





ENERGY

Energy use is essential and deeply embedded in all aspects of daily life for lighting, heating and cooling buildings, transporting people and goods; nearly everything we do requires energy. We have understood for at least fifty years that human dependence on fossil fuels is not sustainable. Only now are we beginning to grapple with climate change resulting from burning fossil fuels. Changing the ways we generate and use energy will be an incremental process as utility infrastructure and technology, the building stock, transportation systems and land use patterns adapt to a new energy regime. There is an active grassroots effort in Vermont and around the world to act locally in addressing climate change. . This chapter provides an understanding of current energy use by Norwich residents and businesses in the context of Vermont's 90% renewable by 2050 goal. This chapter describes the current setting for energy use in Norwich, and then moves to a consideration of how much renewable energy Norwich can generate. Policies and objectives focus on those decisions directly within the control of the town, assuming the current regulatory scope and commitment of resources. Opportunities for promoting changes in consumer behavior with existing town volunteer resources are also identified. Assumptions made in the Vermont 2016 Comprehensive Energy Plan (CEP) and the shortcomings in available data are noted to encourage more rigorous planning at the state level, where the vast majority of decisions regarding energy markets (fossil fuel and renewable) are made.

Current Energy Use

According to the 2018 Progress Report by the Energy Action Network, Vermont's greenhouse gas emissions have been increasing despite significant reduction commitments. Transportation & thermal energy are the largest contributors to Vermont's greenhouse gas emissions. This plan assumes that this state-level analysis applies to Norwich as well.

The accepted estimate of the total amount of energy being used in Norwich is from the Community Energy Dashboard(<https://www.vtenergydashboard.org/my-community/norwich/progress>) which suggests that in 2016 (the latest year actual use figures are available) 508,115 MMBTUs (million BTUs) were consumed town-wide for electricity, thermal (heating and cooling buildings), and transportation as shown in figure **xx pxx**.¹ Energy use in Norwich reflects the settlement pattern, which is dominated by low density residential lots, and little or no industry or commercial activity.

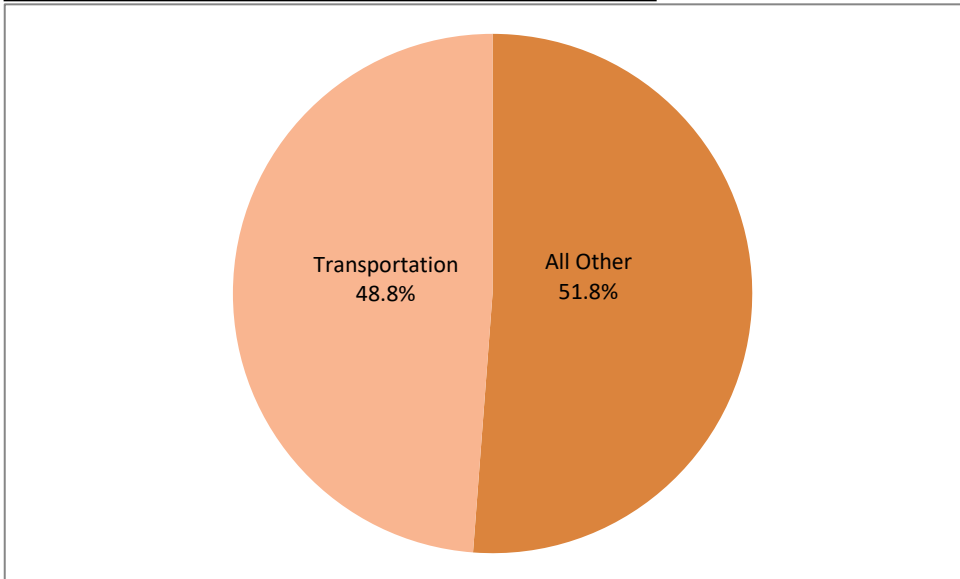
In developing this chapter, the town relied upon:

- 2017 Two Rivers Ottawaquechee Regional Commission (TRORC) energy planing general and the following specific sources of information about energy use in Norwich
- The Energy Action Network's, Community Energy Dashboard which tracks the progress of each Vermont community towards the state's goal of meeting 90% of local energy needs through efficiency and renewable energy by 2050.
- The Act 174 Supplement prepared for Norwich by TRORC is incorporated into this plan and included in **Appendix B**.

Green Mountain Power (GMP) as a utility regulated by the VT Public Utilities Commission (PUC) provides detailed statistics about electricity generation and use as part of fulfilling their license to operate. Current commercial transportation energy use and future needs were not assessed by TRORC as part of Act 174 energy planning. The published figures for thermal and transportation energy use are rough estimates based on statewide averages and Census data. More reliable and accurate data about thermal and transportation energy use at the local level is needed for town energy planning to be meaningful and effective.

¹ We expect new data in May and will update this section when the data is available.

Fig 1: 2016 Fossil fuel use by category



Renewable Energy Resources

Vermont's Renewable Energy Goal

Greenhouse gas emissions caused by human activity are driving global climate change. Vermont adopted a goal in 2011 to obtain 90% of the total energy used in the state (electricity, thermal, transportation) from renewable sources by 2050. Advisory targets have been set for each Vermont municipality to reduce overall fossil fuel use and transition to renewable sources by 2050. The energy use and conservation targets for Norwich are shown in Norwich's Energy Targets [Figure xx](#). Specific targets for renewable energy generation are included in [Appendix X, Energy Targets and Conservation Goals](#)

Town-level efforts to meet the state's 90% by 2050 goal need to focus on redirecting thermal and transportation energy demand to renewable (primarily electric) sources, but are challenged by the severely circumscribed authority of municipalities to affect energy use outcomes. Energy products (including efficiency and renewable alternatives) are allocated via markets. The power to regulate these markets is reserved to states and the US federal government. Municipalities are best understood as institutional consumers, they have no jurisdiction over the structure and daily operation of energy markets. In the case of Norwich the town is a very small consumer even compared to the local school districts and large regional employers. The powers that municipalities do have mostly pertain to regulation of land use (in VT an authority granted to municipalities by state statute and further constrained by case law). Because land use patterns in Norwich have been consistent for many decades, and the rate of development is exceedingly slow, changing land use patterns in town may not play a major role in achieving the targets within the timeframes identified by the VT CEP.

Norwich obtains 57% of its electricity from renewable sources (based on GMP's renewable portfolio and on-site local generation), 0.5% below the 2016 target. Converting current electricity use to renewable sources has been relatively straightforward in response to state policies such as the Renewable Energy Standard, which required utilities to procure 55% of their electricity from renewable sources in 2017. That figure will increase incrementally to 75% by 2032. Conversion of transportation and thermal energy (the majority of energy used in Norwich) to renewable sources are beyond the regulatory scope of the municipality, and thus the Town can only influence the outcome at the margin.

In summary, it is important to acknowledge that the Town's ability to meet the ambitious and necessary state energy goals is limited. It falls primarily in land use regulation, modeling the adoption of energy conservation and renewable energy in Town facilities and equipment, and providing infrastructure and regulations that support residents in the same. The Town of Norwich is determined to do all that it can in this area.

Potential for Renewable Energy Generation

Act 174 Maps. As required by the state under Act 174, TRORC has mapped areas of Norwich that have potential for renewable energy generation as discussed in Appendix x, Energy Mapping, shown on page**.

The maps for solar potential were derived from analyzing aspect (with south facing landforms most suitable for solar generation). The maps do not use key features including: current land use and lot boundaries, extent of forest cover, proximity to roads, distance to electric distribution (particularly 3 phase power and transmission infrastructure, or the ability of the power grid to take additional load). Each of these factors presents serious limitations to utility scale (> 500 kW) solar energy development.

At present, the most salient factors for determining where non-residential renewable energy projects may feasibly be located is proximity to the existing power grid (three-phase power and transmission lines) and the capacity of the grid to accommodate additional load. As of 2019, the GMP Solar map 2.0 indicated that there were system limitations only on the circuit along the Thetford-Norwich border and to the far west of Norwich near the Sharon town line. . Norwich operates on circuit 71G1 of the Wilder substation, which the utility lists as having 75% of its capacity remaining on the transformer (approximately 10.6 MW). Installation of numerous 150-kW solar arrays is feasible. Three-phase power lines currently run along Main Street (as far as Willey Hill Road), Route 5 South, and Route 5 North (to just south of Loveland Road). <https://greenmountainpower.com/help/construction/3-phase-service-vermont/> Infrastructure upgrades would be required for larger projects.

Wind Power.

According to the Energy Action Network's Community Energy Dashboard there are no wind energy projects installed in Norwich as of 2018. There is no meaningful potential for utility- or community-scale wind generation in Norwich given current turbine technology, which generally requires an average wind speed of at least 6 meters per second. Only two locations in Norwich are identified through the Act 174 mapping process with wind speeds at 6 meters per second or above (accessed via turbines set between 50 and 70 meters high). Both are off Chapel Hill Rd along the Sharon town-line . These sites are not currently accessible from roads suitable for this scale of development, nor to a power transmission line.

SolarPower. The Energy Action Network's Community Energy Dashboard identifies 217 small sites in Norwich, with a total capacity of almost 1,800 kW (approximately 11% of the generation goal). The Norwich Energy Committee tracks solar, including households that have purchased shares of solar projects located in other towns. This count tallies 283 residences, businesses, or churches that have "gone solar," – more projects of this scale and type are likely. The Energy Dashboard ranks Norwich 13th out of 250 towns in Vermont for the number of solar electric sites.

While large scale development of solar energy will require proximity to a substation and three phase power, the utility grid in Norwich is well-suited for smaller projects of about 150kW. Using the Act 174 mapping methodology 6,341 acres out of a total 28, 620 acres in Norwich has solar potential (southern facing slopes). But, 22,116 acres (or 77%) of Norwich is forested. About 67% of the area identified as having solar potential is currently under forest. Aside from the economic cost of clearing, the release of carbon from cleared lands would diminish the climate change benefits of utility scale solar development. The mapping of solar potential erroneously includes the Right of Way (ROW) for interstate 191 and other lands not available for development.

About 16 MW of installed solar would be needed for Norwich to meet its renewable energy generation target, about 20,000 MWh Appendix x, table 1Q. This is the Town's share of projected statewide energy demand in 2050, in proportion to its population. 16 MW of solar arrays would require about 160 acres total, or about 0.5% of the Town's total land area.

Hydro Power. There are no hydropower facilities currently located in Norwich according to the Energy Dashboard. Small, run-of-the-river generators would be the only likely future hydro generation, given current state regulations with regard to damming waterways.

Biomass. While it is not known how much wood is harvested for fuel in Norwich on an annual basis, it is clear that there is potential for sustainable biomass production given that the town is more than 77% forested. Wood is a renewable source of thermal energy and technological improvements have greatly increased the efficiency and reduced the pollution associated with burning wood. A large percentage of homes in Norwich use wood as either a primary or secondary heating source. The State of Vermont is encouraging schools and municipal facilities to install high efficiency wood pellet or woodchip heating systems.

Geothermal. There is one ground source heat pump installed at a residential property in Norwich according to the Energy Dashboard. The feasibility of installing geothermal systems needs to be assessed on a site-by-site basis.

Energy Conservation and Efficiency

Structures

The scenario for meeting the state's renewable energy goal presented on the Dashboard shows that by 2050 Norwich will need to use a total of 156.8 MMBTUs of energy fewer than it did in the baseline year of 2014. Under the US and VT constitutions the town has no role in shaping or regulating the market provision of energy conservation or efficiency products and services. In addition, the annual rate of new construction or even substantial improvement is

very low. Nevertheless, the town can still play a role: encouraging energy code compliance, modeling energy-efficiency in municipal facilities, supporting outreach and information-sharing with residents, and investigating how it could take on inspection and enforcement.

Transportation

Of note here is the assumption that the town's total energy use for transportation will go from 205,793 MMBTUs in the baseline year of 2014 to 56,348 MMBTUs in 2050. That is, the town's transportation energy use in 2050 will be 27% of what it was in 2014. It is also expected that fully 90% of the 2050 transportation energy budget will be provided from renewable sources. This is a major change from the town's current modes of transportation and, as usual, not entirely within the control of municipal decision-making. Land-use policy, a clear area of town authority, will play an important role, as will town support for regional public transit and town infrastructure for walking, biking, and electric vehicles.

Future Generation, Use and Conservation

Energy Targets

Future targets for energy generation, use and conservation have been set for all Vermont municipalities as part of the state's enhanced energy planning under Act 174 (see "Norwich Energy Targets"). The planning scenario presented on the Energy Action Network's Community Energy Dashboard envisions that total energy consumption in Norwich will decrease to 228,400 MMBTUs by 2050 from the 2014 baseline consumption of 524,400 MMBTUs. In other words, the goal is for energy usage in the Town of Norwich to be, in 2050, 43% of what it was in 2014. Moreover, only 32,300 MMBTUs (or 14% of the total) will be from fossil fuels.

This plan's land use, housing and transportation goals, objectives and policies call for new housing and economic development to be focused in and adjacent to the village. This is where people can live close to employment, shopping and services, and where it is more feasible to provide public transit, which will reduce energy used for transportation. Encouraging such a development pattern through the town's land use regulations and provision of public infrastructure are the most effective and direct measures Norwich as a municipality can take to move towards meeting the state's energy goals.

The 2017 TRORC Energy Plan recognizes that Norwich is currently generating 0.50 MW of electricity from solar and sets a target for a total of 19,167 to 23,426 of MWh[inconsistent units] of renewable energy generation by 2050. This is calculated on the current percentage share of the Norwich population as compared to the total regional population. The portfolio of renewable energy generating sources includes both rooftop and ground-mounted solar, wind, and hydropower. The TRORC energy plan suggests that there is 81 times more 'suitable land' than is needed to host such renewable energy projects in Norwich.

Renewable Energy Project Siting Standards

This plan supports renewable energy production in Norwich. For this policy to continue with broad community support it must be balanced with this plan's policies related to:

- Protecting natural resources, environmental quality, scenic resources and rural character.
- Maintaining viable farms and the working lands needed to sustain them.
- Focusing development in those areas of town already served by existing public infrastructure.
- Preserving the cultural resources within Norwich village
- Preserving the recreational and natural value of those lands identified in the Ridgeline Protection Overlay Area, and Shoreline Protection Overlay Area

This plan calls upon the Public Utilities Commission to issue Certificates of Public Good for renewable energy projects in Norwich only when the following standards are met: [RF Note: *the policy statements below are intended to be illustrative of what is required/possible under Act 174 and I anticipate these will be replaced/edited as a result of the second phase of work on the plan*]

- For individual or group net metered renewable energy projects, the property owner must take reasonable measures to site and/or screen the installations to minimize any visual or noise impacts beyond the property line, particularly on sites where there are neighboring homes in close proximity.
- To the greatest extent feasible, solar projects larger than 150 kW must be located on roof-tops, within parking lots, and on previously developed land with other development limitations such as former gravel pits. These will be considered preferred sites. This plan identifies the following preferred sites based in existing uses and conditions:
 - Norwich Farmers Market site (stalls and parking lot)
 - King Arthur Flour (rooves and parking lot)
 - The Coop Service Station (roof and parking lot)
 - Marion Cross School (parking lot)
 - Dan and Whits Grocery (parking lot)
 - Huntley Meadow Playing Fields (parking lot)
- Projects larger than 150kW must meet existing standards for setbacks, site design (landscaping, screening, lighting, stormwater, etc.) as laid out in the Norwich Zoning and Subdivision Regulations.

- Projects larger than 500 kW must have a management and decommissioning plan that will ensure the land will be returned to its prior condition when no longer actively used for renewable energy generation. Wherever feasible, the energy generation use must be combined with continued agricultural use of the land.
- Projects larger than 500kW must not clear land within a mapped forest block (see*Ecological Resources Map) unless there is a management and decommissioning plan that will ensure the land will be re-forested and managed in accordance with a forest management plan when no longer actively used for renewable energy generation.

Objectives

1. Reduce Single Occupancy Vehicle (SOV) among Norwich commuters (in and out).
2. Increase the amount of renewable energy being produced in Norwich in a manner that is consistent with the goals, objectives and policies of this plan.
3. Reduce overall energy use in Norwich through conservation and efficiency measures

Policies

1. Promote smart-growth development in a review of the Norwich Zoning and Subdivision Regulations, paying particular attention to the possibility of increasing the density of development immediately adjacent to the existing village area.
2. Promote non-vehicular transport modes (bike and pedestrian) using best practices for traffic engineering (sidewalks and bike lanes) and dedicated trails.
3. Advocate on behalf of non-vehicular road users before VTTrans for improved accommodations on state highways
4. Encourage large-scale development or redevelopment projects to install solar collectors on rooftops and parking lots.
5. Support individual or residential renewable energy projects (including EV chargers) that are compatible with the goals, objectives and policies of this plan.
6. Consider lifecycle costs (initial construction and ongoing operation) when planning to construct or upgrade municipal facilities.
7. Support programs that assist owners with weatherizing and improving the efficiency of existing buildings, and/or provide incentives for energy-efficient construction or renovation
8. Encourage owners to manage forest land for long-term, sustainable harvesting of wood as a renewable fuel source.
9. Support Advanced Transit to provide a range of commuter services to Norwich, connecting with locations where residents attend school, work and shop
10. Encourage climate-change and energy awareness in Norwich through the ongoing work of the Energy Committee

Actions

1. Participate in Section 248 process before the Public Utilities Commission to make decisions that further the goals, objectives and policies of this plan
2. Implement to the best of our abilities (non-binding) Article 36 from the Town of Norwich 2019 ballot: Shall the voters of Norwich direct all Town officials to take immediate and sustained efforts to gradually and continually reduce the Town's direct use of fossil fuels, beginning at a rate of no less than 5% per year starting in the 2019-20 fiscal year and continuing until they are eliminated entirely, and shall the

Town Manager be charged with monitoring such efforts and reporting on them each year in the annual Town Report, and no capital expenditures shall be made that contradict or undermine this direction, absent a majority vote of the Selectboard?

3. Work with community groups and other to support non-vehicular transportation options in Norwich