

GRAFTON TOWN PLAN - Revision 2015, 2016

Chapter Five

ENERGY

For the purposes of this chapter, sources of energy are defined as those derived from:

Fossil fuel sources:

- Transportation fuel coal, natural gas, propane, heating oil and kerosene. Biomass and Biogas :

- including wood, manure

and grasses, Solar:

- including solar-electric (photovoltaic), and material heated by sun (solar thermal) hot water and hot air.

Wind;:

- converted to electricity through the use of turbines, Hydro:

- converted to electric through the use of turbines. Nuclear power:

- electricity generation from steam driven turbines Geothermal energy:

- use of ground temperature for heating and cooling through the use of heat pumps and heat exchangers.

Ambient Heat:

- outdoor air used for heating and cooling through the use of heat pumps and heat exchangers.

Reliable and sustainable energy supplies will enhance the growth and economic development of Grafton and improve the economic life, health, safety and comfort of its residents.

The energy field has evolved significantly since the creation of the previous Town Plan. The State of Vermont has issued a guideline called the Comprehensive Energy Plan, which sets a goal of 90% renewable energy sources by the year 2050. Currently about 45% of energy consumed and almost all energy generated in Vermont comes from renewable sources. [EIA 2016] Grafton is seeking ways to contribute to the statewide effort, while respecting its own unique environment and character. (See Land Use chapter.) The most effective and suitable measures towards this goal are efficiency, conservation, community-based, small-scale energy generation projects, and commercial wind power.

ENERGY USES

On a statewide level, Vermont uses 35% of energy for transportation, 29% for residential heating, 20% for commercial and 16% for industrial purposes. In Grafton the share of commercial and industrial uses is lower. Fuel oil is the heating source for roughly 60% of

homes in our region, with wood accounting for 21%, gas (bottled, tank, or LP) 13%, and electricity 6%. (Source: Windham Regional Commission.)

ENERGY SOURCES

Hydro

Streams within Grafton once powered a multitude of mills that sustained the economy. None of these mills exist today and present water quality regulations would prevent reestablishment of the store and release impoundments so commonly used in the past. Use of newer technology with dam-less diversions and run-of-river use of water could allow multiple small-scale hydroelectric installations without unreasonable stream habitat impairment.

Government incentives are available for small hydro development where suitable and approved. The Vermont Agency of Natural Resources has defined several criteria that must be met in order to avoid detrimental impacts. However, Grafton has only modest surface flow within the North and South Forks of the Saxtons River. The cost of regulatory approval would likely outweigh the value of energy produced in most circumstances.

Wood and Biomass

Grafton's forests and farm fields can yield energy for heating and transportation. Wood can be used directly for heating or indirectly as a gas for combustion. Pellet burners are capable of yielding high efficiency with minimal air pollutants. Processing of cellulose based crops and forest waste into ethanol as transportation fuel is also a possibility. Oil bearing crops could yield biodiesel fuel. All harvest should follow principles of sustainability, net positive energy contribution, balance with food production needs, and have limited effect on air and water qualities.

Cord wood and pellet fuels were the least expensive fuel sources for heating in Vermont in 2016, but only slightly less than heating oil, natural gas and air-sourced heat pumps. In combination with appropriate forest management practices,

biomass can provide a useful alternative to fossil fuels. Spurred by government initiatives and fluctuating costs of fuel, it is expected that the use of biomass for home heating will increase significantly. At the same time emissions from biomass burning can cause environmental concerns. New use of outdoor wood boilers is restricted to specified low polluting models by the Vermont Agency of Natural Resources due to heavy emissions produced by earlier models. Improved technology and low emission burning appliances are helping reduce pollution and therefore their increased use should be encouraged.

Natural Gas

Among fossil fuels, natural gas emits the lowest levels of almost all pollutants per unit of energy used. Nationwide, the price of natural gas dropped about 23% since 2008 due to improved technology in hydraulic fracturing (fracking). Questions remain about the environmental implications of fracking, and new restrictions on fracking may reverse the recent lower costs. At the moment there is no natural gas pipeline in Windham County, although there is a Vermont Gas Systems pipeline serving parts of Northern Vermont. One Vermont-based company has been delivering compressed natural gas to one customer in Putney since 2013.

Propane provides about 13% of area homes with primary heating fuel and is also used for cooking and hot water.

Solar

The sun is earth's ultimate source of energy. Grafton has much of its settlement open to southern sun exposure which allows capture of solar energy. Where there is such southern exposure available on the residential parcel both solar thermal and solar photovoltaic technologies are viable passive technologies. Solar thermal energy can displace electricity and propane as sources of hot water, and if new housing architecture follows good energy efficiency standards, which include passive solar, household heating by fuel can be reduced or eliminated.

In recent years there has been great progress in solar technology, making it both more efficient and more cost-effective. Locally, both individual and shared (community) solar installations have become more common. The Federal Government incentive in 2016 is a 30% tax credit based on the cost of the installation. Vermont utilities will credit an additional 5 cents/kwh above the current residential rate for solar generated power. These rates may change in the future. The netmetering law requires utilities to permit customers to generate their own power using small-scale renewable energy, with the excess power being fed back to the utility for future credit. Excess production from one facility can also be credited to other customers.

within the same utility company territory through Group net-metering

Municipal contracts for solar power credits (Community Solar) are available from independent solar developers. Detailed and current information on Net Metering ad opportunities for businesses and homeowners can be found on the Vermont Public Service Board website:

http://publicservice.vermont.gov/topics/renewable_energy/net_metering

Grafton is actively seeking suitable solar sites that are in alignment with the overall land use goals of the town and avoid erosion or loss of property value.– Locating in floodplains is acceptable, whereas in floodways is not. Driven piles vs. concrete bases maintain ground absorption, minimizing runoff. Grazing of small animals (chickens up to goats and sheep) is a common dual use of agricultural property. Grafton needs to keep what agricultural land there is available. (see Land Use Chapter). Abandoned gravel pits and non-productive open areas are suitable. Most residences can host a system on a roof or ground suitable for the power needed by the home. Community solar projects should be made available for businesses, homeowners and renters who do not have suitable locations of their own.

Specifically, the Town owns land near the Town garage where conditions appear advantageous for a solar array. Three distinct parcels around the garage are all south to southeast facing, and altogether the acreage could contain a 1.4 MW facility, enough to power 280 average homes. Private entrepreneurs are also engaged in identifying ground locations that appear suitable for a microgrid or a community array. An area in the Cambridgeport section of town could host a ground array with 300 kW

Wind

Large-scale commercial/industrial wind facilities are one potential source of renewable energy generation. Grafton has measured, commercially viable, wind resources on its border with Windham, and by extension of similar topography, most probably on several other peaks and ridges within the town. In 2016 about 6% of the energy used in Vermont was provided by wind power. Currently there are four large-scale wind facilities operating in Vermont. As a result Vermonters are becoming informed on the impacts and benefits of such facilities. Some of the issues to be addressed in such projects and mitigated as possible by the developer of the project include: public health, conservation of wildlife, endangered wildlife, watershed, water quality, and storm-water run-off planning and control. Since the facilities need to be built where the resource is located (high altitude land and ridges) where headwaters of streams originate, the opportunity presents itself to mitigate peak flows of those waters when flooding occurs (See Flood Resiliency chapter.)

The Town of Grafton supports and actively encourages the use of alternative and renewable energy sources. As with other development, it must fit the scale, topography, settlement patterns, and character of the Town. It must be sensitive to impacts on neighbors and quality of life. It must minimally impact the special qualities of our ridgelines or of woodlands that accommodate healthy headwaters, a wide variety of wildlife and its habitat and other important features. There are many ways, including those involving solar power, wind power, energy conservation and efficiency, for the Town and its residents to make a positive impact on the larger environment without compromising the local environment and ecology or the health of our residents.

Any commercial/industrial wind energy systems must be consistent with Grafton's land use goals. These include maintaining a working landscape, use of existing utility infrastructure, maintaining uninhabited passage for wildlife between forested areas, and maintaining the purity of our headwater streams

Grafton must also consider the potential effects of large-scale wind installations on its economy. Grafton depends to a large degree on tourism, being one of New England's most picturesque and historic towns. Many of its full time and second home owners are motivated to locate in Grafton because of its quiet, unspoiled, rural, and historic nature and, as with all of Vermont, scenic vistas. These essential characteristics of the town may change if the town is the site of a commercial/industrial facility since the wind towers must be placed where the resource is strongest, which is on the ridgelines and the highest peaks in the area. The change, however, should not be judged on the basis of aesthetics, because whereas some dislike the appearance of anything but trees on our ridgelines, others see wind turbines as a graceful embodiment of our goals to generate renewable energy.

Small-scale net-metered wind power installations that serve homes or businesses may provide benefits to Grafton residents and business owners. With an average wind speed of 12 mph required for a 50% performance from most wind turbines it is likely that small wind assets will gain limited popularity. The challenges of siting and the costs associated with such single-turbine facilities may discourage their

widespread use, with the current technology available. Some residents have installed turbines on their properties but eventually dismantled them, because the wind resource was insufficient. Some small residential turbines also may produce a sound that may be disturbing to neighbors and should therefore not be installed where the sound would be annoying to other residences.

Geothermal

The earth has a great reservoir of heat. The temperature at about ten feet underground stays at a steady 45 to 50 degrees Fahrenheit all year long. This is cold enough to cool our housing in summer and warm enough to use a heat pump (reverse cycle air conditioner) in winter to supply heating. Conventional methods of extraction include closed loop pumping of deep water wells and tubing grids laid in excavated trenches. Grafton has geothermal resources in all locations in town.

Currently there are some incentives to install geothermal energy in homes and businesses. Customers who install geothermal heat pumps can receive a 30% tax credit for systems that are placed in service by the end of 2016.

Ambient Energy

As with geothermal energy the heat and cold of the atmosphere around us can be utilized to reduce our energy costs and consumption. Air-sourced heat pumps take heat from outside air (as low as 15 degrees below zero, Fahrenheit) through a compression cycle producing warm air in a building at a cost less than 20% that of electric baseboard (resistance) heating, and less than 50% the cost of oil or propane. The cost and complexities are far lower than the ground source heat pump systems. Free-Air cooling is a process which utilizes cold outside air in place of refrigeration equipment in small to large commercial applications. This has been employed at the Grafton Cheese Company and eliminates almost all compressor driven refrigeration from November through March. Heat Pump water heaters operate at approximately 25% the cost of electric water heaters, 40% of oil heat and 50% less than gas.

Methane

Methane digesters that use cow manure for input are presently too large and expensive for any of the farms in Grafton. As this technology matures, smaller units may be perfected. Methane is used to fire an internal combustion engine which then drives an electric generator.

Incentives for developing methane small scale digesters should be encouraged, as they generate useful power from biomass by burning methane, one of the most detrimental greenhouse gases.

Conservation and Efficiency

Grafton recognizes the need for energy conservation, and efficiency and encourages both whenever and wherever feasible. There are several opportunities for conservation and efficiency.

Housing

Buildings within Grafton are, much as the rest of Vermont, quaint drafty boxes built when energy efficiency was not important and insulation/sealing technology did not exist. Our two greatest energy uses are housing and transportation, so housing must be improved to make it efficient.

Whole structure energy audits can diagnose inefficient practices through thermal imaging, blower-door infiltration checking, and electrical load analysis. Homes can then be retro-fit with better insulation, air sealing and electric load reduction measures. New housing can benefit from earth sheltering and energy efficient design at inception. Town government could lead the way with retrofitting public buildings as has been started in the Town Hall and offices.

Insulation improvements and air sealing will significantly reduce home energy costs. These should be encouraged with the distribution of information on rebates and tax credits available.

Transportation

Settlement is dispersed within Grafton with only small village concentrations. In addition, few commercial opportunities for jobs currently (See the Economic development Chapter 3) exist within the community, thus forcing residents to commute out of town. As transportation fuel becomes more expensive the viability of public transportation becomes greater. Grafton should support this infrastructure so that it exists when it becomes more needed. Highway planning could provide for walkways also suitable for bicycles to minimize vehicular traffic within town. The Town vehicular fleet could implement anti-idling guidelines to conserve fuel and use biofuels for greenhouse gas reduction.

Electric Power

Vermont's residents are almost universally wasteful in their use of electric power. Grafton is no exception. Average Vermont residential consumption of electricity is about 650 kilowatt hours per month. Residents who live off-grid can live very comfortable lives, but without conspicuous waste, on about 150 kilowatt hours per month. Opportunities exist to reduce lighting loads with LED bulbs, refrigeration loads with energy star refrigerators (and freezers), and heating-ventilation-air conditioning loads with proper mechanical/architectural choices. Outside lighting could be triggered-on only with the passage of a warm person or vehicle

Land use

Dispersal of residents homes from locations where they work increases the energy consumed for transportation and it eliminates the viability of using industrial and commercial process waste heat for residential heating. Co-location of residential and industrial/commercial developments facilitates energy conservation. The new Vermont Telephone Co. high speed fiber optic cable makes working from home more possible.

Waste and Recycling

Energy demands required for manufacturing from recycled materials as opposed to raw materials are much less. Waste stream separation and preferential purchase of easily recycled products can minimize energy expenditures.

Goals

1. Foster energy conservation ...Defined as not using or reducing the use of energy for any particular purpose. Turn off the light bulb.
2. Encourage energy efficiency ...Defined as using the least amount of energy needed for any task. Replace the light bulb with one that produces needed light with less electricity.
3. Educate residents about energy issues and options so that they may make informed decisions about energy.
- 4- Encourage homeowners to invest in locally distributed, small-scale renewable energy sources to serve individual and community needs.
5. Encourage the formation of a Town Energy Committee.
6. Use the Grafton Town web site for communication of all Town business, including energy issues and education.
7. Actively promote renewable energy generation.

Policies

1. Promote reduction of idling of motor vehicles.
2. Promote use of energy efficient electrical devices, lighting, and appliances.
3. Support building heating and cooling energy efficiency.
4. Promote use of renewable fuels for building heating.
5. Promote use of biofuels for transportation.
6. Encourage sustainable practices for the agricultural production of biofuels.
7. Support regional resource recycling.
8. Consume less, source reduction.
9. Regulate a property owner's ability to install renewable energy collection and generation facilities only to the extent prescribed by state and federal regulation.

Recommendations for Action

1. Town government should lead the anti-idling campaign by example with municipal vehicles and ask the School District to adopt a similar policy. Signs could be purchased and donated to local business owners to post with an anti-idling message for patrons and delivery vehicles.

2. Town government should replace incandescent lamps and older design fluorescent fixtures with new high efficiency LED models. Heating and refrigeration appliances should be replaced with models meeting "Energy Star" rating by the US Department of Energy. An LED sales campaign should be part of an Energy Committee agenda for the Town.
3. All Town buildings should be energy audited ...which should include electrical load analysis, infiltration testing with a blower door, and thermal imaging to identify air leaks and inadequate insulation. The example provided and lessons learned can be used to educate Grafton's residents about the techniques and benefits of energy auditing.
4. Investigate renewable energy sources at the Town Garage and possibly at the Town Hall. Collaborate with the School District to study renewable conversion for heating the Grafton Elementary School and Athens Elementary School. Presently, many schools in Vermont are successfully heated with wood chips with significant cost savings compared with oil heat. Solar, wood pellets, and the use of heat pumps should also be evaluated.
5. The Town should consider running a blend of biodiesel in its trucks and equipment to the extent allowed by seasonal temperature effects on gelling of the fuel.
6. Encourage new commercial, industrial and major housing developments to follow design and construction principles that are energy efficient, conserve energy, encourage small scale alternative energy production, conserve important forest and agriculture soils, and minimize contribution to greenhouse gasses. Grafton's Subdivision Regulation as well as public purchase of easements on private land can be utilized to accomplish these goals. Grouping of buildings can reduce utility footprint, make cogeneration a possibility, and reduce fragmentation of wildlife habitat and agricultural land.
7. Form an Energy Committee. This committee could be either ad hoc or Selectboard appointed, to promote the energy related goals, policies, and recommendations of this plan. The Town Energy Officer (Selectboard appointee) should serve on this committee. The Committee will help residents identify opportunities for conservation and efficiency as well as renewable energy generation projects.
8. Develop a greenhouse gas budget for the town. Set and track progress on goals for reduction of town greenhouse gas. This is a task for the Energy Committee but a responsibility of the Selectboard.
9. Encourage public transportation companies to include Grafton in their routes, publicly publish the schedules, and financially subscribe when necessary to ensure service is provided.
10. Develop a ride-share list for Grafton's residents. This could be initiated by polling residents as to their regular commuting locations and publishing it on the Town's web site. Alternative web-based services might be utilized.
11. Continue participation in the Windham Regional Commission and other regional and state forums as they may relate to energy issues.

12. Request filing of the builder's certificate of compliance with Vermont's building energy codes with the Grafton Town Clerk by builders of any new construction in Grafton. This should be part of hand-outs for Grafton's voluntary Building Notification filing.
13. Security lighting and street lighting should be high efficiency, of limited wattage, limited to illumination of things (not people's eyes), and whenever possible thermally triggered by passage of people or vehicles. Street lights should not have such triggering. Town buildings can make these lighting changes and Grafton's Subdivision Regulation could address Major Development security lighting and street lights.
14. Continue participation in regional programs for resource recycling. Consider local collection points for materials. Make Town purchases of products with a bias for those that can be easily recycled.
15. Establish setbacks for solar or wind projects that comply with Vermont State regulations.
16. Collaborate with state and regional agencies and entities in pursuing energy storage facilities as a step toward enabling local distributed generation
17. Assist landowners with identification of locations suitable for location of renewable energy generation.