountain National Forest. This area is not under Town ownership and not available for development.

Refer to the "*Energy Goals, Policies, and Action Steps"* section below for policy statements regarding unsuitable generation sites.

4. Londonderry's Energy Targets and Conservation Challenges

The Windham region was given an overall renewable energy generation target, as determined by the Department of Public Service, based on its percentage of the state's population (which directly affects its share of statewide consumption). The Windham Regional Commission (WRC) then determined energy generation targets for each of their member-towns, based on both the resource availability in town and its population. The resulting town generation targets are an average between those two characteristics.

Table 1 below shows the targeted percentage of consumed fuel sourced from renewable energy, across the three consumption sectors. This is in line with Vermont's renewable energy goals outlined in the 2016 Comprehensive Energy Plan.

Use of Renewable Energy			
Sector	**2025**	**2035**	**2050**
Transportation (as a percentage of total Btu's consumed)	10%	31%	90%
Heating (as a percentage of total Btu's consumed)	56%	67%	93%
Electricity (MWh to be generated in town)	*See the "Energy Generation Targets" section below.*		
The data above shows targets for the percentage of energy use coming from renewable sources for each sector at each target year. This was developed using information from the LEAP analysis (see sections below).			

Table 1: Percentage use of renewable energy.

Energy Generation Targets

In Londonderry, it is estimated that 3,807 megawatt-hours of renewable energy should be generated each year, by 2050, to achieve Vermont's energy generation goals outlined in the 2016 Comprehensive Energy Plan. This estimated generation target serves as a starting point from which the town can develop policy to address its energy needs. Table 2 below shows the cumulative generation target amount over the benchmark years.

Londonderry's Energy Generation Targets at Benchmark Years	
This is the target amount of renewable energy generation in town by 2025 (25% renewables goal), in MWh.	1,057
This is the target amount of renewable energy generation in town by 2035 (40% renewables goal), in MWh.	1,692
This is the target amount of renewable energy generation in town by 2050 (90% renewables goal), in MWh.	3,807

Table 2: Renewable energy generation targets at 2025, 2035, and 2050.

To translate this figure into what kinds of installations would be required, 3,807 MWh of renewable energy each year would require a total of 2,928 kilowatts of solar photovoltaic installations, using the assumption that only solar energy would contribute to the overall energy generation target, not any other generation source. In reality, the Town of Londonderry would accept a diversity of generators that conform with Town Plan policies, so as to create a more resilient local energy network. But generally speaking, solar installations are more viable in Town due to their relatively low impact on the landscape as opposed to wind-powered generators.

On the landscape, this could mean that the town identifies 176 acres of solar-capable land. This is a very conservative figure; assuming that each mega-watt of energy requires 60 acres (on average, solar installations produce a single mega-watt over 8 acres equating to only 23 acres of actual installations). Using the 60 acres/megawatt energy production rate is for contingency; meaning that it reserves space for landowner, grid, or spatial constraints that may limit development. This ensures enough space would be delineated. If other renewable energy sources were to be used, this amount of solar photovoltaic installations would decrease. Tables 3 and 4 below demonstrate that Londonderry has sufficient land to meet these generation targets.

Acres Available in Municipality for Energy Generation	
Total number of acres in town (from GIS analysis).	23,018
Total number of acres available for prime solar (with no state or local constraints).	3,297
Total number of acres available for residential wind (with no state or local constraints).	329
Total number of acres available for small commercial wind (with no state or local constraints).	59
Total number of acres available for utility wind (with no state or local constraints).	9

Table 3: Acres of available resource potential for different generation technologies.

Acres Needed for Municipal Energy Generation	
This is the estimated number of acres of **land needed for solar installations** to meet municipal targets.	23
This is the amount of land that should be **identified in plans for solar installations** (as a planning contingency).	176
For estimated solar generation, **this is the percentage of land in town needed for installations** (not accounting for potential rooftop solar).	0.10%
For estimated solar generation, this is the **percentage of acres identified as prime solar resource needed in town** for installations (not accounting for potential rooftop solar).	0.71%
This is the estimated percentage of the municipal target that can be met by rooftop solar on existing structures.	48%
This is the estimated amount of energy that can be generated from rooftop solar annually, in MWh.	1,820

Table 4: Acres needed for Londonderry to meet generation target.

The tables also show that, in addition to demonstrating that only 0.71% of the modeled prime solar resource potential land area is needed for energy generation, it is estimated that almost half of Londonderry's renewables target can be met by rooftop solar installations on existing structures. This will lead towards the Town incentivizing these types of installations, so as to minimize the amount of land area in town used for ground-mounted photovoltaic generation facilities.

Although renewable energy generation can occur in the Town and supply its residents with reliable, affordable, and clean power, the Town is challenged by the current amount of energy being consumed. In order to minimize the amount of energy generation required, the Town must first develop strategies to reduce the amount of energy consumed.

Projected Energy Use: LEAP Model Results

To help inform the Town's policies on energy conservation measures, the Town used guidance from the LEAP (Long-Range Energy Alternatives Planning system) model, conducted by the Vermont Energy Investment Corporation as part of the State's comprehensive energy planning initiative.

The LEAP model is used to guide the state's regions towards reducing the amount of greenhouse gas emissions and consuming 90% renewable energy by 2050 (referred to as the "90x50" goal). To accomplish the State's energy goals (as outlined in the 2016 Comprehensive Energy Plan), there are several interim benchmarks built into the LEAP model which ensure a progressive pace in attaining that "90 x 50" goal. The state energy goals are:

- Greenhouse gas reduction of 50% from 1990 levels by 2028, and 75% by 2050.
- 25% of energy supplied by renewable resources by 2025 (25 x 25).
- Building efficiency of 25% of homes (80,000 units) by 2020.

Incorporating those goals into the model produced energy generation, conservation, and fuel conversion targets for benchmark dates for all regions in the state, and is informed by the region's current energy profile. The WRC received the results from this model and was tasked with making those results relevant to its member-towns. The WRC therefore divided its region-wide benchmark targets among its towns based on their population (which is assumed to most directly impact the amount of energy the towns consume).

The following paragraphs and figures show Londonderry's LEAP model results, and how much energy could be conserved in order to reduce the burden of energy generation facilities in the region.

Residential Heating Conservation & Fuel Conversion

In order to determine how much energy would have to be conserved or how much fuel conversion to renewable energy, the LEAP model produced both a "Reference" and "90x50" scenarios. The Reference scenario is meant to depict energy use over decades if no major changes were made in our energy profile. It is the "business as usual" scenario. The "90x50" scenario shows one pathway that communities can adopt in order to reduce greenhouse gas emissions, conserve energy, and generate renewable energy so as to meet the state's goals. This pathway is translated to Londonderry's use, and is shown below. It is another data estimate that serves to help inform the town to develop its own policies for energy conservation and fuel conversion.

Figure 4 below shows the LEAP results for Londonderry's residential heating sector. In both the Reference and 90x50 scenarios, energy consumption is modeled to decrease (on account of technological improvements, building innovation, and home efficiency improvements).

Figure 4: LEAP model scenario of residential heat consumption over the benchmark years.

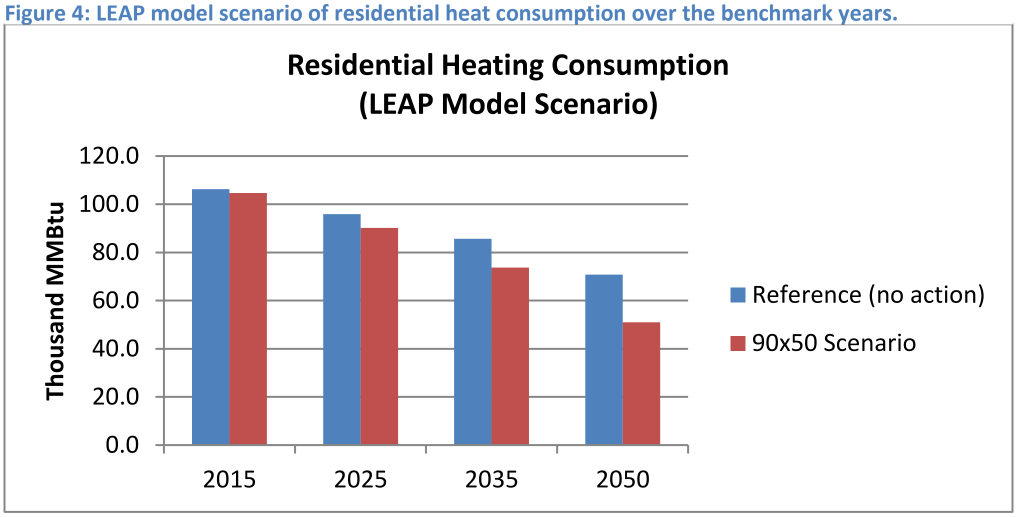
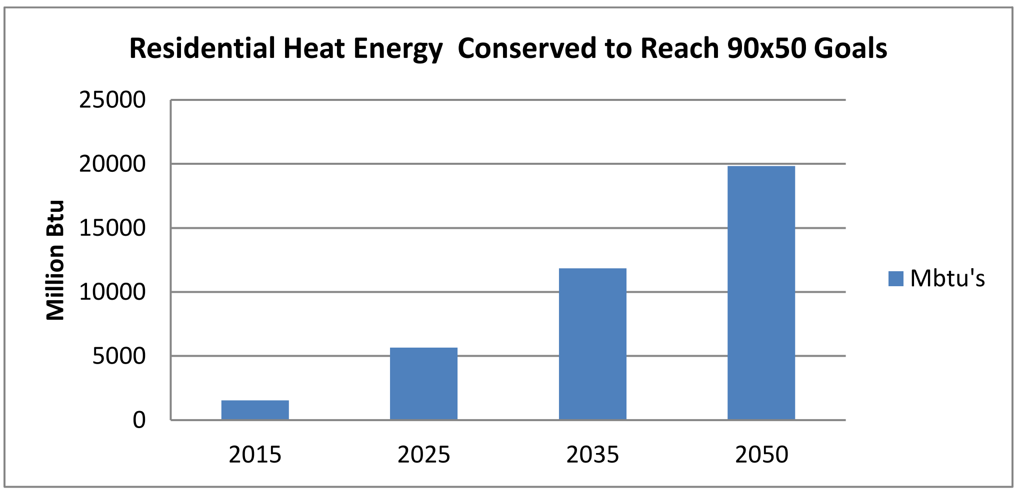


Figure 5: Reference vs 90x50 scenario for residential heating; amount of energy to be conserved over the benchmark years.



However, the 90x50 scenario shows a sharper increase in the amount of energy conserved in residential heating. Figure 5 shows how much energy should be conserved, through 2025, 2035, and 2050, to help the town arrive at these energy goals. Not only would energy need to be solely conserved by building efficiency measures, but also fuel conversion to more efficient energy sources would be promoted.

In order to attain the renewable energy goals, the following cumulative targets have been established for Londonderry for years 2025, 2035, and 2050.

Thermal (Heat) Efficiency Targets at Benchmark Years			
Use/Sector	**2025**	**2035**	**2050**
Residential thermal (increased efficiency and conservation): Percent of municipal households (1,463 total) to be weatherized over benchmark years to meet efficiency targets.	11%	21%	44%
Residential thermal (increased efficiency and conservation): Estimated number of municipal households to be weatherized.	161	307	645
Commercial thermal (increased efficiency and conservation): Percent of commercial establishments (75 total) to be weatherized over benchmark years to meet efficiency targets.	9%	16%	30%
Commercial thermal (increased efficiency and conservation): Estimated number of commercial establishments to be weatherized.	7	12	23

Additionally, the following fuel conversion targets are set for heating fuel types used, with an emphasis towards shifting to more renewable heat sources and using more efficient sources (such as heat pumps).

Heating Fuel Switching Targets			
Use/Sector	**2025**	**2035**	**2050**
Residential and Commercial Thermal Fuel: Estimated **new efficient wood heat systems overall** (in units) in the LEAP 90x50 scenario (this includes both wood stoves and wood pellet burners for homes and businesses). *This number may decline over the target years, which indicates an overall trend toward energy conversation and building weatherizing, which reduces the demand on heating systems.*	518	503	518
Residential and Commercial Thermal Fuel: Estimated **new wood pellet systems only** (in units) in the LEAP 90x50 scenario.	85	93	117
Residential and Thermal Fuel: Estimated **new heat pumps** (in units).	151	298	421

Transportation System Changes

The LEAP model created benchmark targets for both light- and heavy-duty vehicles, assuming a difference in residential and industrial energy needs and changes over time. Below are the two interpretations of these sector's efficiencies over time.

Figure 6: LEAP model scenario for light-duty vehicle energy consumption over the benchmark years.

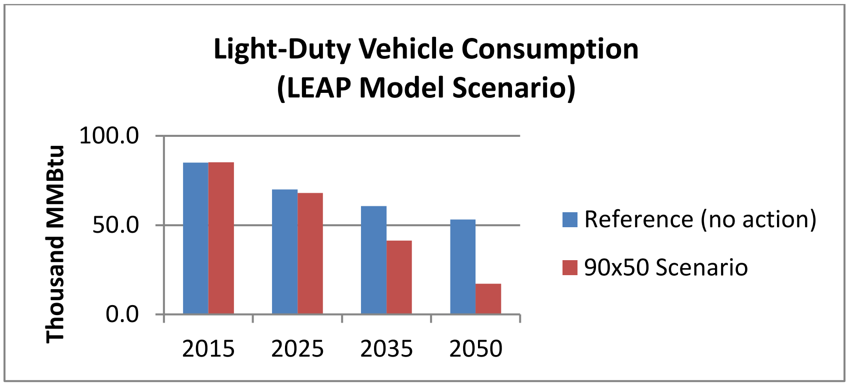


Figure 7: Reference vs 90x50 scenario; the amount of energy to be conserved over the benchmark years.

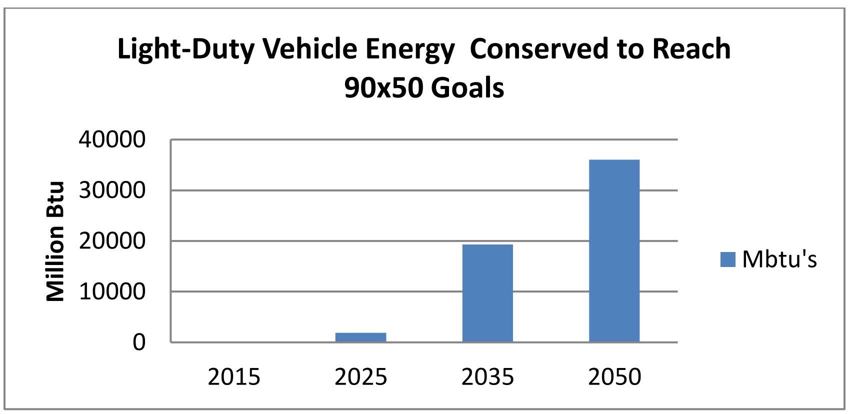


Figure 8: LEAP model scenario for Heavy-duty vehicle energy consumption over the benchmark years.

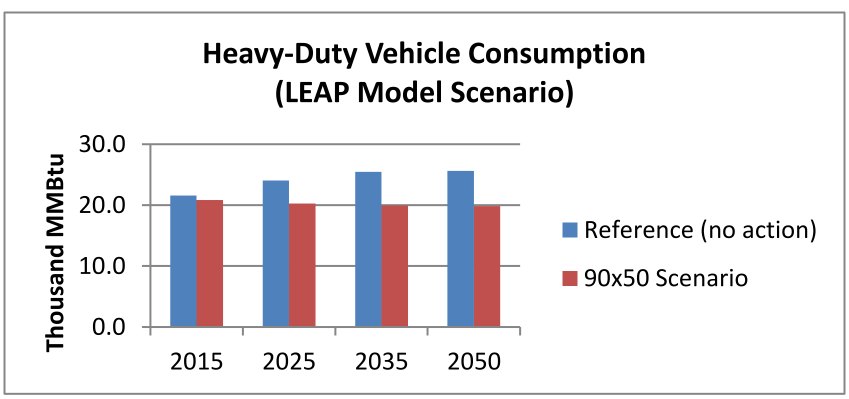
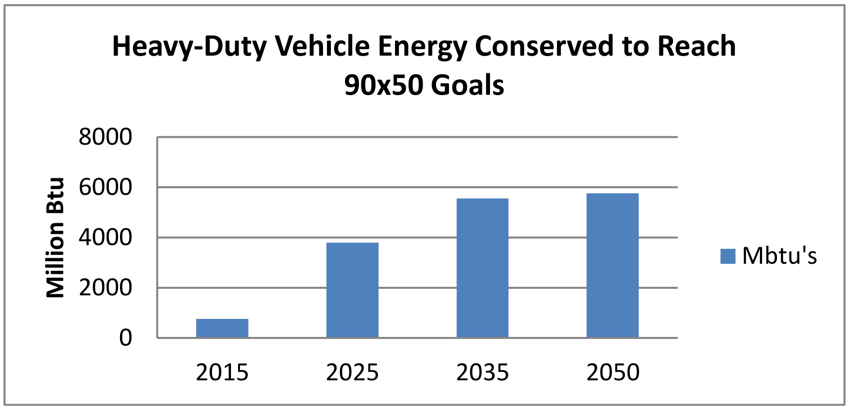


Figure 9: Reference vs 90x50 scenario; amount of energy to be conserved by heavy-duty vehicles.



Light-duty vehicle consumption represents a larger portion of the total amount of energy consumed by the transportation sector, and there is a large amount of energy conservation required. The LEAP model projects much of this conservation of energy comes from the electrification of the vehicle fleet, especially as market demand changes and technology improves. This reduction in gasoline consumption and electrification of the car motor comes in addition to increased cluster developments and other land use changes that improve the efficiency of our community's transportation network. The following targets for the years 2025, 2035, 2050 are set for the town's transportation fuel conversion:

Transportation Fuel Switching Targets			
Use/Sector	**2025**	**2035**	**2050**
Transportation Fuel: Estimated number of **new electric vehicles, in town.**	104	736	1,554
Transportation Fuel: Estimated number of **biodiesel-powered vehicles, in town.**	159	305	528

Table 5: Fuel switching targets for the transportation sector, across the benchmark years.

Heavy-duty vehicle consumption doesn't show the same curves as per light-duty vehicles, since commercial and industrial applications for this vehicle fleet isn't anticipated to change as much. However, efficiency in this sector is achieved by changing the fuel type for these vehicles from diesel to bio-diesel.

Electricity Conservation

Over the benchmark years, electricity rates are anticipated to increase in the Reference scenario, due to a combination of more amenities, appliances, and motors being supplied by electric power, and an increase in the number of people using those products. The 90x50 scenario promotes electricity conservation in the form of energy-efficient appliances, lighting, and heating/cooling.

Figure 10: LEAP model scenario for electricity consumption.

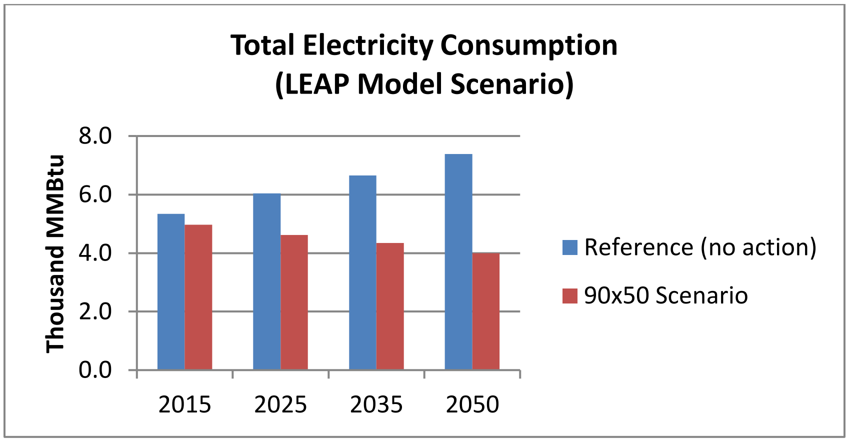
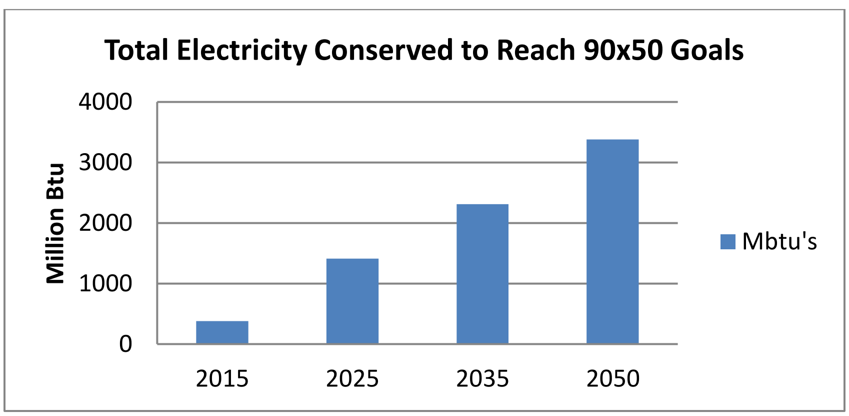


Figure 11: Reference vs 90x50 scenario; amount of energy to be conserved in the electricity sectors across the benchmark years.



Pursing these upgrades, the town is targeted to save the following in electrical conservation measures for target years 2025, 2035, 2050:

Efficiency Targets at Benchmark Years			
Use/Sector	**2025**	**2035**	**2050**
Electricity: Number of kilo-watt hours to be conserved, annually, over the target years.	1,947,500	3,182,500	4,655,000
Electricity: Percentage of number of homes and buildings that will have been upgraded with electric efficiency improvements.	42%	68%	100%

Table 6: Electric-sector efficiency targets across the benchmark years.

Conservation and Efficiency Strategies

With total energy expenditures in the town around $8.9 million dollars (see Total Energy Costs section above), there is considerable opportunity for savings from various energy conservation and improved efficiency measures. Because most of the energy use in Londonderry is for private uses (home heating, commuting, etc), savings would accrue primarily to residents. Public education is one of the most effective strategies to bring about savings through energy conservation and improved efficiency, though there are some specific policies that can also move the community in that direction.

The following section outlines the energy policies and their association implementation action to achieve the energy efficiency and renewable generation targets outlined in the aforementioned sections.

5. Londonderry's Energy Goals, Policies, and Action Steps

Goal 1: The Town of Londonderry will reduce total energy use by promoting energy conservation and efficiency measures and a shift toward renewable energy sources.

Policy 1.1: Encourage appropriate energy conservation and efficiency measures and renewable energy generation by individuals and organizations through public education, awareness, and engagement.

Action Steps

1. Reestablish Londonderry Energy Committee to help provide resources to residents on energy conservation, efficiency, and renewable fuel options.
2. Provide energy information during public events, as appropriate, and hosted by the Londonderry Energy Committee.
3. Provide information and assistance with rebate forms associated with energy conservation or renewable energy products.
4. Engage the Energy Committee to follow an informed, collaborative, and deliberative siting process for proposed facilities.

Policy 1.2: Support programs for insulation and weatherization of new and existing dwellings, especially for low and moderate-income households.

Action Steps

1. Enforce compliance with the Vermont Residential Building Energy Code by ensuring that certificates are filed upon completion of construction.
2. *Promote implementation of residential and commercial building efficiency ratings and labeling.
3. *Consider adoption of stretch codes.
4. Review current zoning bylaws to determine whether existing standards related to energy conservation, pedestrian and bicycle circulation, commercial and home-based businesses and energy efficient site design and building construction are adequate. Revise as necessary to require optimum feasible energy reduction and efficiency.

Policy 1.3: Encourage and support awareness programs on energy conservation and the availability and use of renewable and alternative fuels.

Action Steps

1. *Promote switching to wood, liquid biofuels, biogas, geothermal, and/or electricity as fuel sources, when applicable.
2. *Promote other suitable devices such as advanced wood heating systems and cold-climate heat pumps, or other energy efficient heating systems.
3. *Identify potential locations for, and barriers to, deployment of biomass district heating and/or thermal-led combined heat and power systems.
4. Support the establishment of a community-based co-op for the purpose of bulk renewable energy purchasing.

Policy 1.4: Commit to energy conservation in all Town properties, facilities, and vehicles.

Action Steps

1. Conduct an energy audit on all town properties and other facilities and prepare an energy efficiency plan that emphasizes energy reduction and efficiency as facilities are upgraded, replaced, or expanded. Once audited, implement Energy Plan.

Policy 1.5: Support the use of energy efficient automobiles, appliances, heating units, lighting, and other powered devices.

Action Steps

1. Review, update, and implement street lighting plan town-wide using efficient light fixtures and renewable energy, as feasible.
2. Examine opportunities for providing home energy audits for resident and property owners so that they may take action to conserve energy and reduce related costs.

Policy 1.6: Encourage the use of local forest resources for heating and energy generation in a manner that sustains the resource base, maintains proper safety standards, and has a minimum impact on the environment.

Action Steps

1. Explore feasibility of wood-chip power generation as a mode of energy production consistent with the Town's tradition of forest-related industry and activities.
2. Explore opportunities for an online wood marketplace for community members to access locally-source and renewable wood products.

Goal 2: The Town of Londonderry will work to reduce transportation energy demand and single-occupancy vehicle use, and encouraging use of renewable or lower-emission energy sources for transportation (See Transportation chapter of the Londonderry Town Plan for more related policies).

Policy 2.1: *Encourage the increased use of public transit, as appropriate.

Policy 2.2: *Promotes a shift away from single-occupancy vehicle trips through strategies identified in the Transportation chapter.

Policy 2.3: Encourage, through transportation policies, opportunities for walking, and cycling, or other energy efficient alternatives to the automobile.

Action Steps

1. Consider implementing improvements that encourage safe and convenient walking and biking.

Policy 2.4: Promote the individual use of electric vehicles, instead of fossil fuel consuming light-duty vehicles.

Action Steps

1. Develop a plan for locating electric vehicle charging stations in Town.

Policy 2.5: *Consider current and future technological advancements for fuel efficiency in town vehicles.

Goal 3: The Town of Londonderry will promote appropriate land use patterns and development densities that result in the conservation of energy (See Land Use chapter of the Londonderry Town Plan for more related policies).

Policy 3.1: Maintain the Town's scenic resources and Resource Conservation Overlay District by protecting them from commercial energy generation and new transmission facilities.

Policy 3.2: Minimize the need for new facilities and reliance on the private automobile by directing development to designated concentrated development, and limiting such development in the least accessible areas of the community.

Policy 3.3: Promote land use and conservation policies that encourage ongoing forest management to maintain a local source of fuel-wood and local agriculture to maintain and increase the supply of locally produced food.

Goal 4: The Town of Londonderry will locate zones and/or areas appropriate for renewable energy generation based on resource potential and development constraints.

Policy 4.1: Support appropriate renewable energy generation in Londonderry, including bio-mass using local wood supplies, solar, and dispersed small-scale wind, solar and hydro-power sources.

Action Steps

1. Support incentive programs for small-scale net-metering energy production and energy conservation for private use.
2. *Support the preference of small-scale, up to 15kw, active and passive solar installations, specifically on rooftops, rather than larger scale ground mounted utility installations.
3. *Support small-scale, residential wind generation facilities where there are no adverse visual, ecological, or sound affects to nearby residences.
4. *Support permit-able small-scale hydro systems where there are no adverse affects on the geomorphic stability or ecological health of the respective water body.
5. *Support a wood-pellet mill, particularly within the Service Commercial land use district, that uses locally-source forest products for energy generation.
6. *Encourage biomass generation facilities in areas of existing or former wood processing facilities or any other previously disturbed or industrial locations.

Policy 4.2: Encourage any potential commercial generation facilities to be within the areas deemed most suitable as described in this Enhanced Energy Element and within the Energy Generation Potential maps, and maximize potential for those facilities in these preferred areas:

Former gravel pits, quarries, or other heavily disturbed areas,
Parking lots and gas station canopies,
Existing commercial buildings or facilities with generous rooftop availability that is capable of hosting solar photovoltaic installations.

Policy 4.3: *When considering upgrades to or expansion of transmission infrastructure or 3-phase power lines, encourage the strategic development of energy generation facilities so that community centers and local businesses may benefit from the infrastructure upgrades, thereby maximizing positive community development overall.

Policy 4.4: *Promote the siting of renewable energy generation facilities within compatible Land use districts, namely within Rural Residential-1 or Rural Residential-3, and in such a manner that minimizes site disturbance and development, reduces impacts on local roads and infrastructure, and maximizes energy resource availability so as to provide the most benefit.

Policy 4.5: *Encourage energy generation facilities in existing or prospective agricultural areas, where the energy generation installations conform to, compliment, or add value to the agriculturally-productive landscape or to the surrounding ecosystem services.

Policy 4.6: Review any renewable energy generation facilities in the designated Village Residential and Village Commercial land use districts that do not conform with existing land use or landscape patterns, or do not conform with the Village character

Policy 4.7: Discourage any renewable energy generation facilities in these identified unsuitable areas, identified by the Town of Londonderry:

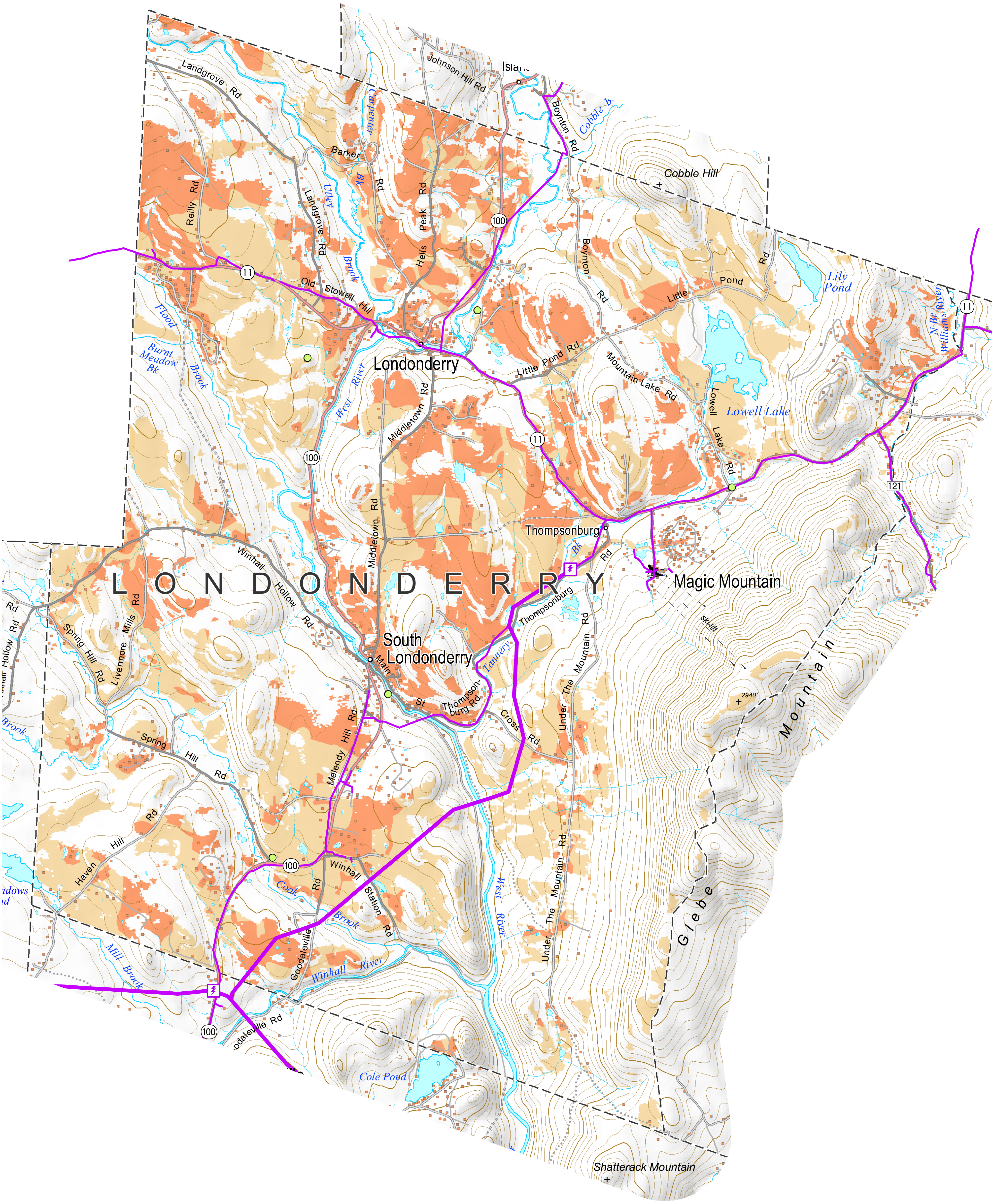
*Within the three resource overlay districts (Resource Conservation, Shoreland, and Flood Hazard),

*Fragile natural areas, as determined by the Land Use chapter of the Londonderry Town Plan.

Policy 4.8: Discourage industrial-scale wind energy generation and the associated transmission infrastructure within the Resource Conservation Overlay District, and hydro-power facilities on the main stem of the West River.

Policy 4.9: *Town of Londonderry will demonstrate leadership by example with respect to the deployment of renewable energy by promoting energy generation facilities on all town buildings, town parks (for smaller-scale installations), and at Flood Brook School, where appropriate and feasible.

Policy 4.10: When considering new renewable energy generation facilities, refer to the town's specific renewable energy bylaws.



Town of Londonderry Solar Energy Potential

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" constraints are identified by the Vt. Public Service Department (Vt. PSD) in their Act 174 Energy Planning Standards
"possible" constraints are identified by Vt. PSD and the Town of Londonderry

0 0.5 1 2 Miles

Existing solar installations:
- 1 - 19 kW (generally smaller-scale on-site:
- 20 - 70 kW residence, farm, school, or business)
- 140 - 150 kW (generally larger-scale
- 360 - 2000 kW commercial/utility solar farms)

Existing solar installations from the Vermont Energy Atlas, developed from Certificates of Public Good; they may correspond to the address of the certificate holder and not the actual location of the installation.

Note: prime vs. secondary solar energy resource is NOT based on solar intensity.

Substations
3 Phase Power Lines
Transmission Lines

5 acres
10 acres
50 acres
100 acres

August 2017

map by Windham Regional Commission, Brattleboro, Vt.
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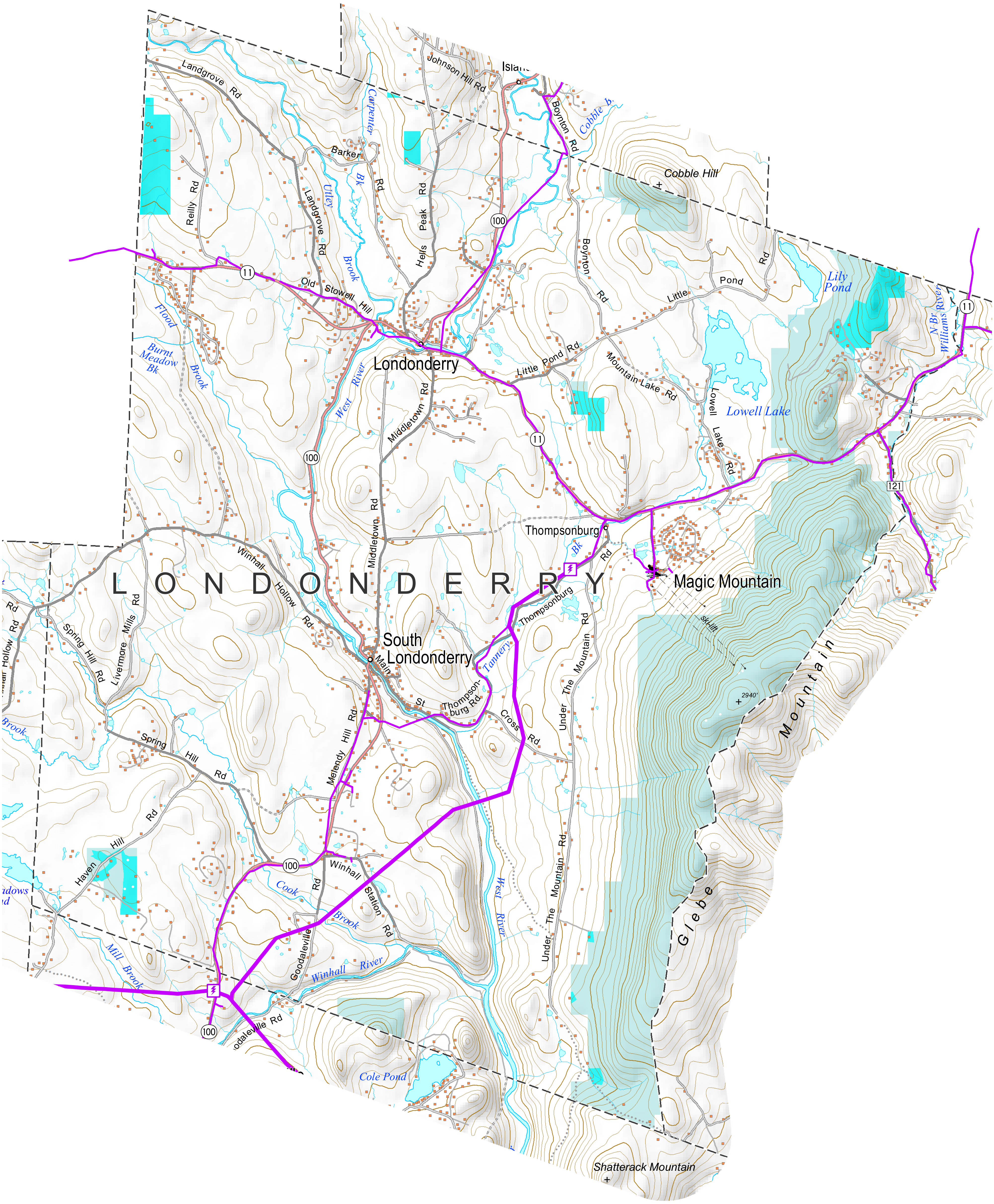

Town of Londonderry Wind Energy Potential

Prime Wind Energy Resource
generally adequate wind resources and no identified constraints (i.e., no "known" and no "possible" constraints)

Secondary Wind Energy Resource
generally adequate wind resources and no "known" constraints, but at least one "possible" constraint

"known" constraints are identified by the Vt. Public Service Department (Vt. PSD) in their Act 174 Energy Planning Standards
"possible" constraints are identified by Vt. PSD and the Town of Londonderry

0 0.5 1 2 Miles

5 acres
10 acres
50 acres
100 acres

Existing Small Wind
Existing Commercial Wind
Commercial Wind In Development

No existing wind energy generation in this area.

Existing wind from the Vermont Energy Atlas, developed from Certificates of Public Good. They may correspond to the address of the certificate holder and not the actual location of the installation.

Note: prime vs. secondary wind energy resource is NOT based on wind speed.

Substations
3 Phase Power Lines
Transmission Lines

August 2017

map by Windham Regional Commission, Brattleboro, Vt.
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