

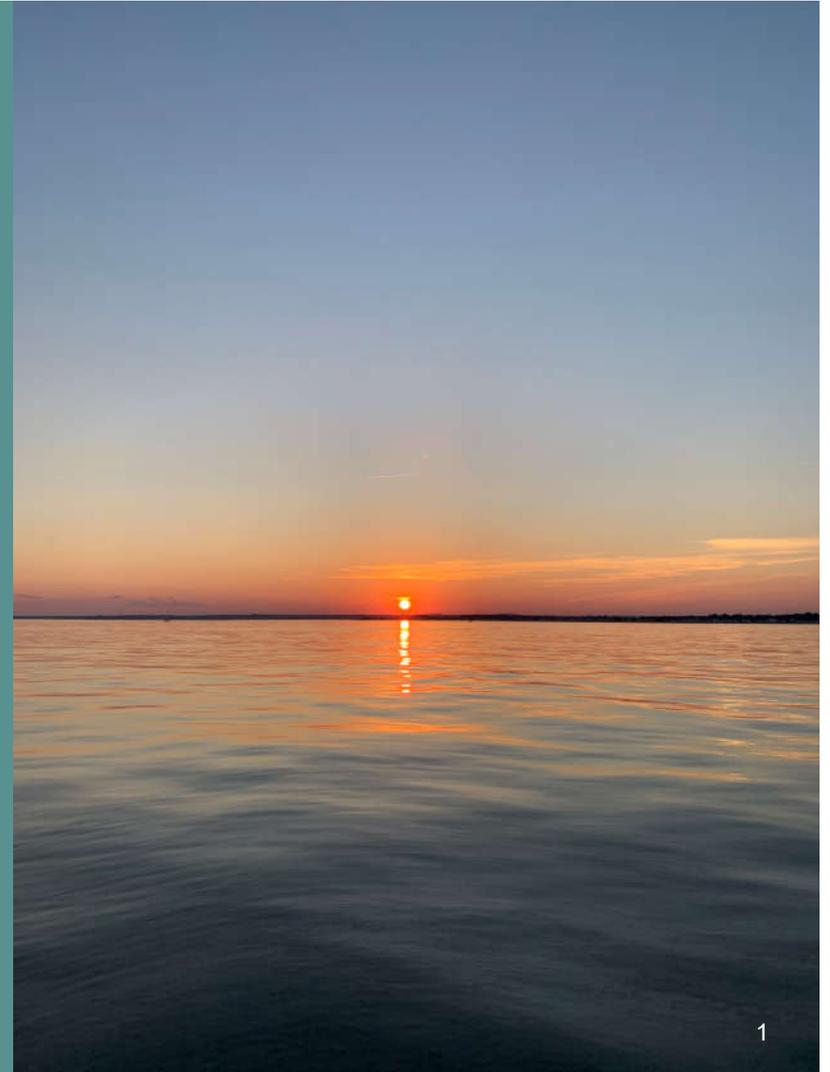


2020 BRANFORD Energy Plan

July/27/2020

Branford Clean Energy Ad hoc Committee

Branford Sunrise



Introduction

Energy is the lifeblood of Branford. We use it to heat and cool our homes and businesses, to run our appliances and to travel to work and play. It is also one of the largest expenditures for our residents and businesses.

In a recent survey, a strong majority of residents agreed that Branford should do more to promote energy efficiency and renewable energy (2019 Plan of Conservation and Development (POCD), p. 104). The POCD recommended the following strategies:

- Reducing energy use / becoming more energy efficient
- Reducing reliance on fossil fuels
- Encouraging increased use of renewable energy (solar, wind, etc.)
- Promoting “greener” buildings / vehicles
- Providing for alternative energy approaches (fuel cell, micro-grids, etc.)
- Providing for electric car charging stations
- Continue to participate in SustainableCT

The Branford Clean Energy Committee has prepared this Energy Plan to help guide the town toward greater energy efficiency and sustainability. Carrying out this plan will yield many benefits to town residents and businesses, including:

- **Savings:** We estimate that the town can reduce its energy expenditures significantly. And, we can keep more of the money we spend right here in town.
- **Health:** By reducing our reliance on fossil fuels and electrifying heating, cooling and transportation, we will improve air quality, leading to a range of health benefits, including notably lower asthma rates and lower risk factor for COVID-19.
- **Comfort:** By making our homes and businesses more energy efficient, they also become more comfortable.
- **Resilience:** Through greater reliance on local energy generation and a more modern electric grid, the town can weather storms, outages and natural catastrophes longer and more safely and contribute to slowing global warming.



Branford's 1.37 MW Tabor Solar Field

In 2018, the State of Connecticut set a goal of producing 40% of its electric power through renewables by 2030, rising to 100% by 2040 and of reducing greenhouse gas emissions to 80% below 2001 levels by 2050 (2018 CT DEEP Comprehensive Energy Strategy). This energy plan aims to achieve these goals for Branford as well (per 2019 POCD, section 12.1, pp102-105).

We recognize that there are barriers to achieving this vision, but we are already making progress. It is both achievable – even with today’s technology – and realistic – other cities and states have set similar aspirations and timelines. By fostering a culture of conservation throughout the entire community and by making the right choices, Branford can address energy and climate change challenges in a meaningful way. Now is the time for the Town to lead by example and launch our community into an affordable, resilient, and clean energy future.

Branford Clean Energy Committee
July 2020

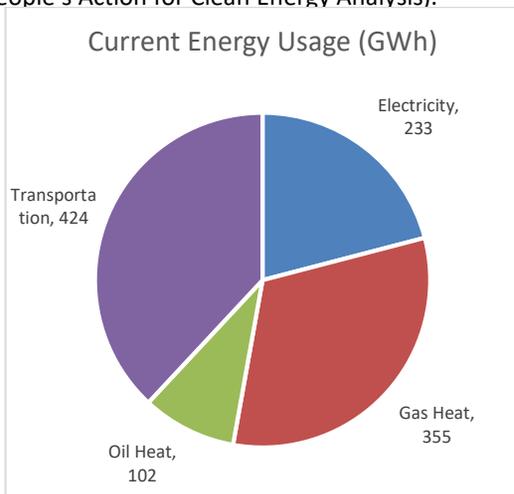
Branford's Energy by the Numbers

In 2018, Branford:

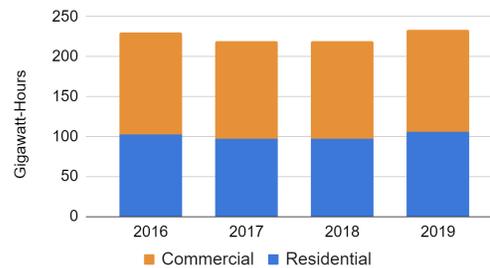
- spent \$97.3 million on energy, or \$3,463 per person;
- consumed the energy equivalent of 1,113,000 megawatt-hours, or 40 MWh per person;
- generated 286,425 tons of greenhouse gases (GHG), or 10 tons per person.

These amounts include the entire town (i.e., residents, businesses, the Town of Branford and the Board of Education), and they include heating, transportation and electricity.

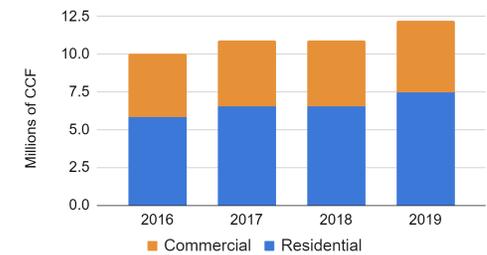
As seen in the graph below, 41% of the town's energy is spent on heating with natural gas and oil. Another 38% goes to transportation and 21% to electricity (Source: People's Action for Clean Energy Analysis).



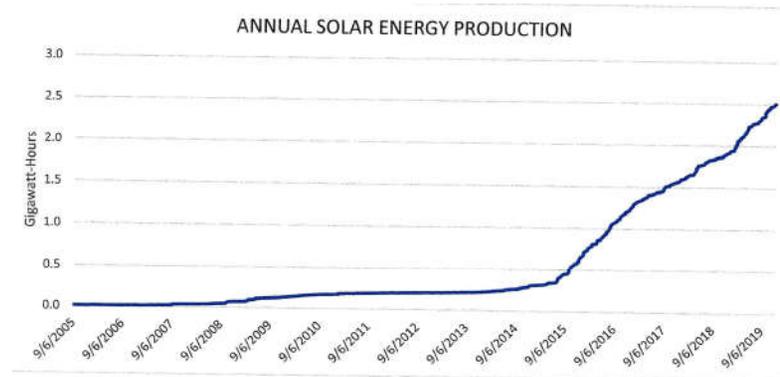
Electricity Consumption



Natural Gas Consumption



Branford has roughly 279 residential solar arrays, capable of producing approximately 2.5 gigawatt-hours of electricity each year, or 1.1% of current consumption as of 2019 (Source: CT Green Bank). We estimate that the town could locally site 173 Megawatts of solar energy capacity. (Source: Project Sunroof data explorer, November 2018).

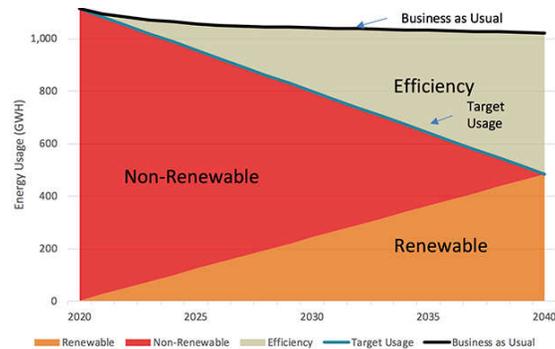


Branford aims to use 100% renewable energy by 2040

The path to 100% renewable energy comprises two complementary actions:

- Overall energy consumption must be decreased dramatically by a combination of conservation, energy efficiency and electrification of heating, cooling and transportation.
- Electricity consumed in town must come from clean, renewable sources.

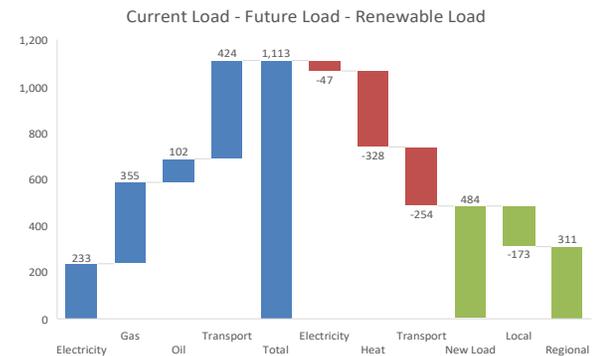
These complementary actions are visible in the declining overall consumption and increasing renewables in the chart below.



The key elements of this energy plan are:

1. Reduce our energy usage by improving the efficiency and performance of our buildings, both public and private.
2. Transition to high efficiency heating and cooling technology.
3. Promote the responsible development of renewable energy in town, including residential solar, community shared solar, commercial solar, carport and other types of renewable energy. For example, the CT Green Bank offers municipalities and public institutions a solar power purchase agreement (PPA) with no money down.
4. Pursue regional energy solutions partnerships through SustainableCT and advocate for a cleaner grid.
5. Promote public transportation and the transition to electric vehicles through various measures, including planning for sufficient charging infrastructure.
6. In collaboration with Eversource, modernize the local electric grid to enable higher levels of distributed renewable energy and storage.

The chart below is another way of visualizing Branford’s path to 100% renewable energy. The blue bars on the left side of this graph represent the town’s current energy usage, expressed in a common unit: gigawatt-hours. The red bars represent the potential reduction in energy usage through efficiency and electrification, resulting in a vastly reduced energy load. The green bars represent the sources of local and regional renewable energy to meet this need.



Energy Reduction Targets

As seen in these two graphs, Branford aims to reduce energy consumption by over half in roughly twenty years. Because these reductions will be accomplished in part through “fuel switching” (e.g., from gasoline to electric vehicles), we do not set reduction targets for each fuel type. In fact, we expect electricity usage to more than double over this period.

Branford’s 2040 energy target can be achieved through modest annual reductions of 2.3% per year after 2018. **Based on our initial analysis, we are selecting a 3% annual reduction target for all town sectors: residents, businesses and municipality. Over a five-year period, the targeted reduction is therefore 15%.** As our analysis of the town’s energy usage develops, we may differentiate this target by sector and year. Together with the Dept. of General Government Buildings and the Branford Schools, the Clean Energy Committee will monitor town energy usage, track renewable energy production and update this analysis annually using Energy Star Portfolio Manager.

Energy Efficiency and Building Performance

Energy efficiency is sometimes referred to as the “first fuel” because it offers the possibility of reducing energy consumption before turning to more expensive and complex energy generation. Efficiency offers some of the highest investment returns in reduced energy costs. A range of programs and incentives exist for both residential and commercial buildings to make measures such as weatherization, insulation, appliances and building controls more achievable and affordable. It is realistic to expect average energy usage reductions of 25-50% after upgrading.

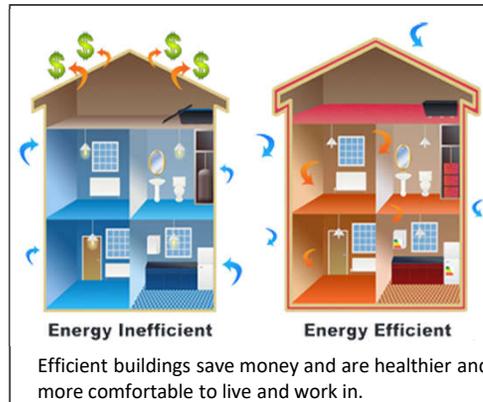
Before looking to increase generation of electricity and expansion of natural gas lines, the town should look for ways to educate and incentivize residents, businesses and the municipality to first reduce energy needs through cost effective efficiency measures.

Progress to date:

- Currently monitoring results of recently completed (Honeywell) Energy Saving Performance Contract for 19 public buildings.
- Currently converting streetlights to LED (by Eversource).
- 263 Small Business Energy Advantage (SBEA) energy upgrades in town since 2006.
- 15% of households and 20% of businesses participated in Energize CT efficiency programs since 2006 (data from Eversource).

Benefits:

- Savings for residents and businesses.
- Local job creation.
- Reduced need for energy production.
- More comfortable, safe and healthy living and work environments.
- Greater resilience during extreme weather.
- Lower CO₂ and greenhouse gas emissions.



Action

- Design a public outreach education plan
- Participate in PACE HeatSmart campaign to promote adoption of residential air-source heat pumps and high efficiency heating/cooling.
- Conduct residential Home Energy Solutions (HES) campaign.
- Offer informational sessions on energy services available to low- and moderate-income residents.

Action

- Monitor and benchmark energy usage in buildings over multiple years, separately for Town, residents and businesses using EPA Portfolio Manager and Home Energy Yardstick.
- Evaluate municipal buildings for more projects to further increase energy efficiency.
- Complete a feasibility study for a transition to electrification of municipal and school buildings.
- Hire an energy manager/sustainability manager.
- Revisit and clarify the role of the Public Building Commission as it relates to energy use. Consider establishing a facilities management commission (perhaps combined with the PBC) (POCD p.112).
- Evaluate the progress of municipal efficiency upgrades from the Honeywell performance contract.
- Establish energy design standards for public buildings. (Adopt standards 2018 IECC or IGCC)
- Increase strategic planting of trees to provide shading, windbreaks and carbon sequestration
- Identify and promote energy assistance programs for businesses such as the Small Business Energy Advantage (SBEA) program.
- Promote financing tools for energy related projects such as C-PACE, local and state incentives
- Explore town efficiency incentives through zoning regulations and/or tax incentives.

2020 Goals:

Develop a plan to achieve 100% renewable energy by 2040.

2025 Goals:

- 50% of residences conduct energy audits; 25% carry out deeper measure retrofits.
- 50% of town businesses conduct energy audits; 40% Implement efficiency measures.

2040 Goals:

- 80% of residences and businesses conduct energy audits and implement deeper measure upgrades.

Heating and Cooling

Heating and cooling account for 40% of the energy use in a typical U.S. home. In Branford, the vast majority of homes heat with oil or natural gas. New high efficiency (HE) technology such as air-source heat pumps can help homeowners lower their heating and cooling energy costs, and at the same time reduce greenhouse gas (GHG) emissions. Long used for cooling in warm climates, heat pumps are now able to provide efficient heating in cold climates even at outdoor temperatures as low as -15 °F. Air-source heat pumps are capable of not only heating in the winter (by extracting heat from outside air) but also cooling in the summer (by extracting heat from inside air.) Heat pumps use the same technology as a refrigerator or air conditioner. Heat pumps can be used alongside existing heating systems to address specific needs and lower costs. Municipal and institutional buildings, where costs can be amortized over a longer time period, can also take advantage of the higher efficiency heating technology, including ground source heat pumps.

Progress to date:

First public building installations of ground-source heat pumps at the new Fire Headquarters and air-source heat pumps at the Community Center.

Benefits:

- Lower heating and cooling costs.
- Comfort – With advances in controls, heat pumps can maintain very constant temperatures.
- Safety – Because heat pumps are electrically powered, there is no risk of combustion gas leaks.
- Improved air quality – Heat pumps filter indoor air all year and dehumidify it in the summer.
- Room-by-room control.
- Reduced greenhouse gas emissions.



An illustration of a ductless mini-split system.

Actions:

- Evaluate public buildings for heating, ventilation and cooling improvements.
- Create schedule of proposed HVAC upgrades for public buildings.
- Ensure HE technology is considered for public building upgrades.
- Carry out town-wide Heatsmart campaign to educate residents about and promote the use of heat pumps and other technologies. The HeatSmart Coach will designate a volunteer or volunteers who will focus on low-moderate income households in Branford.
- Work with town staff and P&Z to promote heat pumps in new construction.
- Publicize examples of heat pump installations, both new and retrofits, for public, residential and commercial buildings.
- Engage the commercial and business community in campaigns and building audits for VFD's (variable frequency drives) and controls.

2025 Goals:

- Develop program goals and tracking plan.
- Introduce 10% of residents to using heat pumps through HeatSmart Campaign. Upgrade 10% of HeatSmart participants' homes.
- Promote 5% of commercial businesses to complete energy audits.
- Upgrade 5% of business participants to HE technology including VFD's and controls.

2030 Goals:

- Increase program participation to 35%.

2035 Goals:

- Increase program participation to 60%.

2040 Goals:

- Increase program participation to 90%.

Renewable Energy

Branford currently derives approximately 2.4% of its electricity from roughly 365 solar arrays in town, on houses, businesses and public buildings. As prices for solar panels continue to decline, even more households and businesses will seek to lower their energy costs by going solar.

There is more we can do, including educational campaigns, solar arrays on public buildings, schools and parking lots and other structures, and promoting Community Shared Solar.

It is our desire to have a public discussion about how to promote solar responsibly and sustainably. For example, which lands and buildings should be avoided due to their aesthetic, historic, agricultural and environmental value versus which are good candidates to produce clean energy.

Progress to date:

- Total of approximately 279 residential arrays with total annual production of 2.5 GW hours as of 2019.
- Solar arrays on Branford High School, the new Fire Headquarters and the transfer station.
- A major advance in the utilization of solar in Branford occurred with the 2018 installation of the 4.3-acre 1.37 MW solar farm at the Tabor property, producing power for the sewage treatment plant equivalent to the amount used by 125 average homes.

Benefits:

- Reduces and stabilizes electric bills.
- Improves public health by decreasing pollution from fossil fuel plants.
- Reduces greenhouse gases.
- Reduces energy imports.
- Creates jobs and economic growth.
- Presents an educational opportunity, especially with arrays on schools.
- Reduces climate change.
- Helps the state meet its renewable energy and greenhouse gas emission goals.

Actions:

- Pursue Community Shared Solar project.
- Conduct educational campaign(s) starting with energy conservation and technology. Then build to engage the community in a discussion of responsible and sustainable clean energy development.
- Review and develop local regulations, improve the permitting process and promote incentives for renewables.
- Adopt a policy for solar-ready new construction.
- Advocate for solar access rights in CT.
- Adopt Community Choice Aggregation (when enabling state legislation is passed).
- Participate in CT Green Bank solar power purchase agreement (PPA) program for public buildings.
- Explore potential for generating clean energy on land, buildings and infrastructure.
- Investigate the potential for additional renewable power for public buildings via virtual net metering PPAs.

BRANFORD CLEAN ENERGY

AD HOC COMMITTEE

Shirley McCarthy, Chair

Greg Ames

Bob Babcock

Elena Cahill

Marshall Cox

Bill Horne

Sharon Huttner

John Prins

Dan Rabin

2025 Goals:

- Increase solar capacity to 5% of consumption or by 10 MW installed solar capacity on land, buildings and parking lots.
- A town-wide solar installation campaign.
- Initiate Community Shared Solar projects.
- Solar-friendly policy for construction permitting.

2040 Goals:

- Total solar generation capacity of 50MW.
- Community Choice Aggregation adopted.

Transportation

Transportation is a large source of greenhouse gases in the United States. According to the EPA, emissions coming from transportation increased more over the last 2 decades than any other greenhouse gas source and now accounts for 27% of total emissions.

Decreasing transportation emissions can have an immediate effect on local air quality in a way that other sustainability activities may not. For example, the exhaust from diesel school buses expose children to very fine particles and a mixture of toxic gases. Benzene, a component of diesel fuel and exhaust, has been classified as a probable human carcinogen.

Connecticut has set a goal of converting the state fleet of cars and light duty trucks to electric vehicles (EVs) by 2030. The town of Branford will seek to meet or exceed that goal.

Encouraging people-powered transportation (bikes, walkways), increasing public transportation access, and supporting non-fossil fuel transportation options (electric cars) are all ways to move toward our goals.

Progress to date:

- EV charging stations installed: 6 at East Shore District Health Department, several at local businesses.
- First municipal fleet battery EV purchase underway.

Benefits:

- Improved local air quality and noise levels.
- According to the National Association of Realtors (NAR), walkable/bikeable communities are preferred by homeowners (2017).
- Communities with available and easy-to-use public transportation show resilience in property values even in times of volatility (NAR, 2013).



Actions:

- Develop a transportation plan for the town including EV charging infrastructure in town.
- Upgrade Town vehicle fleet with EVs.
- Support State requirement for new construction to include electric circuits capable of supporting EV charging and EV parking spaces.
- Work with Planning and Zoning to require charging stations at multi-family, commercial/industrial and retail locations.
- Evaluate EV charging stations for municipal properties.
- Electrify the school bus fleet.
- Promote personal property tax incentives and information on EVs to the community.
- Increase Branford residents' awareness and use of local public transportation.
- Conduct no-idling campaign.
- Establish a broad-based advocacy committee dedicated to promoting bicycle/pedestrian use, (including sidewalk ordinance, crosswalks, pedestrian lighting, etc.).
- Explore a Complete Streets plan for the town.

2025 Goals:

- Create a plan for EV charging infrastructure.
- Complete initial installations.
- All new town and school fleet vehicles EVs.
- Identify potential key charging station locations across town.

2030 Goals:

- Fully electric town fleet.
- Electric school bus fleet.

Microgrids

All of us in Branford rely on the electric grid to provide electricity to our homes, businesses and Town facilities. Our aging grid performs well, but it was built and designed before the advent of solar panels, which limits the potential for individual houses and businesses to generate electricity and install batteries for storage. Moreover, it has been vulnerable to extended blackouts during major storms and weather-related peak hours of demand.

The grid will evolve to accommodate these resiliency measures with more renewable energy, integrated storage and smart technology. Microgrids, consisting of smaller subsets of power sources, users, wires and controls, will be a key building block of the future grid. Microgrids are capable of operating while connected to the wider grid, or they can “island” or operate separately in the event of a grid outage.

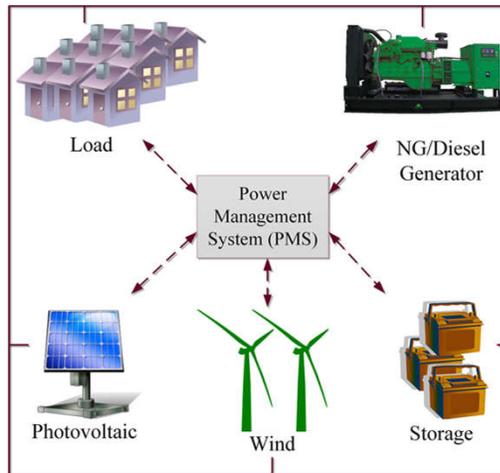
A microgrid could include a collection of key Town facilities and services, renewable energy sources, battery storage and a backup generator. In the future, the grid might consist of a series of interconnected microgrids. The POCD proposes investigating the installation of fuel cells and microgrids in Branford Center and other areas where redundant electrical generation is considered critical to storm resistance and recovery (POCD section 16.2).

Progress to date:

-

Benefits:

- Enables more renewable energy through integration of storage and smart controls. Electricity can flow in multiple directions.
- Greater resilience, allowing key facilities (e.g., emergency shelter, first-response facilities) in the microgrid to operate even when the broader grid is down.
- As prices of solar and batteries decline, microgrids offer cost savings.
- Gives local residents greater flexibility and control of their energy usage and generation.



Actions:

- Establish dialogue with towns that have experience with microgrids.
- Educate residents and businesses about microgrids.
- Complete a feasibility study for a Town microgrid(s) and fuel cells.
- Identify critical infrastructure and priority businesses, services and facilities to be connected through a microgrid.
- Explore funding support for microgrid and resiliency projects
- Build a pilot microgrid for key municipal facilities and emergency services.
- Develop a master plan for multiple microgrids in town.

2025 Goals:

- Feasibility study for microgrids that can be operational in town.
- Establish an energy resiliency plan
- Select a pilot microgrid project

2040 Goals:

- 50% of Town facilities and priority services organized in microgrids.

Branford's Energy Action Plan

Municipal

2020

1. Establish energy performance requirements for public building projects based on a standard such as the 2018 IECC or the IGCC.
2. Develop a strategic plan to achieve 100% renewable energy and electrification by 2040.
3. Develop a feasibility study and program to achieve further energy efficiency and electrification of public buildings.
4. Pursue solar arrays on public buildings and parking lots with the Connecticut Green Bank.
5. Develop a plan to reduce peak demand in public buildings.
6. Complete assessment and plans for EV charging infrastructure.
7. Establish a facilities management committee (under the Public Building Commission?) as recommended by the Plan of Conservation and Development (POCD, p.112).
8. Hire an energy manager /sustainability manager for Town facilities.
9. Initiate annual update of municipal energy usage (using Energy Star Portfolio Manager).
10. Explore town efficiency incentives through zoning regulations and/or tax incentives.
11. Investigate and plan for electric school buses.
12. Establish a Transportation Plan & Commission to pursue the recommendations of the POCD chapters 14 & 15.

2025

1. Complete Green Bank solar projects providing 1000 KW on Town buildings.
2. All vehicles purchased for Town fleet will be battery electric vehicles.
3. At least two electric school buses in use. All new buses will be EVs.
4. Develop pilot renewable energy microgrid for critical Town properties.
5. Implement Community Choice Aggregation
6. Monitor Town building HVAC operation for future heat pump installations.
7. Expand renewable sourcing for Town electricity.

Residential & Business

2020

1. Conduct residential heat pump campaign (Heatsmart program).
2. Consider conducting energy survey of town residents.
3. Propose energy efficiency/renewable energy policy for new and existing public and private buildings in Branford.
4. Conduct annual update of residential and business energy usage (using a benchmarking toolkit).
5. Promote financing tools for energy-related projects such as C-PACE and local and state incentives.
6. Promote ongoing participation in the Small Business Energy Advantage program (SBEA).
7. Educate commercial businesses that do not qualify for SBEA about incentives to be energy-efficient for their type of building.
8. Work with Town staff and Planning and Zoning Commission to promote solar, heat pumps and EV-readiness in new construction.
9. Consider a moratorium on new natural gas service in town.

2025

1. Conduct commercial building benchmarking and audit campaign.
2. Educate both residential and commercial sector on incentives.
3. Engage the community in a discussion of responsible and sustainable solar development.
4. Run a town-wide Solarize campaign. Increase solar capacity to 5% of consumption or 10 MW installed solar capacity on land, buildings and parking lots.
5. Initiate Community Shared Solar projects.
6. Solar-friendly policy for new construction and permitting.
7. Create a plan for EV charging infrastructure.

Additional Resources

Energy Efficiency in Buildings

"A Citizen's Guide to Reducing Energy Waste," Environment America
https://environmentamerica.org/sites/environment/files/resources/AME_Fact-Sheet_EE_Sept2018_PRINTv1a.pdf

Heating and Cooling

"Exploring Climate Solutions: Renewable Thermal Technologies: Heat Pumps"
https://www.ct.gov/deep/lib/deep/climatechange/gc3_webinar_series/heat_pumps_4_8_16.pdf

Solar Energy

"Ten Ways Your Community Can Go Solar," Environment America
https://environmentamerica.org/sites/environment/files/resources/AME_Solar-booklet_Mar2019_Overview_PRINTv1a_0.pdf

Transportation

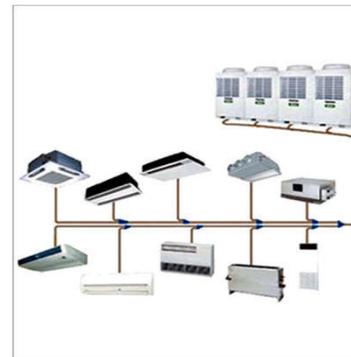
<https://www.plugshare.com/location/89998>

Microgrids

[Meet the microgrid, the technology poised to transform electricity](#)
www.microgridknowledge.com
<http://www.clean-coalition.org/our-work/community-microgrids/>

DSIRE

<http://www.dsireusa.org/energy-efficiency-resource-standards-2/>



Appendix: Branford's 2018 Energy Consumption



		Unit	Commercial	Residential	Total
Current Energy Used	Natural Gas	CCF	4,757,532	7,480,875	12,238,407
	Transport	Gallons	2,374,505	10,193,019	12,567,525
	Oil Heat	Gallons	298,945	2,195,107	2,494,052
	Electricity	KWh	127,484,532	105,560,476	233,045,008
Current Energy in Gigawatt-Hours	Natural Gas	GWh	138	217	355
	Transport	GWh	80	344	424
	Oil Heat	GWh	12	89	102
	Electricity	GWh	127	106	233
	Total	GWh	358	755	1,113
Current Greenhouse Gas Emissions	Natural Gas	GHG - tons	27,855	43,801	71,656
	Transport	GHG - tons	22,439	96,324	118,763
	Oil Heat	GHG - tons	3,348	24,585	27,933
	Electricity	GHG - tons	37,238	30,834	68,072
	Total	GHG - tons	90,881	195,544	286,425
Current Energy Expenditure			<u>Consumption</u>	<u>Price</u>	<u>Annual Cost</u>
	Natural Gas	\$	12,238,407	\$1.09	\$13,339,864
	Transport	\$	12,567,525	2.79	35,063,393
	Oil Heat	\$	2,494,052	2.80	6,983,345
	Electricity	\$	233,045,008	0.18	41,948,101
Total	\$			\$97,334,704	

Notes:

Natural gas and electricity figures provided by Energize CT. Municipal data is provided by the Dept. of Public Works. Oil and propane figures are estimated using data from the Branford Grand List and U.S. Census Bureau American Community Survey.

Conversion factors for each fuel type to MWh are:

- 1 CCF Natural Gas = 0.0293 MWh
- 1 Gallon Heating Oil = 0.04059 MWh
- 1 Gallon Propane = 0.02677 MWh
- 1 Gallon Gasoline = 0.03341 MWh

Greenhouse gas emission rates are:

- 1 CCF Natural Gas = 0.005855 tons GHG
- 1 Gallon Heating Oil = 0.01120 tons GHG
- 1 Gallon Propane = 0.006348 tons GHG
- 1 Gallon Gasoline = 0.00980 tons GHG
- 1 MWh Electricity = 0.0000292 tons GHG

Costs per unit of fuel are:

- \$1.09 per CCF Natural Gas
- \$2.80 per gallon Heating Oil
- \$3.00 per gallon Propane
- \$2.79 per gallon Gasoline
- \$0.18 per KWh Electricity