ENERGY

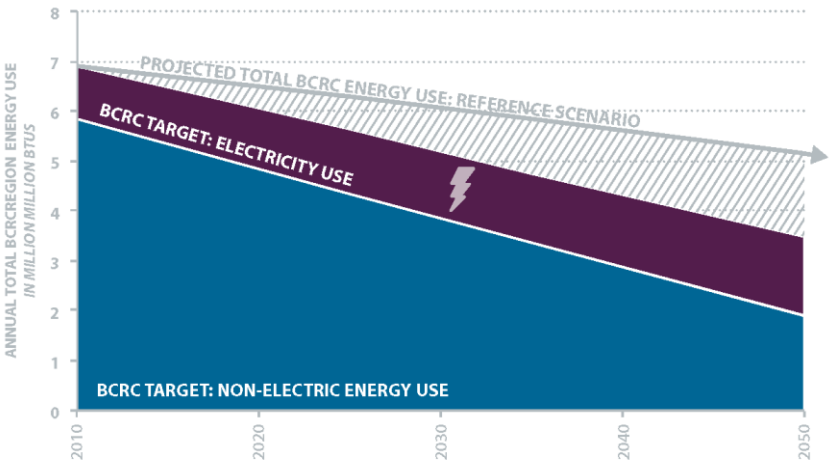
Energy Planning in Town and State

Energy is a resource that must be considered in any comprehensive planning process. The Town of Sunderland recognizes that as conventional fuel resources dwindle globally, the future resilience of its small community will require lowering dependence on imported, non-renewable fuels, tapping local energy sources for enhanced self-reliance, and improving efficiency.

Sunderland Energy Goals and Policies:

- **Use land use planning to reduce reliance on fossil fuels and imported energy sources.**
- **Reduce overall energy consumption through conservation and efficiency.**
- **Develop renewable energy resources locally.**

The State of Vermont established markers through its Comprehensive Energy Plan (CEP updated 2016) to help guide communities to a sustainable future. A central goal of the plan is to attain 90% renewable energy by 2050. To achieve this goal, however, development of new renewable energy sources is insufficient on its own. Since renewable sources yield less energy per unit than their fossil fuel-based counterparts, a drastic reduction in overall energy consumption is critical to meeting this target.



BCRC Region Energy Cost Estimates, 2014

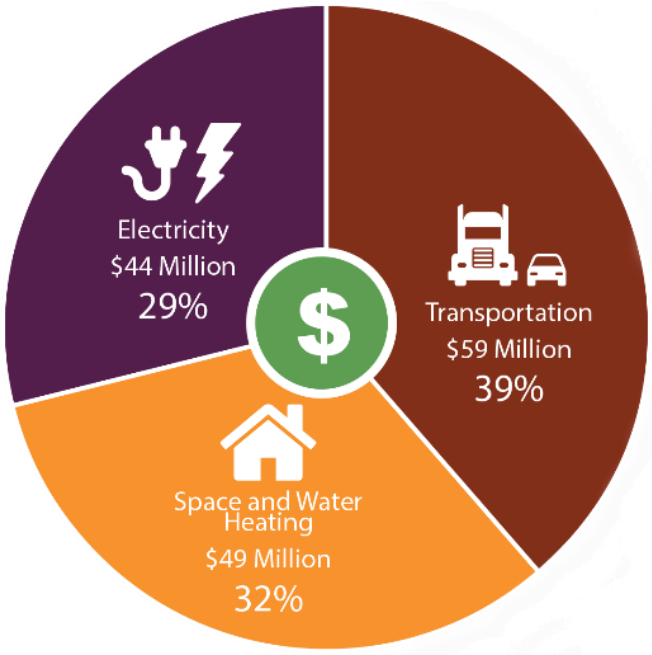
According to LEAP estimates (see below for more details), to achieve the 90X50 energy goal, the BCRC region will need to dramatically reduce energy use by increasing efficiency and relying on electricity for many more purposes. The 'Reference Scenario' above represents a business-as-usual scenario.

VT Energy Goals and Policies (VT CEP 2016):

- **Obtaining 90% of energy for all uses from renewable sources by 2050.**
- **Reducing greenhouse gas emissions to 50% below 1990 levels by 2028 and 75% by 2050.**
- **Relying on in-state renewable energy sources to supply 25% of energy use by 2025.**
- **Improving the energy efficiency of 25% of homes by 2025.**
- **Meeting the Vermont Renewable Energy Standard through renewable generation and energy transformation.**

In the Town of Sunderland, total energy consumption would have to be cut by more than half by 2050 to meet this goal. Energy conservation efforts combined with improved energy efficiency through technology upgrades and building weatherization will enable Vermont towns to reduce energy consumption.

A key aspect of improved efficiency will be a greater reliance on electricity. Since electricity can be generated from renewable resources, and electric-powered technologies such as heat pumps and electric vehicles are highly efficient, switching to electricity will help lower overall energy consumption even as lifestyles remain much the same as today. By 2050, nearly half of all energy will be supplied through electricity according to projections in the VT CEP.



BCRC Region Energy Cost Estimates, 2014

Based on data from Census Bureau, VT Dept. of Motor Vehicles, and US Energy Information Administration.

Though this major shift in energy use is considerable, there are opportunities to lower costs and bolster the local economy through a transformation of the Energy Sector, which now costs the Bennington Region over $150 Million a year in imported fuels electricity costs (2014 estimates). Nearly all this money currently flows out the region and the state, so redirection of these funds to local energy businesses and jobs will better retain wealth in local communities.

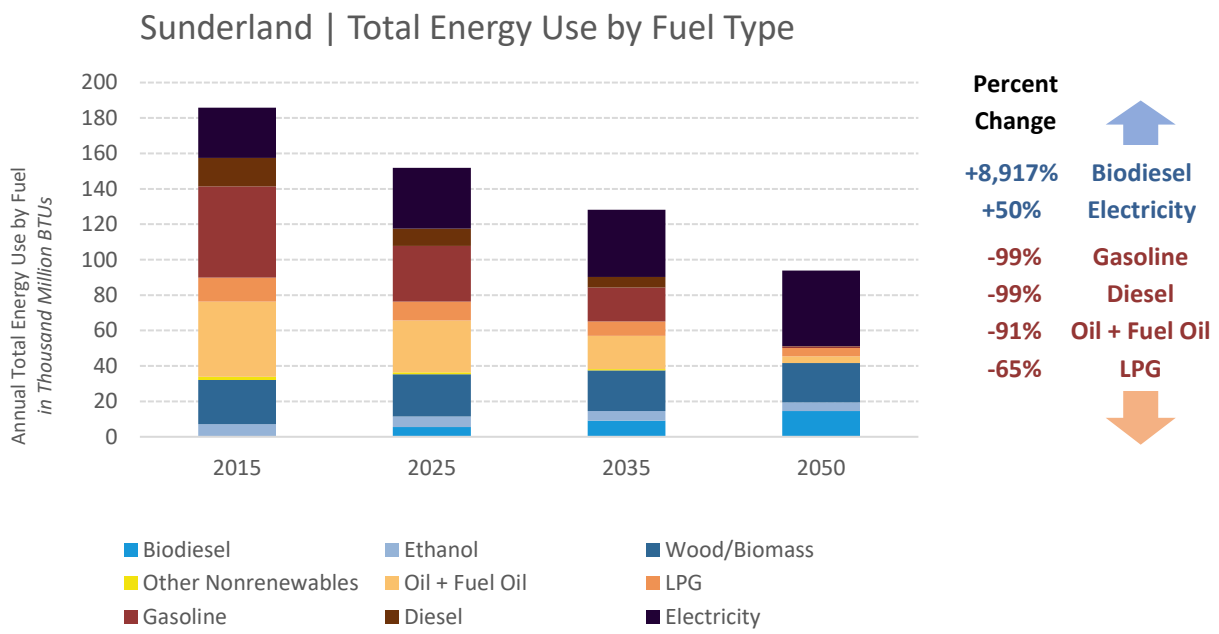
The Energy Chapter of the Town of Sunderland municipal plan is intended to provide the residents and local leadership of the town with information and strategies needed to plan for an energy future that maintains a vibrant community, as the energy sector evolves to lower energy costs, to promote local renewable energy development, and to better protect the environment.

Current and Future Energy Use

As a rural town with 956 residents housed mostly in single family homes, Sunderland consumes a considerable amount of energy every year to meet its transportation, space heating, and electricity needs. According to LEAP model projections (see BCRC Regional Energy Plan 2017, page 39, for more details), Sunderland uses over 180,000 thousand million BTUs (British Thermal Units) per year.

The chart below illustrates one path the town can pursue to achieve this target through gradual adaptation and fuel switching over the next several decades. With the year 2015 as a baseline, the town has identified energy use targets by fuel/energy carrier for years 2025, 2035, and 2050. According to LEAP projections, Sunderland would phase out fossil fuels through electrification of the transportation and heating sectors, with biodiesel replacing some conventional diesel and oil fuels, and with widespread use of woody biomass for space heating. Over time, electricity will go from meeting just 15% of total energy needs in 2015 to 46% of energy needs in 2050. More details on how specific technologies and strategies will achieve this energy reduction and fuel conversion are broken down by energy sector below.

Sunderland Total Energy Use by Fuel Type, 2015—2050. Based on LEAP projections.



Residential Energy Use

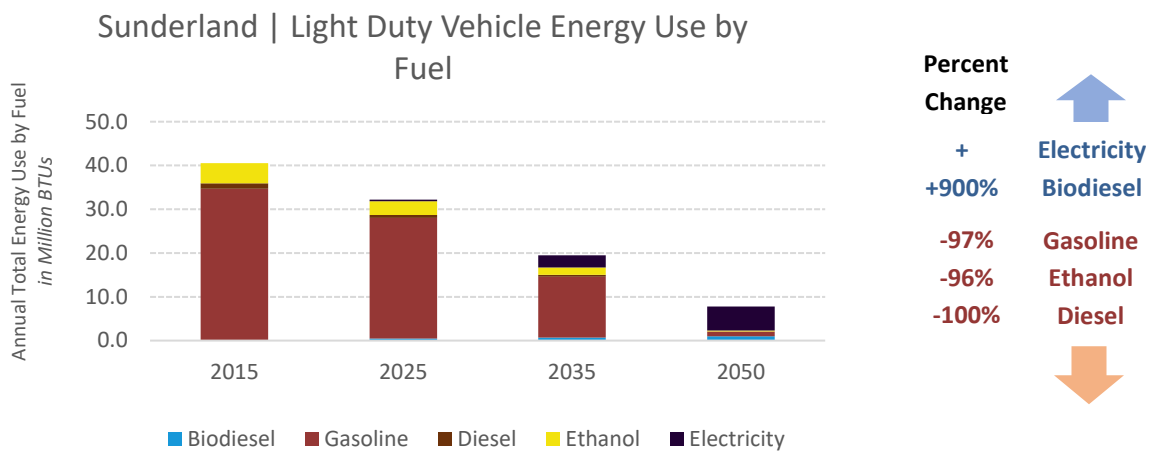
Energy use can be grouped into 3 major sectors: transportation, thermal (heating and cooling), and electricity. Sunderland's more than 900 residents consume large amounts of energy for transportation, to heat space and water, and to power lights and appliances with electricity. By identifying technologies and practices capable of catalyzing the transformation of each energy sector, Sunderland aims to provide its residents and municipal officials the tools necessary to realize the state's energy goals.

Transportation

In Sunderland, and across all Vermont, transportation consumes the most energy of any one sector. Due to Sunderland's rural location, people and goods constantly travel long distances to move to and from the community. The light duty vehicle has made this independent mobility and the freedom and access that come with it possible, yet most vehicles rely on vast amounts of non-renewable fuel inputs to function. Given the dependence most households have developed on fossil fuel vehicles, transportation represents one of the greatest challenges to reducing overall energy use.

The average worker living in Sunderland has a mean commute time of 23.4 minutes, or about 35 miles roundtrip per day. With roughly 516 resident workers mostly commuting to work alone, commuting accounts for approximately 18,060 miles per day of travel, over 150,000 gallons of gasoline per year, and a yearly cost of over $390,000 to commuters. It is estimated that Sunderland residents own over 800 vehicles and drive about 8.5 million miles per year, so commuting represents only a fraction of total transportation in the area (all data based on 2015 ACS estimates).

Sunderland Light Duty Vehicle Energy Use by Fuel, 2015—2050. Based on LEAP projections.



Electric vehicle (EV) technologies have advanced significantly in recent years and these systems are projected to dominate the car industry in coming decades. By electrifying the light duty vehicle fleet, Sunderland residents have the opportunity to improve transportation efficiency and divert money currently spent on fossil fuels. Targets for gradually reducing energy consumption and converting to EV technologies are shown in the chart on the following page.

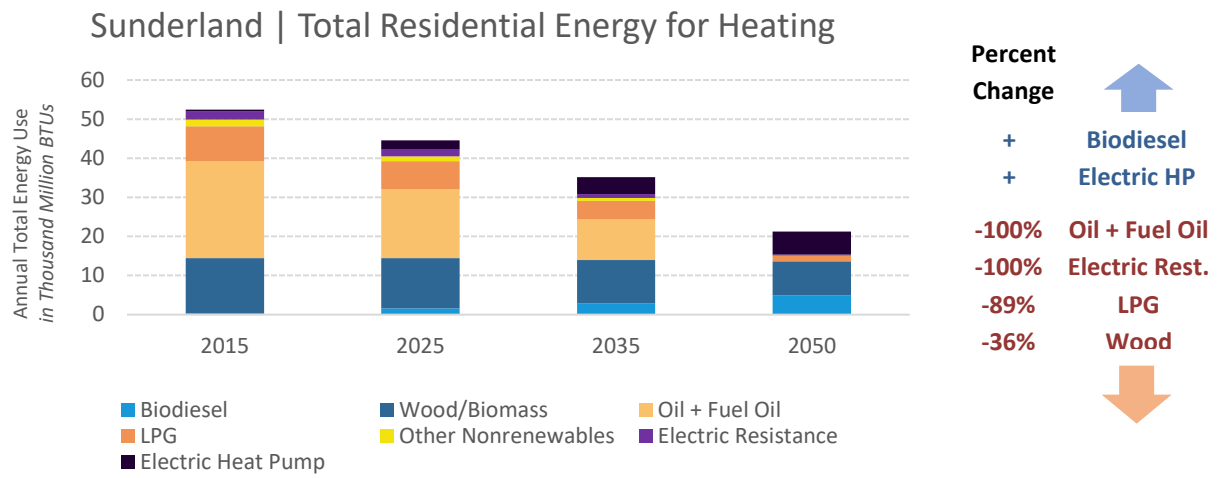
Over the next three decades, total energy for transportation would fall gradually to just 20%, or one fifth, of current levels by 2050. Electrification of 70% the light duty vehicle fleet would account for much of this reduction in energy use. The following EV vehicle count targets should guide adoption rates in Sunderland: by 2025, 44 EVs; by 2035, 325 EVs; and by 2050, 672 EVs (targets generated through LEAP analysis). A combination of biodiesel and gasoline fuels will power the remaining portion of light duty vehicles.

While EVs will play a major role in reducing energy use while allowing Sunderland residents to continue to rely on some personal vehicle travel, efficiency gains from EVs alone will not account for all the energy reduction needed to meet future transportation energy targets. Conservation through behavior changes such as carpooling, transit use, and increased reliance on walking and biking will be critical to reaching 2050 energy targets. Policies that encourage dense land use development and implementation of Complete Streets road design are necessary to shift the predominant transportation model from being vehicle-centric to multimodal and efficient-by-design.

Thermal

Close to half of Sunderland homes are heated throughout the 7-month heating season by oil. Though this fuel source has been inexpensive and widely accessible in the past, projected future shortages of fossil fuels suggest that the town should mitigate reliance on this fuel source by switching to more efficient systems that can be powered by local resources. Woody biomass is one abundant local resource already used for space heating. Wood and pellet stoves currently heat 27% of Sunderland residences, and this proportion is projected to increase to about 40% of Sunderland homes by 2050. Though the number of homes heated by woody biomass will increase, the total energy consumed by these systems will lower from about 14 thousand million BTUs to 9 thousand million BTUs as aging stoves are replaced by newer, more efficient ones.

Sunderland Total Residential Energy Use for Heating, 2015—2050. Based on LEAP projections.



Sunderland's energy use for residential heating would decline to just 40% of current use, or 21 thousand million BTUs, by 2050. Cold-climate electric heat pumps are another highly efficient technology that will play a major role in lowering overall energy consumption in the town through electrification. By 2050, one in four homes would use an electric heat pump as its primary heating source. Cold-climate heat pump technology, based on the mechanism that cools refrigerators by extracting cold air from ambient space, has improved significantly in recent years. In addition to being more energy efficient than other heating technologies, heat pumps can cool one's home during the warmer months. To meet 2050 goals, electric heat pumps can be adopted in accordance with the following household target counts: by 2025, 21 households heated primarily by cold climate heat pump; by 2035, 50 households; and by 2050, 113 households (targets generated through LEAP analysis).

The overall shift in residential thermal energy use can also be shown by portion of households (see chart on following page). According to LEAP estimates, of Sunderland's more than 400 households, over 160 homes would rely for heating on woody biomass through high efficiency pellet and wood stoves, about 115 homes would use electric heat pumps, and almost 100 homes will use biodiesel-based systems. Some homes would continue to use liquid propane gas (LPG), but at a fraction of today's usage (about 27 homes in 2050).

Gradually switching thermal systems to more efficient electric options would do much to improve energy efficiency, but thermal conservation gains would rely on extensive weatherization of existing homes and incorporation of building codes for new construction. The following household weatherization count targets can help guide efforts in Sunderland: 36 households weatherized by 2025; 112 households by 2035; and 243 households by 2050 (targets generated through LEAP analysis).

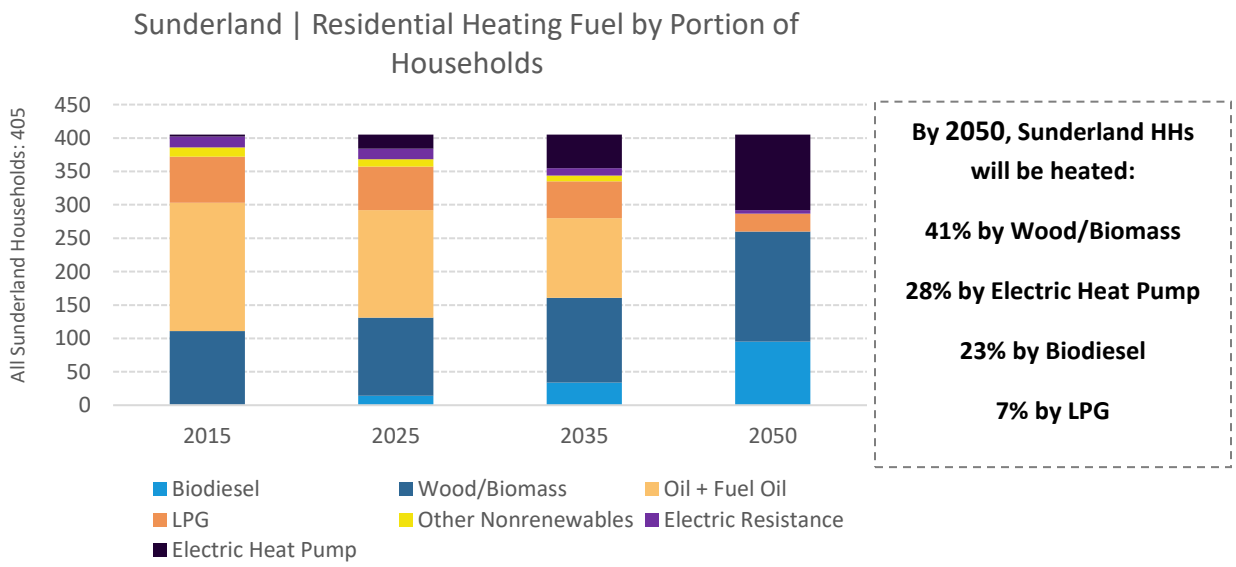
Sunderland Residential Heating and Electric Use and Costs. ACS 2015 Estimates, Efficiency Vermont data.

The vast majority of Sunderland's 448 occupied housing units are single family homes, which together consume close to $1.6 million a year in heat and electric energy use. Town residents spend the most money on heating oil and non-heat electricity.

	Occupied Residential Units	Total Oil Use (gallons)	Total LP Gas Use (gallons)	Total Wood Use (pellet bags)	Electric Use for Heat (kWh)	Non-heat Electric (kWh)	Total Cost by HH Type	Cost /Unit
Single Family	386	197,923	73,852	30,427	363,427	3,860,000	$1,572,479	**$4,074**
Two-Family	16	6,153	2,296	946	11,298	144,000	$52,416	**$3,276**
Multi-Family	0	-	-	-	-	-	-	**-**
Mobile Homes	46	17,690	6,601	2,720	32,482	368,000	$143,929	**$3,129**
Cost Factor		$2.75/gal	$3.45/gal	$5.00/bag	$0.15/kWH	$0.15/kWH		
Total Cost		**$609,858**	**$285,483**	**$170,462**	**$59,899**	**$643,121**		

Methodology: Assumed heating efficiency of 60,000 BTU/sq.ft. and the following square footage assumptions: 2,000 sf; 1,500 tf; 1,000 mf; and 1,500 mobile homes (higher sq.ft. due to generally lower efficiency). Units in housing structure and heating source shares from Census.

Sunderland Total Residential Energy Use for Heating by HH, 2015—2050. Based on LEAP projections.



By better sealing and insulating homes, total energy use will decrease drastically since it requires less energy to heat and cool a weatherized home. NeighborWorks of Western Vermont is a regional organization that offers technical assistance and financing options to make weatherization programs accessible. Efficiency Vermont data

shows that at least 24 Sunderland households made thermal shell improvements in 2016, indicating that residents already value this approach to efficiency.

Electricity

As mentioned previously, electricity use will expand greatly in the future since it is a reliable way to make renewable energy sources available for use. Electricity is a conductor of energy, not a source, but electricity is often mentioned as if it were an energy source since widespread adoption of appliances, vehicles, and thermal technologies powered by electricity are critical to achieving Vermont's energy goals.

Current trends suggest that total electric use is already declining in Sunderland homes:

Sunderland Electricity Usage by Year and Sector (in kWh). Source: Efficiency Vermont.

Sector	2014	2015	2016
Residential	4,085,807	3,954,751	3,809,560
Commercial & Industrial	816,417	1,105,384	1,161,441
Total	**4,902,225**	**5,060,135**	**4,971,001**
Count of Residential Premises	604	601	600
Average Residential Usage	7,511	7,324	7,081

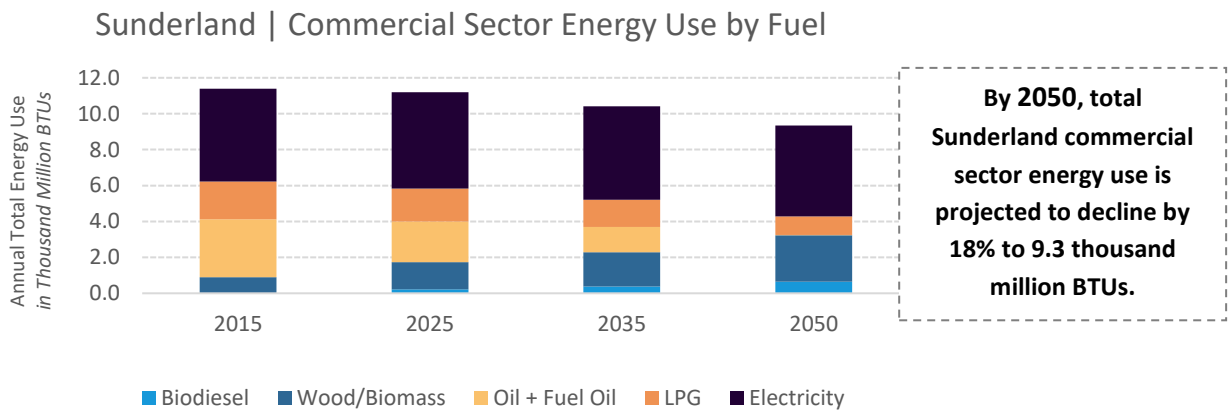
Efficiency Vermont reports that electricity use has declined in residences over the past several years, in part due to efficiency enhancement programs and initiatives. Efficiency Vermont estimates that Sunderland homes have saved $8,300 since 2014 by switching to high efficiency appliances and weatherizing their homes. While these trends show electricity consumption on the decline, total electricity use will eventually begin to increase as Sunderland residents switch to electric transportation and thermal systems.

As part of this process, total electricity use is expected to increase to 42.7 thousand million BTUs, more than doubling current usage, by 2050. This increase may seem contrary to energy use reduction goals, but since electricity is much more efficient than the fuels it will replace, total energy consumption will decline even as electricity use rises. More is said about local generation of electricity in a later section on *Local Renewable Energy Potential*.

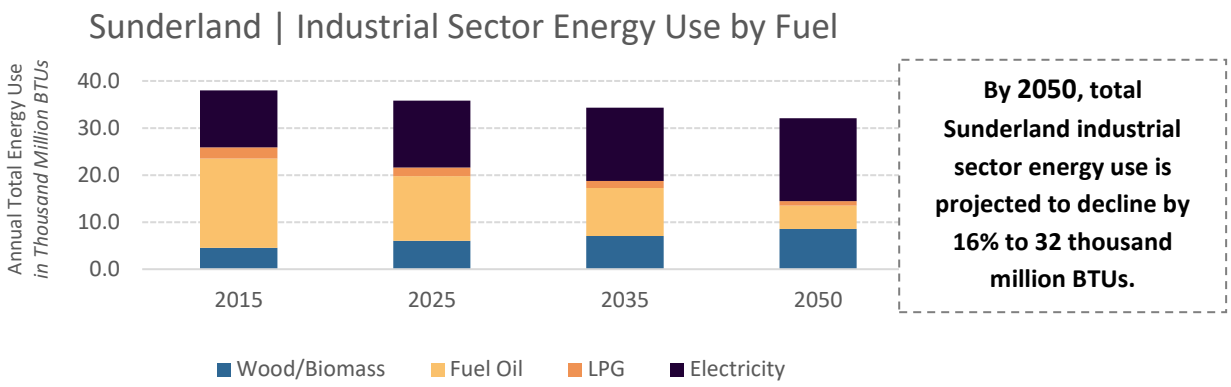
Commercial and Industrial Energy Use

Sunderland is home to several manufacturing, utility, and service-based establishments that provide 79 jobs and some of the highest average wages in the county. About 15 establishments are classified as commercial (service producing) and 11 as industrial (goods producing) (VT Dept. of Labor, 2016).

Sunderland Total Commercial Energy Use by Fuel, 2015—2050. Based on LEAP projections.



Sunderland Total Industrial Energy Use by Fuel, 2015—2050. Based on LEAP projections.



Overall energy use reduction at Sunderland's businesses and industries is not projected to be as dramatic as for Sunderland homes. This flexibility is intended to prevent energy reduction goals from threatening local establishments' viability over the next several decades. At the same time, policies and market forces still expect businesses to pursue energy reduction strategies appropriate to their ability.

Fuel oil use is projected to decrease almost entirely in the commercial sector and 74% in the industrial sector by 2050, businesses will need to plan for electrification, woody biomass combustion systems, and biodiesel use to replace this fuel over time. Most businesses can reduce energy consumption through straightforward conservation practices such as upgrading lightbulbs and appliances, powering down appliances and machinery when not in use (such as by using programmable timers), and adjusting thermal settings. Comprehensive energy audits are an excellent first step to identifying strategies that make the greatest impact on energy reduction and cost savings. Additionally, since many commercial and industrial operations involve sizeable building footprints, some sites may be well suited to accommodate rooftop solar arrays.

Municipal Energy Use

Local government and schools are significant consumers of energy, and the costs associated with energy use by those entities have a direct bearing on taxes. Energy conservation and use of alternative energy systems in this

sector have the potential to produce significant savings for the community and to set a visible example of responsible energy use. Fortunately, Sunderland's town offices are housed in a new building completed in 2014, so the offices are well-insulated and have up-to-date heating and electric systems that keep energy costs low. Baseboard propane and propane radiant heat systems in the floors warm the building in winter, and two heat pumps are installed to provide A/C in the summer. The heat pumps have not been necessary, though, since building insulation keeps office spaces comfortably cool year-round.

The town garage – in contrast to the offices – is notoriously energy inefficient with minimal insulation in its aging metal construction. More than twice as much propane is currently used to heat the garage than the town offices (more details on office and garage energy use and costs provided in Table 3). Though the town has made patch improvements to the garage in recent years, a comprehensive building upgrade is needed and could deliver significant savings to the town over time.

Annual Fuel Consumption and Cost for Town Offices and Garage, FY16-FY17: Sunderland, VT.
Estimates from Town, 2018.

Energy Source	Quantity Used	Cost Factor	Total Cost
Town Offices			
Propane Heat	238 gallons	$3.75/gallon	$892
Electricity	7,131 kWh	$0.15/kWh	$1,049
Town Garage			
Propane Heat	509 gallons	$3.75/gallon	$1,909
Electricity	8,776 kWh	$0.15/kWh	$1,291
Diesel Fuel	6,897 gallons	$2.75/gallon	$18,966
Total Cost			**$22,198**

The town offices and garage consume comparable amounts of electricity. Offices use high-efficiency indoor and outdoor light fixtures for which Efficiency Vermont issued rebates. Indoor lights are connected to timed motion sensors and outdoor lights are scheduled to come on for the least number of hours possible each day. The garage houses several municipal vehicles and pieces of equipment, including a pick-up truck and two dump trucks that use diesel fuel. Over 85% of total municipal energy expenditures go to diesel fuel costs.

Sunderland Elementary School serves about 84 children in kindergarten through sixth grade school levels. The school building (about 9,000 sq.ft.) is a modular construction built in the late 1960s. The school uses baseboard oil heat and has no A/C systems. Roughly seven years ago a series of improvements were made to the building, including a new roof, replacement of all windows with double-paned windows, new external doors with better weather sealing, a new oil furnace, and a vestibule entrance to reduce heat loss. At the time, about 80% of all baseboard heating units and electric systems were upgraded to new, digital systems. A few years later, lighting was upgraded to high-efficiency fluorescents and the water heater was replaced with a heat pump water heater with the support of Efficiency Vermont rebates. In the past year, LED exterior security lights were installed and the school purchased a new school bus to replace its existing bus.

Annual Fuel Consumption and Cost for Sunderland Elementary School, FY16-FY17: Sunderland, VT.
Estimates from Bennington-Rutland Supervisory Union, 2018.

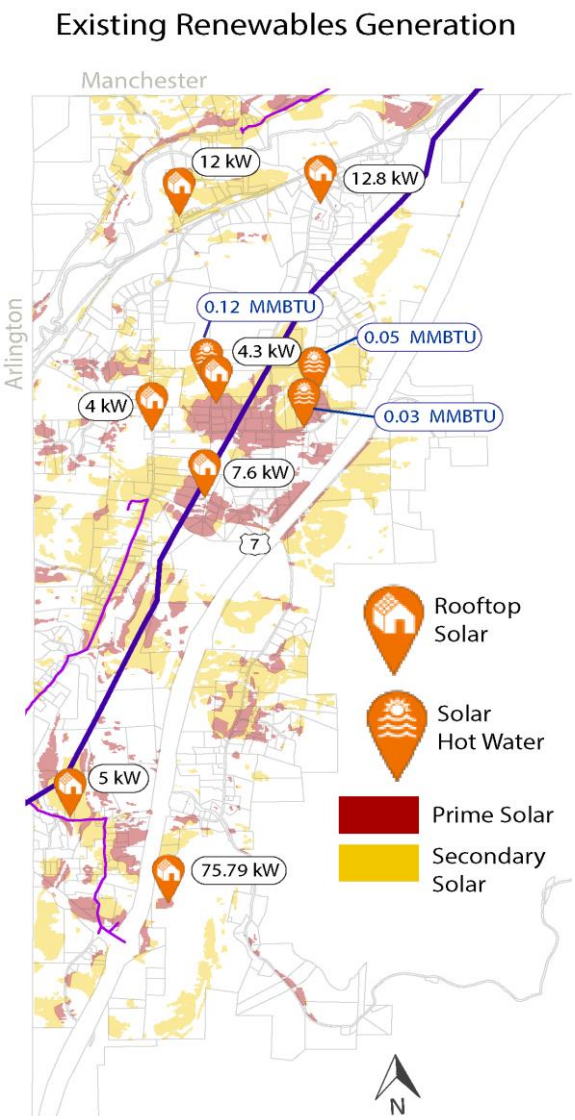
Energy Source	Quantity Used	Cost Factor	Total Cost
School Building and Bus			
Oil Heat	2,523 gallons	$2.50/gallon	$6,307.00
Electricity	30,720 kWh	$0.19/kWh	$5,772.24
Electricity for Security Lights	7,300 kWh	$0.20/kWh	$1,456.72
Diesel Fuel for School Bus	927 gallons	$2.15/gallon	$1,961.93
Total Cost			**$15,498**

The school spends over $15,000 each year on energy costs (see full estimate breakdown in above table), with the largest expenditure being for heating oil. One way to lower this cost could be to install cold climate heat pumps in strategic areas of the building as a complement to oil heating (these units also provide A/C in warmer months). Electricity is currently a significant energy expense at the school, and it may be lowered by installing timed motion sensor light switches that automatically turn off after a few minutes of inactivity and by completing the upgrade of the school electrical system to new and digital systems.

One opportunity for wider community energy savings lies in greater use of the school bus. The bus driver estimates that only about half of students currently use the school bus despite the fact that the bus route is designed to serve most of the community. It appears to be a matter of preference and habit that many families opt to drive children to and from school. A campaign to raise bus ridership could lower passenger vehicle trips to the school, creating savings for Sunderland families.

Local Renewable Energy Generation and Potential

Nearly all energy consumed in Sunderland is currently imported in the form of gasoline, oil, propane, and electricity. Some imported electricity is powered from renewable sources, primarily the electricity purchased from hydroelectric generating facilities in Quebec and Labrador, Canada. Today limited energy production occurs in Sunderland in the form of numerous rooftop solar arrays (total installed capacity of 110 kW) and several residential solar hot water heaters. At least two



Based on VT Energy Dashboard data, accessed 2/14/18

Sunderland Existing Renewables

local businesses have placed solar panels on the rooves of their commercial buildings: the Hill Farm Inn (12 kW) and Orvis Company headquarters building (75kW).

There are many more areas in the municipality where specific scales of solar and wind development are appropriate. The following map analyses, which comply with Act 174 standards for renewable resource mapping (for more details, see Bennington County Regional Energy Plan, pages 80-83), are intended to provide information about renewable resource availability in the town. Maps were generated using GIS data layers developed by VCGI (the VT Center for Geographic Information).

Renewable resource layers were mapped, and then 'Known Constraints' (vernal pools; river corridors; floodways; state significant natural communities and rare, threatened, and endangered species; national wilderness areas, and class 1 and 2 wetlands) were removed entirely from available resource areas.

Then 'Possible Constraints' (VT agriculturally important soils; special flood hazard areas; protected lands; deer wintering areas; conservation design highest priority forest blocks; and hydric soils) were overlapped with renewable resources to highlight where there are potential complications for developing generation facilities.

Remaining resource areas that do not overlap with any environmental constraints are considered 'Prime' resource areas, and resource areas that overlap with Possible Constraints are considered 'Secondary' resource areas.

Locally-Identified Constraints

Act 174 authorizes municipalities to identify local resource areas where renewable energy development is inappropriate and comparable development is already restricted. Two such areas exist in Sunderland, namely the Forest land use district and the Route 7 right-of way. The Town Plan notes that development near the Route 7 interchange should be carefully guided so as to protect scenic and natural resources, and that significant points of observation along Route 7 should be preserved. For the Forest land use district, the Town Plan states that permanent development such as roads and utilities is discouraged in order to protect forest resources and minimize costs for maintaining access to backlands. Agricultural soils are flagged so that precautions be taken to preserve agricultural soils when possible.

Solar

There is abundant solar resource throughout low-lying areas of the town, and much of this resource is unrestricted by state-identified environmental constraints. See local constraints, 'Prime' and 'Secondary' resource areas, and preferred solar sites in the Sunderland Solar Resources Map.

The town has identified preferred sites for commercial-scale solar facilities in the Commercial/Industrial (CI) District, as shown on the Land Use Plan (Map 6). Solar electric generation facilities of 75 kW capacity and greater are encouraged in these areas. Solar facilities of 75 kW capacity and greater shall not be developed in other areas of town. Solar generation facilities of a capacity lower than 75 kW are permitted throughout the town, except in the local constraint areas of the Forest (F) land use district and VTRANS right-of-way. Preferred areas for solar facilities less than 75 kW include the following areas: roof- mounted systems; former brownfield sites; disturbed areas such as gravel or sand pits, sealed landfills, and former quarries; areas where topographical features or hedgerows naturally screen a site from common view; and areas adjacent to large-scale commercial or industrial buildings.

The Town of Sunderland encourages solar development at residential and commercial scales in appropriate areas throughout town. Residential scale solar arrays, which primarily provide energy onsite and typically range from 1 to 15 kW, are suitable on rooftops and on ground-mounted trackers at homes and businesses. Commercial solar arrays, which primarily produce energy for sale to the electric grid, range from 75 kW up to several MWs' worth of capacity.

The Bennington County Regional Energy Plan has determined that the Town of Sunderland should aim to develop an additional 3.4 MW of solar capacity by 2050 to help meet regional and state energy targets. The resource areas identified in the Sunderland Solar Resource Map are more than sufficient to meet this target. Resource areas in preferred sites alone total about 120 acres, which will support between 2 MW and 10 MW of solar installed capacity. Given that about 85 kW of the town's solar target is estimated to be met by roof-top solar (see Bennington County Regional Energy Plan, page 91 for calculation methodology), the remaining 2.5 MW of new solar capacity will reasonably be met in the identified preferred and potential mapped resource areas, which total an additional 1,385 acres of solar resource.

Solar energy policies should consider the constantly evolving nature of energy technologies. As capacity and diversity of solar energy systems increase over time, the policies presented here should be reviewed to reflect relevant updates in the technology. For example, recently-introduced Tesla Solar Roof tiles on a Sunderland home may surpass the 75 kW capacity threshold delineated here, but could be found to be aesthetically and environmentally suitable in the town.

Solar Scale Definitions & Examples

Residential-scale:
capacity ≤ 15 kW

Commercial-scale:
capacity ≤ 500 kW

Utility-scale:
capacity > 500 kW

Solar Screening– Ground-mounted solar facilities shall comply with state minimum setbacks and all screening and landscaping requirements of the C/I district. The objective of screening policies is to mitigate the visual impacts of ground-mounted solar facilities on natural and historic vistas as viewed from public roads and neighboring residential properties.

Wind

The Town of Sunderland currently has no wind generation facilities connected to the grid, which is likely due to the fact that areas with significant wind resource are in high altitude, high slope areas where development is generally not permitted. In Sunderland, these high-altitude, high-wind resource areas are conserved as part of the Green Mountain National Forest. Though wind energy development could be allowed in the national forest, it is considered less favorable to develop than other comparable and unrestricted areas are available for development.

The national forest land in Sunderland currently lacks electric transmission infrastructure to which a generator could be connected, making potential grid connection a very costly undertaking.

Due to these points of concern, the town has determined that small-scale (residential) power generation is most appropriate in the municipality. Only wind energy generation facilities referred to as 'residential scale' with capacities up to 10 kW are permitted in the Rural Residential (RR), RCR, and CI districts. Mid-size, commercial-scale wind turbines are only appropriate in the Commercial/Industrial District. No wind energy generation infrastructure is permitted in the F District. The images to the right provide an idea of the scale of residential and commercial-scale wind turbines.

All wind development must comply with the State's turbine noise standards and environmental regulations. See Sunderland's Wind Resource Map below to view areas where wind installations could be most effective.

Wind Scale Definitions

Utility-scale: Turbines with hub heights ≥ 70 meters, and capacity ≥ 1 MW.

Commercial-scale: Turbines with hub heights ≤ 50 meters, and capacity ≤ 100 kW

Residential-scale: Turbines with hub heights ≤ 30 meters, and capacity ≤ 10 kW

Examples

Hydro

There are no existing hydroelectric sites in Sunderland. Due to environmental regulations, it is highly unlikely that new dams or hydro sites will be developed in Vermont. For the moment, Sunderland does not plan to develop hydroelectric generation facilities in the town.

Geothermal

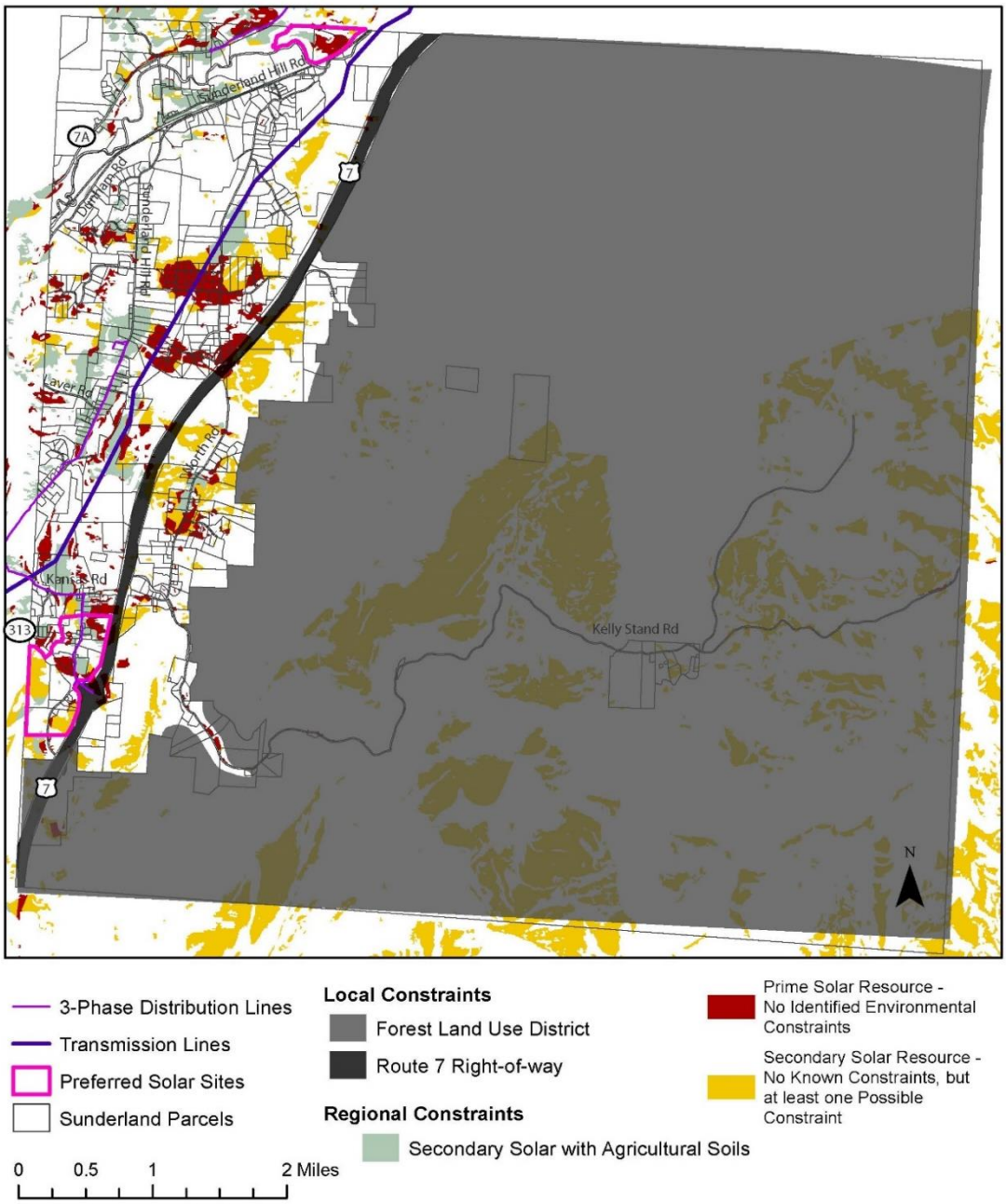
The soils in low-lying, developed areas of Sunderland have high resource potential for geothermal well heating systems. This technology is highly encouraged in new residential and commercial construction.

Woody Biomass

With more than 25,800 acres of forested land in the town, Sunderland has abundant woody biomass resource to be used for local heat generation – the most efficient use of biomass for energy. High-efficiency wood pellet and wood chip heat systems are a good choice for buildings of sufficient scale such as apartment buildings, schools, and other institutions. Local installations of such systems include several sites in the Town of Bennington: wood chip heat systems at the middle and high schools and a wood pellet heat system at Applegate Apartments.

When it comes to using biomass for electricity generation, the town sees combined heat and power biomass projects as preferable to enterprises dedicated solely to electricity generation. Biomass electricity facilities may be appropriate in Sunderland, though only projects operating at a capacity of 5 MW or less shall be permitted in the town. Other plant-derived renewable fuels such as biodiesel can be produced from oil seed crops to support farm operations and to supply businesses in the area.

Sunderland Solar Resource Map



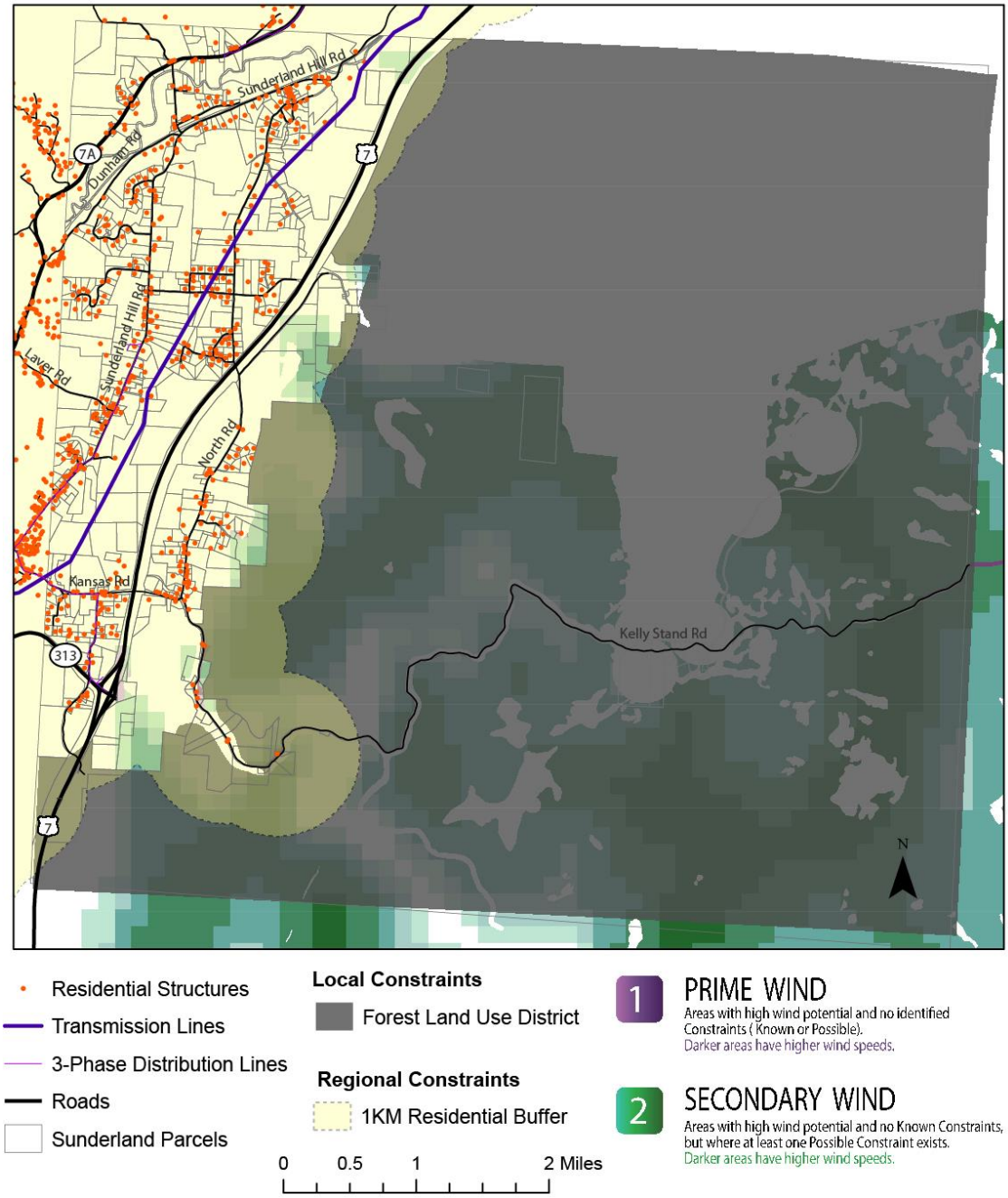
Local Constraints – Solar resource has been removed from these areas where solar development and similar development is considered inappropriate and is not permitted.

Regional Constraint – Presence of prime agricultural soils is flagged. Special attention shall be paid to preserve agricultural soils for future agricultural activities. If development does occur, efforts shall be made to mitigate impacts on agricultural soils and/or preserve portions of agricultural soils for future use.

Preferred Sites – Suitable for all scales of solar development, including commercial (75 kW and greater in the Commercial/Industrial (CI) District). Preferred sites contain about 120 acres of solar resource area.

Prime and Secondary Solar Resource Areas –Solar resource areas outside of preferred sites are suitable for solar electric generation under 75 kW. Potential areas for residential-scale solar include over 1,390 acres of resource area.

Sunderland Wind Resource Map



Local Constraints – No wind energy generation infrastructure is permitted in the F District, where similar development is considered inappropriate and is not permitted.

Regional Constraints - the Bennington County Regional Energy Plan establishes a regional constraint of 1KM residential buffer for utility-scale wind development

Preferred Sites – Sunderland has not identified any preferred sites for wind development in the town.

Wind Resource Areas – Outside of local constraint areas, residential-scale wind facilities (hub heights ≤ 30 meters, and capacity ≤ 10 kW) are permitted. Outside of local constraint areas, commercial-scale facilities (hub heights ≤ 50 meters, and capacity ≤ 100 kW) are only permitted in the Commercial/Industrial District.

Energy Conservation, Efficiency, and Renewable Energy Strategies

To achieve the energy goals advanced by the state of Vermont, Sunderland's residents and municipal officials must commit to concrete actions that reflect the transformations required for this undertaking. Achievement of 90% renewable energy by 2050 will depend on improving efficiency, conserving energy, and developing local renewable energy facilities at a steady, resolute pace over the next three decades.

The town has identified the following policies and actions as the most effective pathways to realize the town's energy planning objectives. Many of the policies indicated here are discussed in more detail in relevant sections of the Sunderland Town Plan, particularly in the areas of transportation and land use. The town referenced both the Bennington County Regional Energy Plan (2017) and Act 174 guidance and standards documents published by the Vermont Department of Public Service to prepare these policies.

Municipal Leadership and Land Use Planning

1. Municipal Energy Committee: The town should establish a municipal energy committee to implement this plan and track progress on the policies and actions stated herein. This committee would promote local residential and commercial efficiency and conservation improvements through coordination of information and technical assistance and advocate for appropriate renewable energy generation throughout the town.
2. Land Use Policies: Land use policies must promote compact, historical development patterns. Though there is currently no single, dense village core in the town, there are areas where future development could be concentrated to establish walkable, multi-use hubs. To encourage development of these dense hubs of activity, EV charging stations could be installed in conjunction with development projects. Participation in state designation programs should be evaluated as potential catalyst for this development.
3. Municipal Infrastructure. All municipal infrastructure should be evaluated to identify opportunities for efficiency improvements and renewable energy generation and use. At the town offices, an EV charging station shall be installed and the viability of installing solar panels on the building's roof shall be assessed. Professional energy audits shall be pursued at the town garage and elementary school to identify cost-effective energy saving strategies. The town's capital budget program should consider weatherization improvements and upgrading existing thermal and transportation systems to high efficiency electric technologies.
4. New Development: New development in Sunderland shall adhere to the state mandated Residential Building Energy Standards, be planned to take advantage of a site's solar resource potential, and be made to accommodate multiple transportation modes through the Site Plan and Subdivision Review processes.

Conservation and Efficient Use of Energy

5. Residential: The Sunderland municipal energy committee should work with BCRC to coordinate presentations and local conversations that promote residential energy efficiency and conservation through the following programs: the "Energy Star" building performance rating system; educational programming and appliance upgrade rebates available through Efficiency Vermont; and weatherization assistance provided by the Bennington Rutland Opportunity Council (BROC) and NeighborWorks of Western Vermont (NWWVT). Providing information on programs that assist low-income residents and owners of rental units in pursuing weatherization and thermal systems upgrades should be prioritized.
6. Commercial and Industrial: Energy efficiency and conservation may be promoted at these sites in the following ways: by requiring all new commercial and industrial buildings meet the state mandated Commercial Building Energy Standards; by encouraging existing business to explore efficiency and

conservation strategies outlined by Efficiency Vermont, which include promoting carpooling and alternative commuting modes among employees, completing energy audits, installing EV charging infrastructure, and upgrading thermal and transportation systems to higher efficiency and electric technologies when possible.

Transportation

7. Electric Vehicle (EV) technology: The Town of Sunderland shall pursue installation of a EV charging station at the town offices and the Sunderland Elementary School. Informational presentations for Sunderland residents and business owners on the advantages of EV technologies as well as state and federal rebate opportunities may be coordinated with the assistance of Efficiency Vermont.
8. Public transit: New public transit routes should be explored and pursued, including the potential for a future bus stop along Route 7 in the RCR District. Installation and maintenance of high quality and ADA accessible amenities at public transit stops such as shelters, benches, bike racks, posted signage and schedules, and park-and-rides should be pursued. Town officials shall be involved in any future proposals to develop passenger rail access along Route 7A.
9. Alternatives to Single Passenger Vehicle Commuting: The municipal energy committee, in partnership with BCRC and other groups, can share information with local businesses and institutions on promoting rideshare, vanpool, and car-sharing, on strategies to support seasonal bike commuting, and on using telecommuting to reduce energy expended for work travel. A school campaign to increase ridership of the school bus could create community savings.
10. Complete Streets Design: The town should assess existing roads for their ability to accommodate safe and convenient walking and biking. Areas for improvement should be prioritized and funding sought to align these areas with Complete Streets guidelines.

Renewable Energy Development

11. The town should offset ongoing fossil fuel consumption by developing residential-scale renewable energy facilities on appropriate town-owned parcels. The town should support interested residents in developing residential-scale renewable energy facilities on their properties. The town should consider trialing use of blended biofuel in diesel-powered municipal trucks and equipment.

Local Food Production

12. The municipal energy committee can help facilitate dialogue between local/regional food producers and local/regional institutions such as schools, hospitals, and meal delivery or provision programs to enhance the interconnectedness of the regional food system.