Chapter 6 Energy

1 Purpose

It is the overall intent of this chapter to encourage the efficient use of energy and the development of renewable energy resources in accordance with 24 V.S.A. §4302(c)(7). It is also the intent of this energy chapter to address the requirements of Act 174 of 2016 and to meet the enhanced energy planning standards developed by the Vermont Department of Public Service (DPS). This was prepared based upon the *Guidance for Municipal Enhanced Energy Planning Standards* (DPS; March 2, 2017) in order for the Chester Town Plan to be given greater weight in the Section 248 process. This chapter describes existing conditions in Chester and conveys community policies on energy conservation, renewable energy production, and how land uses can contribute toward energy conservation.

The Southern Windsor County Regional Planning Commission (SWCRPC) has developed a 2018 *Regional Energy Plan* to meet these standards in order to receive Section 248 "substantial deference". Chester is coordinating the development of this municipal energy plan with the SWCRPC so that:

1. The municipal plan is informed by the ongoing regional energy planning process; and,
2. The municipal plan is compatible with the regional plan.

This energy chapter was developed with assistance from the SWCRPC through funding provided by the Vermont Department of Public Service.

Due Consideration: To give such weight or significance to a particular factor as under the circumstances it seems to merit, and this involves discretion. [*Black's Law Dictionary, 6th ed. 1990*]

Substantial Deference: Means that a land conservation measure or specific policy shall be applied in accordance with its terms unless there is a clear and convincing demonstration that other factors affecting the general good of the State outweigh the application of the measure or policy. [*30 V.S.A. §248*]

1.1 Community Energy Survey

A survey was conducted in January 2018 to get input from residents to assist in this enhanced energy planning process. Key findings from this survey are summarized below.

1. The vast majority of respondents indicate that energy issues are very important (57%) or important (29%) to them. A majority (about three-quarters of the respondents) support the goal of 90% of energy coming from renewable sources by 2050.
2. There is very strong support for roof-mounted solar arrays.
3. Strong support was expressed for non-residential solar power.
4. Support was expressed for non-residential wind power; however, 23% are not in favor and another 21% are neutral.

For more detail about the survey see Appendix C.

1.2 Energy Goals

Through the 2016 Vermont Comprehensive Energy Plan (CEP) and Statute, the State of Vermont has identified a number of goals and strategies to achieve energy conservation throughout the state. The

Town of Chester embraces the State Energy Goals[1] including but not limited to the following. Through the detailed policies and actions contained in this plan, Chester will strive to achieve these goals.

Reduce total energy consumption per capita by

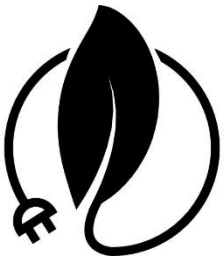
15% by 2025

More than one third by 2050

Reduce greenhouse gas (GHG) emissions from 1990 levels

40% reduction by 2030

80% to 95% reduction by 2050



Meet remaining energy need from renewable sources

25% by 2025

40% by 2035

90% by 2050

2 Analysis of Energy Use

2.1 Power Generation and Transmission Facilities

Green Mountain Power (GMP) is the electric utility provider in Chester and surrounding towns. There are no utility-scale power generation facilities located in Chester. There are 38 known renewable energy generation sites in town presently. Two commercial-scale ground-mounted solar facilities were constructed in Chester within the last few years, both in close proximity to the Chester Substation.

[1] Energy goals as referenced in 24 V.S.A. §4302(7), 10 V.S.A. §578(a), 10 V.S.A. §580, 10 V.S.A. §581, and in the Vermont Comprehensive Energy Plan

There is one known residential-scale wind turbine located in Chester at this time, which does not appear to be net-metered. See Appendix A for more detail about existing energy generation.

Electric transmission is provided by the Vermont Electric Power Company (VELCO). Transmission facilities located in Chester include the following, which are shown on the maps in Appendix _:

- Chester Substation, located along VT Route 103 south of the intersection with Trebo Road;
- A 46 KV line that parallels Trebo Road;
- A 46 KV line that cuts through the northeast corner of Chester; and,
- A 345KV line along the western town boundary with Andover.

2.2 Energy Usage

As discussed in the *2016 Vermont Comprehensive Energy Plan* (CEP), "fossil fuels currently play a dominant role in meeting Vermonters' demand for energy services, with gasoline and distillates (namely diesel and heating oil) alone supplying around half of all of Vermont's primary energy consumption". The CEP states that less than 20% of the statewide consumption of primary energy is from renewable energy sources. More than two thirds of that renewable energy comes from the electric power supply, which includes power generated by hydro, biomass, wind, solar and other facilities. The remaining renewable energy consumption in Vermont is largely comprised of wood for home heating and ethanol blended into gasolines[2].

2.3 Electricity

In 2015, residences accounted for 61% of the current total annual electricity usage, and commercial and industrial uses accounted for 39% of the total 18,335,480 kWh used in Chester. See Figure 6.0 that summarizes electricity use data provided by Efficiency Vermont. Average residential usage is 6,689 KWh (2015).

According to Department of Labor Statistics, there were 129 commercial establishments in Chester during 2015.

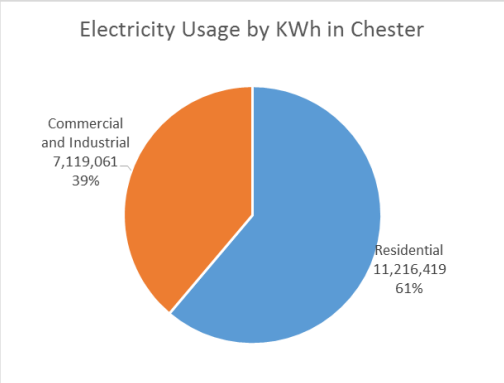
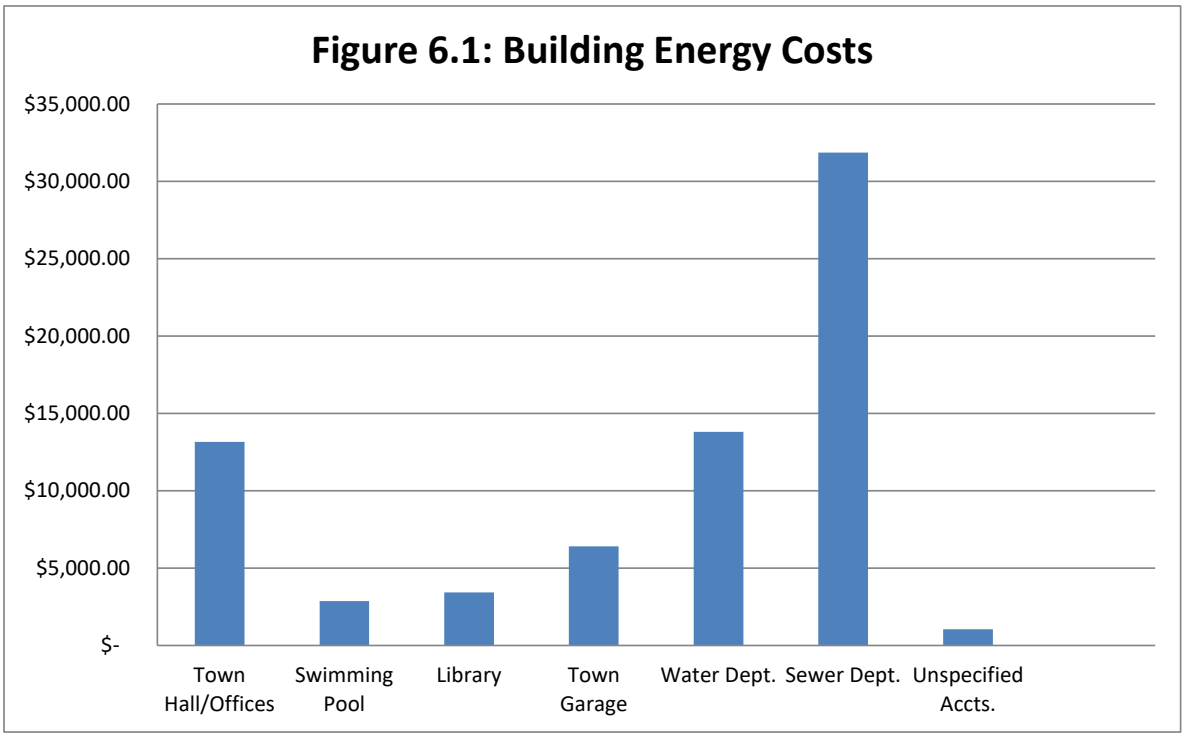


Figure 6.0

Total electricity consumption has essentially leveled off in recent years. (There was a slight increase in total electricity usage in Chester between 2014 and 2016.) See Appendix A for more detail.

An older energy analysis found that the Town of Chester spent $192,795 on fuel (2010), of which 38% was for municipal buildings and 62% for the municipal vehicle fleet. When comparing costs for municipal facilities, the Sewer Department had the highest fuel costs, followed by the Water Department, and then the Town Hall (see Figure 6.1). An energy audit was performed for the Town Hall and a number of recommendations have been implemented to date, including air sealing and basement insulation. The Town is exploring opportunities to make additional energy efficiency improvements to the Town Hall. Audits of other municipal facilities would be helpful to identify cost-effective energy upgrades for other municipal facilities.

[2] *Vermont Comprehensive Energy Plan* (Department of Public Service, 2016)



2.4 Heating

Of the 1,793 total household units in Chester, 18% are seasonal and 20% are renter-occupied. See Table 6-A.2 in Appendix A, which summarizes total housing units in Chester by type from the 2010 Census Bureau.

Fossil fuels are currently the primary fuel type used for heating structures in Vermont[3]. According to American Community Survey (ACS) data (2011-2015), the predominant ways to heat homes in Chester include fuel oil (62%), wood (25%) and propane/LP gas (13%). In 2015, the estimated average annual cost to heat a home was $1,452 and about $6,248 to heat a business. See Appendix A for more detail about heating existing buildings.

Wood is the only form of these heating fuels that is renewable and locally produced. Sustainable forestry operations are important not only to supply fuel wood for residents, but also to maintain an active working landscape in rural Chester and support a local forestry economy.

2.5 Transportation

As a rural area, transportation options for Chester residents is dominated by the personal automobile (see the Transportation Chapter for more information about other modes of travel). The negative environmental impacts of single-occupant vehicle driving is well documented. Costs associated with using an automobile for most of your travel needs can be significant (see the Housing Chapter for more information on household transportation costs). About 88% of the local work force travel to jobs located in another town. Common work destinations are Chester, Springfield, Ludlow, Bellows Falls, and Rutland. Approximately 71% of employed Chester residents drive alone to work. The average commute time is 21 minutes.

[3] *Vermont Comprehensive Energy Plan* (Department of Public Service, 2016)

According to ACS data, there were about 1.9 vehicles per occupied household in 2015. The average vehicle miles traveled in a year is estimated at nearly 13,200, which accounts for approximately 1.9 million gallons of total fuel used and an estimated total fuel cost of more than $4.4 million.

Fuel costs are volatile. Gasoline costs of around $4 a gallon in 2008 and $3.70 in 2014 were challenging for many household budgets. During June 2018, average motor vehicle fuel costs in Vermont are about $2.96 per gallon.

Chester's *Village Center Master Plan* includes recommendations to improve the walking and bicycling facilities in the villages, some of which the Town is actively implementing.

3 Energy Targets

The standards that the Department of Public Service has established for energy targets must be met if this Plan is to receive substantial deference in Section 248 energy siting proceedings. Chester is utilizing targets (or scenarios) developed using the Long-Range Energy Alternatives Planning (LEAP) Model and provided to Chester by the SWCRPC. The background for the targets are described in more detail in the *2018 Southern Windsor County Regional Energy Plan*. The purpose of the targets, when combined with the analysis presented in the previous section, are intended to provide an overview of existing energy use and projections for the pace of change that is needed over the next three-plus decades. **The targets simply demonstrate that, in order to meet 90% of Vermont's energy need from renewable sources by 2050, a significant amount of change will be needed in the forms of energy conservation, behavior modification, and development of new local renewable energy generation.**

Energy targets for Chester are presented in Appendix B.

4 Implementation Actions (Pathways)

In order to meet our stated energy goals and targets, the Town of Chester identifies the following implementation actions, also referred to as "Pathways". These implementation action categories are intended to be consistent with those used in the *Guidance for Municipal Enhanced Energy Planning Standards* (DPS; March 2, 2017).

4.1 Conservation and Efficient Use of Energy

a) The Town of Chester encourages the conservation and efficient use of energy.

Efforts to improve energy efficiency and conservation are Chester's initial focus. Chester has identified the following implementation actions to achieve this policy.

In order to assist in implementing these actions, the Town will consider establishing an Energy Committee under 24 V.S.A. §§4433, 4464. The Town will also consider including priority municipal energy efficiency projects into the Capital Budget and Program. The Town may also consider establishing a fund to support appropriate municipal energy projects (e.g. capital projects, outreach efforts, incentives).

4.1.1 Encourage Conservation by Individuals and Organizations

Chester cannot control the use of energy by individuals and organizations. However, the Town can lead by example, serve as a resource, and encourage individuals and organizations to conserve and use energy efficiently. To do so, Chester identifies and promotes the following resources to provide guidance to individuals and organizations:

a) Inform residents about energy efficiency programs through Efficiency Vermont and the Weatherization Assistance Program for low-income households through Southeastern Vermont Community Action (SEVCA) and encourage residents to participate.
b) Work with partner organizations and Efficiency Vermont to offer workshops and educational opportunities to businesses on efficiency in new construction, retrofits, and conservation practices.
c) Publicize local energy conservation projects to encourage future private and public activities.
d) Utilize various methods to disseminate educational information, such as through Springfield Area Public Access (SAPA) TV, brochures, website materials, public events and digital media.
e) Conduct outreach to service clubs.
f) Identify large energy usage customers (including large businesses, manufacturing facilities, and schools) as a target audience and encourage participation in commercial and industrial efficiency programs through Efficiency Vermont.
g) Encourage local business start-ups to conduct energy audits.

4.1.2 Promote Efficient Buildings

Heating buildings accounts for about 30% of all energy consumed in Vermont. Creating more efficient buildings can be achieved through weatherization and high-performance construction methods. Chester identifies the following to encourage efficient buildings:

a) Promote the use of Vermont's residential building energy label/score.
b) Promote the use of the Residential Building Energy Standards and Commercial Building Energy Standards. To do so, the Zoning Office will distribute State energy code information to all applicants seeking a zoning permit for a structure that is heated or cooled. (Please note that the Town does not currently issue Certificates of Occupancy.)
c) Promote benchmarking (using the free EPA Portfolio Manager tool and/or with assistance from Efficiency Vermont) for commercial buildings.
d) Require that all residential Act 250 projects follow the residential stretch energy code.
e) Require that all commercial Act 250 projects follow commercial stretch energy guidelines.
f) Encourage new buildings to incorporate net-zero ready construction methods.
g) Consider providing incentives (e.g. density bonuses) to developments that exceed the state's stretch energy code, or net-zero ready or net-zero demonstrated requirements, and that are located in an area identified as appropriate for growth.
h) Promote building placement and location with passive solar and active solar in mind, and promote the use of landscaping for energy efficiency.

Net-Zero: A construction method for buildings that generate as much energy as they consume. Also known as a zero-energy building.

Net-Zero Ready: A building constructed in a manner that, with subsequent on-site renewables installed, it can make as much energy as it uses.

Stretch Code: A building energy code that achieves greater energy savings than the base Residential Building Energy Standards (RBES). The Stretch Code is required for Act 250 projects and may be adopted by municipalities.

4.1.3 Promote Decreased Use of Fossil Fuels for Heating

Heating buildings accounts for about 30% of all energy consumed in Vermont and is the second largest contributor to greenhouse gas emissions. Home heating is heavily reliant on fossil fuels at this time. Solutions to address this situation involve high-efficiency heating system upgrades and fuel switching. Chester identifies the following to encourage using less fossil fuels to heat buildings:

a) Promote the use of cold climate heat pumps with education/presentations in coordination with the Efficiency Vermont/electric utilities.
b) Support the use of ground-source heat pump heating and cooling systems for new construction.
c) Identify municipal buildings that would be good candidates for cold climate heat pumps, and develop a plan and schedule to add the heat pumps to those buildings.
d) Encourage, promote, and incentivize advanced wood heating in certain situations by:
    1) Supporting the conversion of existing fossil fuel heating systems to wood;
    2) Encouraging local manufacturing of advanced wood heat technology with low-particulate emissions;
    3) Supporting development of wood fuel delivery infrastructure;
    4) Supporting development of sustainable forestry and procurement services;
    5) Expanding wood fuel processing facilities, encouraging bulk wood pellet delivery systems; and,
    6) Providing training and education on the benefits of heating with efficient, clean wood energy systems that have low-particulate emissions.
e) Promote wood stove change-out programs that take older non-EPA certified stoves out of service and replace them with more efficient and lower emitting cord or pellet stoves.
f) Identify municipal buildings that would be good candidates for wood pellet or chip heating and develop a plan and schedule to convert those buildings to wood heat.
g) Explore opportunities for anaerobic digesters as appropriate.

4.1.4 Demonstrate the Municipality's Leadership by Example with Respect to the Efficiency of Municipal Buildings

Chester wishes to lead by example and demonstrate to individuals and organizations the benefits of building efficiency through the following efforts:

a) Seek support and guidance from Efficiency Vermont for efforts to improve the efficiency of municipal buildings.
b) Develop an inventory and conduct energy audits on municipal facilities, and develop a strategic plan to make energy efficiency and conservation upgrades.
c) Assess the life cycle costs of potential energy improvements during design and construction planning. For example, investment in a new, efficient heating system may be more expensive up front, but more economical to operate over time.
d) Incorporate weatherization/energy efficiency projects into the municipal Capital Budget and Program.
e) Implement low-impact development, green stormwater infrastructure practices, and/or strategic landscaping to shade buildings and reduce temperatures, thereby increasing overall efficiency.
f) Develop policies so that if investing in new municipal buildings, municipalities strongly consider locations that will give people the option to get to those buildings without driving – for

example, by putting a new town hall near the post office or school or other village location instead of distant from the town center.

g) Replace older municipal fossil-fired heating systems with high-efficiency, cold-climate heat pumps, geothermal heat, or advanced wood heating systems with low-particulate emissions (including wood-fired district heat), or considering switching over to biofuels.

4.2 Transportation

a) The Town of Chester encourages the reduction of transportation energy demand and single-occupant vehicle use.
b) The Town of Chester promotes the use of renewable or lower-emission energy sources for transportation (e.g. electric vehicles or hybrid vehicles).

Chester has identified the following implementation actions to help achieve these policies.

4.2.1 Encourage Increased Use of Public Transit

There is a public transit operator that has routes that serve Chester (i.e. Southeast Vermont Transit, a.k.a. "The Current"). Maximizing public transit ridership is a priority. Chester will implement the following actions to encourage public transit:

a) Improve awareness of existing public transit services to residents and visitors.
b) Plan and advocate for access to public transit, especially for Act 250 proceedings for larger developments.

4.2.2 Promote a Shift Away from Single-Occupancy Vehicle Trips

Public transit can meet the needs of some mobility needs, but additional efforts will be needed in order to reach the energy goals for reducing transportation energy use. Chester will work to encourage the following actions to encourage a reduction in single-occupant vehicle trips:

a) Encourage people to re-think their trip before leaving home.
b) Given the very fast internet speeds in Chester at this time, telecommuting is enabled. Evaluate if these internet speeds are available in all parts of town. Explore opportunities for shared work space that better enable residents to telecommute.
c) Promote the Go Vermont webpage, which provides rideshare, vanpool, public transit and park-and-ride options.
d) Support employer programs to encourage telecommuting, carpooling, vanpooling, walking and bicycling for employees' commute trips. Encourage employers to offer such programs and provide information on tax benefits that may be available for doing so.

4.2.3 Promote a Shift Away from Gas/Diesel Vehicles to Electric or Other Non-Fossil Fuel Transportation Options

To meet State energy goals, municipalities will need to contribute toward efforts to reduce the number of vehicle-miles traveled, and switch to renewable, non-fossil fuel transportation options. Chester has identified the following pathways to shift toward electric vehicles and other non-fossil fuel travel:

a) Promote general awareness of the benefits of, and access to, electric vehicles and alternative-fuel vehicles.
b) Promote and seek grants to fund the installation of DC fast-charging infrastructure at strategic locations along major travel corridors and in transit hubs such as park-and-ride locations.

c) Plan, advocate for, and consider requiring the installation of Electric Vehicle charging infrastructure as part of new development or redevelopment, especially for developments subject to Act 250.
d) Encourage the establishment of a local biofuel supplier.
e) Support the development of additional refueling stations for alternative fuels for both private and public transportation fleets by sharing station development costs between public and private interests.

4.2.4 Facilitate the Development of Walking and Biking Infrastructure

Active transportation, such as walking and bicycling, offers significant health benefits and requires no outside energy resources. Chester encourages completing short trips by walking or bicycling instead of driving, by planning for safe and convenient infrastructure that support "Complete Streets Principles". In order to do this, Chester has identified the following pathways:

a) Update municipal road standards (for maintenance and new construction) to reflect complete streets principles.
b) Seek to implement bike and pedestrian improvement recommendations identified in the Village Center Master Plan.
c) Create a committee to create more opportunities to walk and bicycle around town.

4.2.5 Demonstrate the Municipality's Leadership by Example with Respect to the Efficiency of Municipal Transportation

In order to meet the State energy goals, municipalities should lead by example and demonstrate to individuals and organizations the benefits of energy efficiency in transportation. Chester wishes to do so through the following ways:

a) Establish policies that allow employees to telecommute.
b) Install electric vehicle charging infrastructure on municipal properties.
c) Purchasing plug-in hybrid or plug-in all-electric municipal and fleet vehicles when possible, and choosing the most fuel-efficient models if EVs are not practicable.
d) Establishing minimum fuel efficiency standards for the purchase of new vehicles.
e) Consider incentives for employees who commute using methods alternative to single occupancy vehicles, e.g. walking, biking, public-transit, and carpooling.
f) When purchasing diesel fuel, the Town should use the highest biodiesel blend available without compromising the manufacturer's engine warranty. All manufacturers fully warranty their engines with the use of B5, a blend of 5% biodiesel and 95% diesel.

4.3 Land Use Patterns and Densities

a) The Town of Chester encourages maintaining the historic settlement pattern of compact downtowns and village centers surrounded by rural countryside in accordance with 24 V.S.A. §4302 and as described in the Chester Town Plan.
b) The Town of Chester recognizes that compact development has a number of benefits, including furthering both State planning goals and State energy goals.
c) The Future Land Use Map and corresponding descriptions in the Land Use Chapter of the Chester Town Plan encourages the types of land use patterns and densities that are likely to result in the conservation of energy.
d) Zoning bylaws adopted by the Town generally enable the above land use patterns and densities.

e) Chester's Village Center has been designated by the State Downtown Board under 24 V.S.A. Chapter 76A.

According to their Guidance, the DPS anticipates that if municipalities are actively participating in the above statutory frameworks for community planning, they will likely meet Pathways Standard 8.

Chester's Town Plan and various implementation methods, both regulatory and non-regulatory, combine to demonstrate a commitment to the above statutory planning framework. This plan documents what the municipality is doing in this area as it relates to encouraging the conservation of energy through land use development patterns and densities.

4.3.1 The Plan Includes Land Use Policies (and Descriptions of Current and Future Land Use Categories) that Demonstrate a Commitment to Reducing Sprawl and Minimizing Low-Density Development

According to the enhanced energy planning guidance, the reduction of sprawl and low-density development not only reduces energy consumption, but also can improve the local and regional economy.

a) The Future Land Use Map and corresponding descriptions in the Land Use Chapter of the Town Plan generally calls for growth to occur in the Village areas and in discrete nodes of activity, including Gassetts and the special mixed use area (i.e. by the Armory Building). (See the Future Land Use Map and the corresponding language in the Land Use Chapter.)
b) Chester's Future Land Use Map and Town Plan language also calls for maintaining the rural countryside in the areas surrounding the growth areas described in "a" above. (See the Future Land Use Map and the corresponding language in the Land Use Chapter.)
c) Statements for access management and other provisions intended to control strip development along major roadways are included in both the Land Use Chapter and Transportation Chapter.

4.3.2 Strongly Prioritize Development in Compact Mixed-Use Centers

As indicated in the enhanced energy planning guidance, households within a compact, mixed-use center typically use less energy than those located in outlying areas. The energy savings are realized through reduced vehicle-miles-traveled and generally smaller homes, which require less energy to heat and cool. Transportation energy use can be further reduced by locating services such as shopping or daycare within walking or biking distances to the places where people work and live. This enables people to either choose an alternative to driving a single-occupancy vehicle or to significantly reduce the length of their drive. Chester choses to encourage this by:

a) Maintaining Village Center Designation, and improving the awareness of property owners about the tax credit opportunities to help pay for improvements to eligible buildings within Chester's Village Center.
b) Coordinating with Southeast Vermont Transit (The Current) and the Go Vermont program to discuss options to promote car-sharing and public transit services.
c) Continuing to actively work on making sidewalk improvements based on the recent Village Center Master Plan.

4.4 Statement of Policy on the Development and Siting of Renewable Energy Resources

The heating, transportation and conservation targets and pathways combined are not sufficient to meet the 90% by 2050 energy planning goal. The Long Range Energy Alternatives Planning (LEAP) model also

assumes the purchase of additional out-of-state renewable energy will help to reach this goal; however, that is also not sufficient to meet the energy goals. New local renewable energy generation is also needed in order to achieve the ambitious "90 by 50" energy goal. The following sections discuss how the municipality wishes renewable energy generation to take place in Chester.

4.4.1 Evaluate Existing Renewable Energy Generation

According to existing data, there are 38 known renewable energy generation facilities in Chester as of November 2017[4], as summarized in Table 7. Existing facilities nearly amount to 2.17 MW of installed capacity. In order to more easily compare existing facilities with the targets for new renewable energy needs, generation output was estimated in MWh based upon the conversion factors found in the Guidance for regional enhanced energy plans.

Table 7: Existing Renewable Generation in Chester[4]

Type	**Number of Sites**	**Installed Capacity (MW)**	**Est. Output (MWh)**
Solar	38	2.17	2,667
Wind	0	0	0
Hydro	0	0	0

4.4.2 Analyze Generation Potential from Preferred Sites and/or Potentially Suitable Areas

An analysis of renewable energy generation potential was conducted for Chester by the SWCRPC. This consisted primarily of an analysis of existing and available GIS mapping data based upon the guidelines established by the DPS for enhanced energy planning. Table 8 below summarizes the findings of this analysis.

Table 8: Potential Renewable Energy Generation[5]

Type	**Capacity (MW)**	**Generation Output (MWh)**
Roof-top Solar	3.1	3,802
Ground-mounted solar	517.2	634,306
Wind	854.6	2,620,326
Hydro	0.016	56
Total	**1,375**	**3,258,490**

Based upon this analysis, there is significant potential to generate power from renewable sources in Chester, primarily through ground-mounted solar and wind. There is limited potential to generate hydropower from the three existing dam sites that do not generate power at this time. The potential for rooftop solar projects is limited. Without ground-mounted solar and/or some forms of wind, there is not adequate generation potential from hydro and rooftop solar to meet the "90 by 50 goal" alone.

4.4.3 Identify Sufficient Land for Renewable Energy Development to Reasonably Reach the 2050 Targets

Table 9 summarizes Chester's targets for renewable energy generation[6]. There is more than adequate land area in Chester that has solar potential to meet our 2050 renewable energy target of 24,015 MWh, which is the equivalent of approximately 19.58 MW of ground-mounted solar at the installed capacity.

[4] Vermont Energy Dashboard (February 2017)
[5] Derived from GIS mapping analysis (SWCRPC, 2017)

The guidance assumes 8 acres of land is generally needed to support 1 MW of solar. This would amount to about 157 acres of land to meet this target. This represents about 4.3% of the total land area in Chester that is estimated to have potential to generate solar power.

Table 9: Renewable Energy Generation Targets[6]			
Renewable Energy Generation	**2025**	**2035**	**2050**
Chester Targets (in MWh)	6,004	12,008	24,015

4.4.4 Ensure that Local Constraints do not Prohibit or Have the Effect of Prohibiting the Provision of Sufficient Renewable Energy to Meet State, Regional or Local Targets

These constraints have been analyzed, and the Town does not believe that these constraints prohibit or have the effect of prohibiting sufficient renewable projects needed to meet the state, regional or local energy goals.

The following resources are not appropriate locations for renewable energy projects and are hereby excluded from the potential wind and solar sites as depicted on the map. The following are consistent with the "known constraints" as described in the DPS mapping guidance.

a) Vernal pools with a surrounding 50 foot buffer;
b) Department of Environmental Conservation (DEC) river corridors;
c) Federal Emergency Management Agency (FEMA) floodways;
d) State significant natural communities and rare, threatened and endangered species;
e) National wilderness areas; and,
f) Class 1 and Class 2 wetlands.

The following represent constraints that will likely require mitigation and which may prove a site unsuitable after a site-specific study has been conducted based upon state, regional or local policies that are adopted and currently in effect. Points a) through g) below are consistent with the "possible constraints" as described in the DPS mapping guidance.

a) Agricultural soils (NRCS-mapped prime agricultural soils, soils of statewide importance or soils of local importance);
b) Act 250 agricultural soil mitigation areas;
c) FEMA special flood hazard areas (floodplain);
d) Protected lands (state fee lands and private conservation lands);
e) Deer wintering areas;
f) ANR conservation design highest priority forest blocks; and,
[7]g) Hydric soils.

[6] SWCRPC, derived from Regional Shares of In-State Generation Target (DPS, 2017)

4.4.5 Statements of Policy to Accompany Maps

Chester hereby promotes the development of renewable energy generation in order to achieve the energy goals and targets as established in this plan. The following statements of policy apply to renewable energy projects:

a) All new development should be sited to accommodate solar.
b) Chester encourages rooftop solar projects.
c) Chester encourages residential-scale wind turbines.
d) Renewable energy projects, including ground-mounted solar projects of 15 KW and bigger, must not be located in the following areas:
    1. Vernal pools with a surrounding 50 foot buffer;
    2. Commercial scale projects in the river corridors as most recently mapped by the Vermont Department of Environmental Conservation (DEC);
    3. FEMA floodways;
    4. State significant natural communities and rare, threatened and endangered species;
    5. National wilderness areas;
    6. Class 1 and Class 2 wetlands; and,
    7. Within 50 feet of all streams and Class 1 and 2 wetlands.

Undue Adverse Effect (Impact)

An adverse impact that meets any one of the following criteria:

(1) Violates a clear, written community standard intended to preserve the aesthetics or scenic, natural beauty of the area;

(2) Offends the sensibilities of the average person (i.e. it is offensive or shocking because it is out of character with its surroundings or significantly diminishes the scenic qualities of the area); or,

(3) Fails to take generally available mitigating steps that a reasonable person would take to improve the harmony of the proposed project with its surroundings.

This definition is based upon Vermont case law. The term undue adverse effect is used in accordance with 30 V.S.A. §248.

e) All ground-mounted solar projects must meet or exceed the setback standards in 30 V.S.A. §248(s).
f) Any new biomass facility and all ground-mounted solar projects of 150 kW or greater that are within view of public roadways (i.e. state highways, US routes, and Class 1, 2 and 3 town highways) must provide plantings that blends the project with its surroundings. This shall consist of naturalistic plantings using a mix of native plants and avoid introducing invasive species.
g) The applicant must replace any dead or diseased vegetation serving as part of the landscape mitigation measures throughout the life of the project or until the project ceases commercial operation.
h) In accordance with PUC Rule 5.900, the applicant is required to provide a plan for the site to be adequately decommissioned at the time when the project ceases commercial operation. This should involve the removal of all parts of the project from the site including, but not limited to, the solar panels or wind turbine, inverters, metal framework that supports the solar panels, fencing, control invasive species, and any necessary site recovery as stipulated in the permit.

Wind Turbine Categories

Residential-scale – wind turbines that are up to 30 meters (or 98 feet) tall, measured at the hub, or the center of the wind turbine blades.

Community-scale (sometimes referred to as commercial-scale) – wind turbines that are up to 50 meters (or 164 feet) tall, measured at the hub.

Utility-scale – wind turbines that are usually 70 meters (or 230 feet) tall or greater, measured at the hub.

Plants for site reclamation and restoration after decommissioning an energy generation site should be chosen with plant communities in mind, and considering the original composition of the community before disturbance. Consideration of soils, hydrology, solar access and physiographic region should guide plant selection. Plants should include canopy, mid-story, and woody and herbaceous understory layers. All plants should be native to Vermont. Publications to refer to include:

Mixed Hardwood Forests:
http://dec.vermont.gov/sites/dec/files/wsm/lakes/Lakewise/docs/lp_naturalcomm.pdf

Lacustrine, Riparian and Wetland Areas:
http://dec.vermont.gov/sites/dec/files/wsm/lakes/Lakewise/docs/pl_native-veg.buffer-manual.1994.pdf

General Information for determining Plant Community to restore:
https://www.uvm.edu/rsenr/sal/vbp/VBP.pdf
http://vtfishandwildlife.com/node/200
http://vtfishandwildlife.com/learn-more/landowner-resources/liep-invasive-species-program/terrestrial-invasive-plant-resources/native-plant-sources

i) Proposed renewable energy facilities must not have undue adverse impacts on significant wetlands, significant wildlife habitat, wildlife travel corridors/habitat connectivity, stormwater, water quality, flood resiliency, important recreational facilities or uses, scenic resources identified in this plan, or inventoried historic or cultural resources.

j) Proposed renewable energy facilities must not result in forest fragmentation or perpetuate invasive species.

k) For all utility-scale wind (i.e. hub height of 70 meters/230 feet) and commercial-scale wind projects (i.e. hub height of 50 meters/164 feet hub height), the applicant must demonstrate that the proposal was evaluated and that reasonable mitigation was considered with respect to the following criteria:

1. Operational noise, to be measured at the property line, will result in noise levels consistent with state standards.
2. Avoid or minimize "shadow flicker" through careful project siting, planting trees or other methods.
3. Avoid or minimize adverse impacts to significant wildlife habitat and wildlife travel corridors, including applicable terrestrial, aquatic and aerial species (e.g. migratory, resident and breeding bird and bat populations).
4. Avoid or mitigate safety hazards in the vicinity of the project area (i.e. ice shedding or ice throw hazards, blade throw hazard, and tower fall zones).

Shadow Flicker

A flickering effect caused when rotating wind turbine blades periodically cast shadows, such as through the windows of adjacent homes. Shadow flicker is considered by some individuals as a nuisance and may cause headaches. No more than 30 hours per year is commonly used as a limit to reduce nuisance complaints.

4.4.6 Maximize the Potential for Renewable Generation on Preferred Locations

Preferred locations include specific areas or parcels that are specifically identified to indicate preferred locations for siting a generator or a specific size of type of generator. Identifying preferred sites informs the community where renewable generation is desired. The identification of such sites can help to streamline the permitting process.

Preferred sites for Chester include:

a) Rooftops;
b) Parking lots;
c) Brownfield sites; and,
d) Disturbed portions of extraction sites (i.e. gravel pit, quarry).

4.4.7 Demonstrate the Municipality's Leadership by Example

Chester will lead by example by working with partner organizations to identify opportunities for local renewable energy generation that benefits the community and furthers the goals and policies of this plan.

Appendix A: Enhanced Energy Data Summary

Population Table 6-A.1

Total Population[8](2015):	3,110
Proj. Annual Avg. Growth Rate[9]:	0.0
Population Density:	55.6 persons/ square mile

Households Table 6-A.2

Owner-Occupied Units[10]	1,040
Renter- Occupied Units[10i]:	362
Total Households[10]:	1,793
Avg. Household Size[10]:	2.25 people/ household

Businesses[i] Table 6-A.3

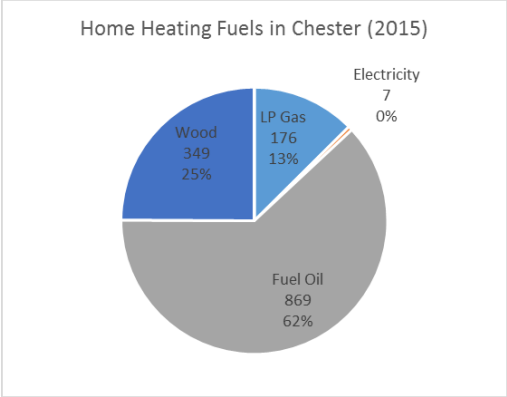
Total businesses in Chester:	129
Employees working in Chester:	909
Average wage:	$37,378

Heating Table 6-A.4

Residential[8] (see figure)

Businesses[9]:

Estimated avg. building space:	5,398 sq. ft.
Total energy use:	33.8 billion BTUs
Estimated total annual cost:	$806,005
Avg. annual cost per business:	$6,248



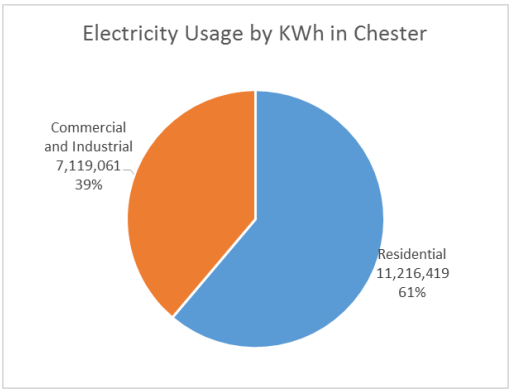
[8] U.S. Census Bureau, American Community Survey (ACS) 2011-2015

[9] Based on Scenario B population projections for 2030 (VT ACCD, 2013)

[10] U.S. Census Bureau, Decennial Census (2010)

Transportation Table 6-A.5

Number of vehicles:	2,694
Estimated vehicle miles traveled:	35.5 million
Estimated gal. fuel used per year:	1.9 million
Estimated fuel cost per year:	$4.4 million
Residents driving alone to work:	71%
Average commute time:	21 minutes



Electricity Use Table 6-A.6

Electricity Usage in 2015[11]	(see figure)
Avg. Residential Usage:	6,689 KWh
Total Usage (2014-2016):	↑ 254,657 KWh
	↑ 1.4%

Energy Generation Table 6-A.7

Existing Renewable Energy Generation

Solar	38 sites	2.17 MW	2,666.6 MWh
Wind	0	0	0
Hydro	0	0	0
Biomass	0	0	0

Renewable Energy Generation Target[11]

2015 (Baseline)	2,666.6 MWh
2025	6,004 MWh
2035	12,008 MWh
2050	24,015 MWh

Potential for Renewable Energy Generation[11]

Rooftop Solar	3.1 MW	3,802 MWh
Ground-Mounted Solar	517.2 MW	634,306 MWh
Wind	854.6 MW	2,620,326 MWh
Hydro	0.016 MW	56 MWh

[11] Based on Scenario B population projections for 2030 (VT ACCD, 2013)

Appendix B: Enhanced Energy Plan Targets

Energy Targets

The standards that the Department of Public Service has established for energy targets must be met if this Plan is to receive substantial deference in Section 248 energy siting proceedings. Chester is utilizing targets (or scenarios) developed using the Long-Range Energy Alternatives Planning (LEAP) Model and provided to Chester by the SWCRPC. The background for the targets is described in more detail in the draft *2017 Southern Windsor County Regional Energy Plan*. The purpose of the targets, when combined with the analysis presented in the previous section, is intended to provide an overview of existing energy use and projections for the pace of change that is needed over the next three-plus decades. **The targets simply demonstrate that, in order to meet 90% of Vermont's energy need from renewable sources by 2050, a significant amount of change will be needed in the forms of energy conservation, behavior modification, and development of new local renewable energy generation**.

In order to meet the 90% by 2050 goal, total energy use in southern Windsor County will need to decrease by 50%. Primarily this must involve a vast reduction in the use of non-renewable fuels, such as gasoline and fuel oil. The LEAP model relies on a number of generalized assumptions to reach the 90% by 2050 goal, such as:

- Electricity use today is about 20% of total energy consumption, but it will increase to 35% of total consumption in 2050;
- The use of non-renewable fuels will be vastly reduced from about two-thirds today to about 10% by 2050;
- Renewables will increase from about 18% now to more than half by 2050. This involves wood consumption remaining relatively constant and biodiesel usage increasing substantially.

Please note that the above section is intended to summarize the assumptions made for this LEAP model. In the intervening years between 2018 and 2050, there are likely to be technological advances that may help us to achieve our energy goals and targets in ways that we cannot anticipate today.

B.1 Electricity

Targets for electricity are mixed. Significant efforts to reduce electricity usage through conservation and efficiency measures will be needed. However, the LEAP model utilizes the increased use of electricity to achieve the goal for both transportation (i.e. electric vehicles) and heating sectors (i.e. cold-climate heat pumps). See Figure 6-B.3 below.

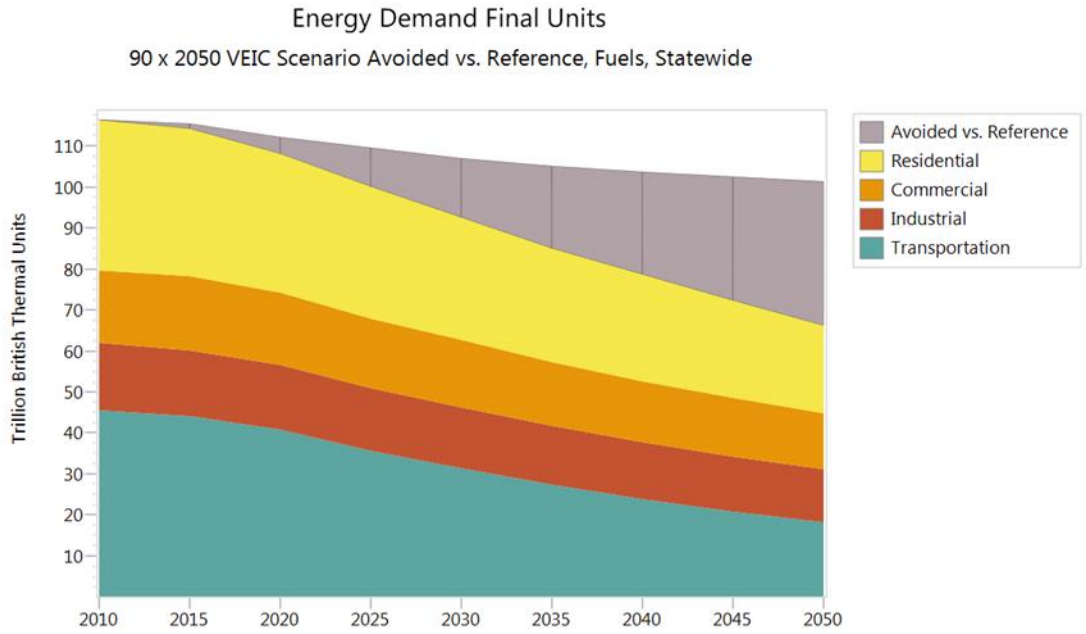


Figure 6-B.3: Vermont must significantly reduce total energy use by 2050 to be successful in implementing the goals of the Comprehensive Energy Plan. The LEAP model referenced in this Plan calls for substantial reductions in energy use by residences and transportation. The line above the grey area represents projections for if we do nothing else to reduce energy demand. The grey area itself represents efforts needed to reduce total energy demand.

Reducing electricity demand through energy conservation and efficiency measures will involve taking advantage of programs offered by Efficiency Vermont, utilization of high-efficiency/energy star appliances, LED lighting upgrades, and other efforts at energy demand management.

Electricity targets also include the development of additional renewable energy generation. The LEAP model includes assumptions for additional imported renewable energy from sources such as Hydro Quebec. However, local generation is also required. Targets for local renewable generation are summarized below in Table 6-B.1 and discussed in more detail in the renewable siting discussion under the Implementation Actions section of the Energy Chapter.

Table 6-B.1: Renewable Generation Targets (in MWh)			
	2025	**2035**	**2050**
Total renewable generation in MWh	6,004	12,008	24,015

B.2 Thermal (Heating Buildings)

The first step to reduce energy demand for space heating is to weatherize homes and businesses (e.g. air sealing, insulation). Table 6-B.2 shows the targets for weatherizing existing structures in Chester. Note that the LEAP model-based targets for weatherization in Chester did not appear to be reasonable, so these targets are modified to be more consistent with statutory goals. Based upon our experience over the past few years, it will be difficult to reach these weatherization targets for existing structures. We assume that all new applicable structures will comply with the State energy building codes (i.e. Residential Building Energy Standards, Commercial Building Energy Standards).

Table 6-B.2: Thermal Efficiency Targets			
	2025	**2035**	**2050**
Weatherize Homes	25%	50%	90%
Weatherize Businesses	25%	50%	90%

The next step is to then move toward the widespread utilization of renewable energy to heat homes and businesses. The LEAP model established the following targets for doing so in Chester. Table 6-B.3 shows the scale to which buildings should switch over to renewable heating systems in order to meet the state energy goals.

Table 6-B.3: Use of Renewables for Heating			
Thermal renewable energy use	**2025**	**2035**	**2050**
	49%	64%	92%

In order to achieve the overall renewable target for heating, the LEAP model is calling for investing in new efficient wood heating systems, cold-climate heat pumps or ground-source heat pumps. (See Table 6-B.4.)

Table 6-B.4: Thermal Fuel Switching Targets (by Number of Heating Units)			
New efficient wood heating systems	**2025**	**2035**	**2050**
	6	14	89
New heat pumps	173	468	901

Cold-climate heat pumps are also referred to as air-source heat pumps, mini-splits or ductless heat pumps. These systems are a good option to retrofit existing houses, and can be used to supplement an existing heating system. As explained on the Efficiency Vermont website, "heat is collected from the exterior air, concentrated via an outdoor compressor, and distributed inside through an indoor room unit. Heat pumps require electricity to run, but can deliver more energy than they use." They also provide air conditioning during the warmer months.

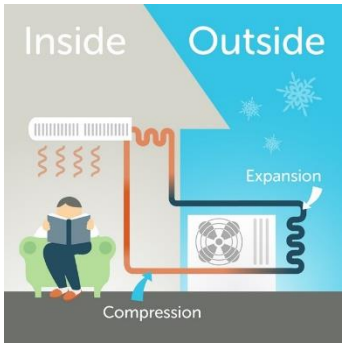


Figure 6-B.4: Illustration of how cold-climate heat pumps work. Source: Efficiency Vermont.

Ground-source heat pumps provide heating and cooling for buildings. They work similarly to air-source heat pumps, but instead they pump water or other fluid through pipes buried in the ground to collect energy. A more detailed description for how these systems work can be found on the US EPA website. These are generally a better option for new construction installations.

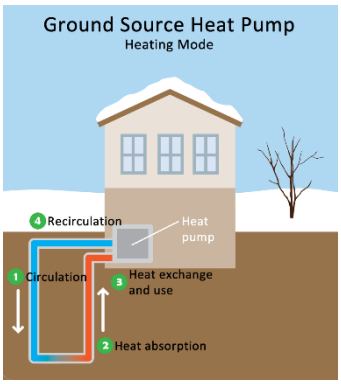


Figure6-B.5: Illustration of how ground-source heat pumps work. Source: US EPA.

Heating with wood is generally encouraged as it uses a locally-available fuel. However, sustainable wood harvesting is important in order to protect the environment and provide a viable, long-term local energy source. New efficient wood stoves that are EPA-certified are encouraged. Wood-chip heating systems are considered a good option to heat larger commercial, industrial or institutional buildings. See the Efficiency Vermont website for more information. A number of schools in the region use such heating systems.

B.3 Transportation

Transportation is probably the most difficult area to "bend the curve" to meet the energy goals, considering the rural nature of this area and how challenging it is to change human behavior. However, it must be done if we are to achieve the 90% by 2050 goal. The LEAP model used a number of assumptions in addressing this issue. The following targets are based on that LEAP model.

Table 6-B.5: Renewable Energy Use for Transportation			
Use of renewables for transportation	**2025**	**2035**	**2050**
	10%	31%	90%

Overall, transportation needs to shift to renewable fuel sources as shown in Table 6-B.5. The LEAP model is largely expecting this to happen through using electric vehicles, and the use of biodiesel by the trucking industry. Table 6-B.6 below shows the fuel switching targets for Chester.

Also required to meet the goals will be additional efforts to lessen the use of energy for transportation, including land use patterns that encourage walking and bicycling, public transportation, driving less, and ride sharing. Efficiency Vermont has information on its website about ways to achieve transportation efficiencies.

Table 6-B.6: Transportation Fuel Switching Targets			
	2025	**2035**	**2050**
Passenger cars switch to electric vehicles	478	765	1,722
Trucks switch to biodiesel	195	312	703

Appendix C: Chester Energy Survey Results

Chester Energy Survey

January, 2018

Five years ago, the State of Vermont embarked on a new energy plan. The goal is to meet 90% of Vermont's total energy needs from renewable sources by 2050. The state has asked towns to create their own energy plans to help reach this goal. State legislators believe Vermont can be a leader in global climate change efforts, while increasing our energy security, improving our economy, protecting ratepayers and reducing our total energy costs. The Town of Chester may choose to participate in this goal by adding an energy plan chapter to its Town Plan, thus gaining some say in the placement of renewable energy installations such as solar and wind. If this chapter is not added, the town will have no voice in the placement of renewable energy projects. The Planning Commission would like to get a sense of how Chester residents feel on this issue. Your input is vital to this process. We included a self-addressed envelope for your reply. You may also find a copy of the survey online by going to the Planning Commission page on the town website: http://www.chestervt.gov/planning-commission.html. You may also scan your filled-out form and e-mail it to Cathy Hasbrouck, the Planning Commission recording secretary at cathy.hasbrouck@chestervt.gov.

Thank you from the Chester Planning Commission:

Naomi Johnson, Claudio Veliz, Barre Pinske, Tim Roper and Cheryl Joy Lipton

1. On a scale of 1 – 5, how important are energy issues to you?

_207_	_105___	_36__	_8___	__6__	__3__
1 – Very important	2	3 - Neutral	4	5 - Not important at all	Blank

2. On a scale of 1 – 5, rate your view of non-residential wind power:

113_	_86_	_78_	_34__	_49_	__5__
1 – I favor it enthusiastically	2	3 - Neutral	4	5 – I oppose it completely	Blank

3. On a scale of 1 – 5, rate your view of non-residential solar power:

_166_	_89	_53_	_24_	__29_	__4__
1 – I favor it enthusiastically	2	3 - Neutral	4	5 – I oppose it completely	Blank

4. Do you currently have solar energy generating facilities at your home or business?

_45 Yes 319_No 1 Blank

5. Do you have a wind generator at your home or business?

_1_Yes 363_No 1 Blank

6. Do your burn wood or wood pellets for heat at your home or business?

190_Yes 166_No 9 Blank

7. Would you be in favor of allocating town resources to develop an energy plan chapter for the Town Plan if it gave the town a voice in the placement of renewable energy projects?

291 Yes 46_ No 5 Pending or unknown 23 Blank

8. How do you feel about large solar arrays?

106	1	_91__	76_	_36__	_41_	14
1 – I favor them enthusiastically	1.5	2	3 - Neutral	4	5 – I oppose them completely	Blank

9. How do you feel about solar arrays on buildings, public or private?

184__	89__	_63___	12__	__8_	9
1 – I favor them enthusiastically	2	3 - Neutral	4	5 – I oppose them completely	Blank

10. Do you support the state goal of 90% of energy coming from renewable sources by 2050?

_201_	73__	_46_	_15_	_18	12_
1 – I favor it enthusiastically	2	3 - Neutral	4	5 – I oppose it completely	Blank

11. Do you currently benefit from solar credits which are generated from a location other than your Chester home or business?

13_ Yes 336 No 4 Unknown 9 Blank

12. Do you currently live in the village or outside the village center?

_90_ in the village center 262_ outside the village center 13 blank

13. On a scale of 1 – 5 how informed do you feel about energy issues?

_88_	1	_114	_117_	_27	_8__	10
1 – Well informed	1.5	2	3	4	5 – Not informed at all	Blank

Appendix D: Enhanced Energy Plan Maps

Maps showing wind and solar potential in Chester with existing substations and transmission lines are included as separate PDF files.