TOWN OF WINDSOR, CONNECTICUT
Special Meeting Notice

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3. During Public Comments if you do not wish to speak you may type your comments into the Q&A feature.

AGENCY: **Citizen Advisory Task Force on Clean and Sustainable Energy**

DATE: **October 7, 2020**

TIME: **6:30 PM**

PLACE: **VIRTUAL MEETING**

AGENDA

1. Call to Order
2. Public Comment
3. *Town Efforts Overview
4. Windsor Climate Action Group Overview
5. *Discussion on sample Municipalities Energy/Sustainability Plans
6. Discussion on Committee Member Resources
7. Discuss Possible Future Agenda Topics
8. Selection of Chairperson, Vice-Chairperson, & Secretary
9. Approval of Minutes
   a) September 16, 2020
10. Adjournment

*Backup materials

Public Act 75-312 requires notice of Special Meetings to be posted in the Town Clerk's Office not less than 24 hours prior to the time of such meeting. No other business shall be considered at this meeting than that listed on this Agenda.

Agenda Item Summary

Date: October 7, 2020

To: Members of the Citizen Advisory Task Force on Clean and Sustainable Energy

Prepared By: Scott W. Colby Jr., Assistant Town Manager

Subject: Town Energy Efforts

Background

Since FY 2010 the Town of Windsor has looked to reduce energy usage by utilizing more efficient technologies and also helping to reduce the overall cost. From FY 2010- FY 2020, the Town has reduced its energy use by approximately 28%. The PowerPoint presentation that has been provided as backup material discusses various items regarding past, current, and future efforts:

- Including energy efficient projects within the Adopted Capital Improvement Program FY 2021- FY 2026
- Installing Solar Photovoltaic Systems at numerous Town and BOE facilities
  - Total system size is 800.8KW
- Installing Geothermal Systems in two facilities
- Participating in C-PACE (Commercial Property Assessed Clean Energy) Program
- Participated in two light bulb exchange programs

Zoning Regulations

The Zoning Regulations that were adopted in December of 2008 and revised in July of 2019 include sections pertaining to the following:

- Provisions for Bicycles
- Provisions for Mass Transit
- Electric Vehicle Charging Stations
- Renewable Energy Facilities
  - On-Site Solar Energy Facilities
  - On Site Wind Facilities
  - On-Site Geothermal Facilities
- Alternative Energy Considerations for Facilities within the Industrial Zone

Plan of Conservation and Development

The Plan of Conservation and Development that was adopted in September of 2015 addressed the need to reduce greenhouse gas emissions through key strategies.

Some of the key strategies that came out of this plan were:

- Continue to replace vehicles with low-emission and alternative fuel vehicles.
- Continue to promote energy conservation programs, alternative energy incentive programs, and simple steps that residents and businesses can take to reduce greenhouse gas emissions.
- Continue to upgrade town facilities to be more energy efficient and to install alternative energy sources.
- Commit to designing new town facilities to meet or emulate green building standards, such as LEED.
- Educate the public on long-term cost savings of energy efficient buildings.

Example Energy Plans

We have also provided sample municipalities' energy plans to use as reference.

Energy Efficiency Efforts

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Energy Overview from FY 2010 thru FY 2020

(All Town & BOE Buildings, Streetlights, & Traffic Control Lights)

Energy=electricity, heating oil, natural gas, & propane

FY 2010

Costs - $2,700,000

Energy Used – 11,500,000 kWh

FY 2020

Costs - $1,995,818

Energy Used – 8,297,396 kWh

This equates:

26% reduction in energy costs or $704,182

28% reduction in energy used or 3,202,604 kWh

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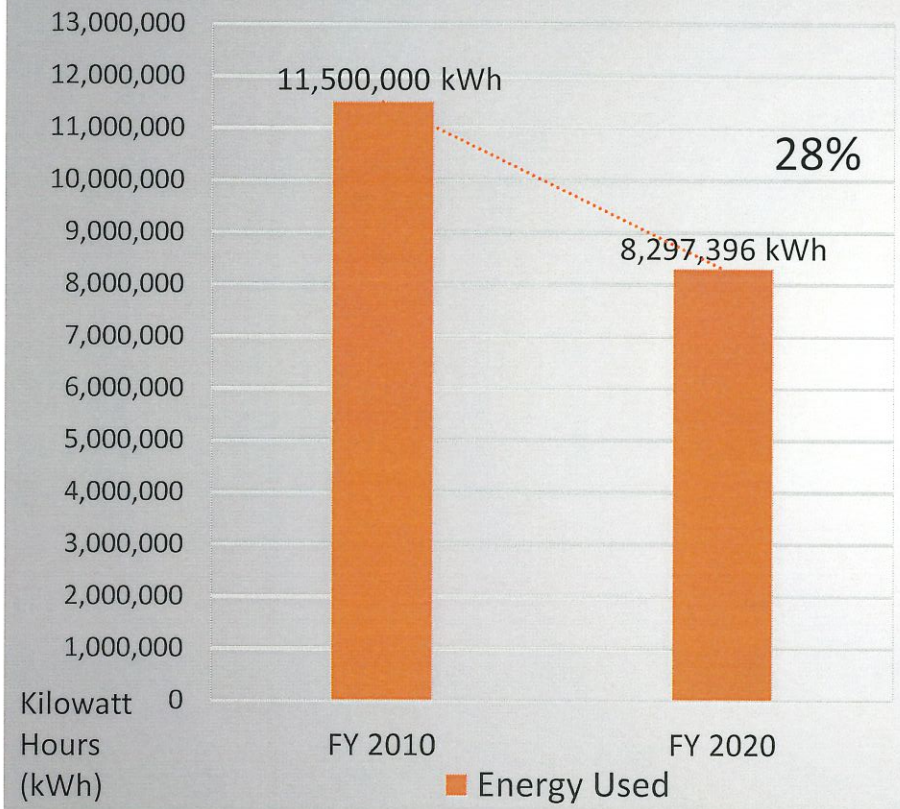
Energy Overview from FY 2010 thru FY 2020



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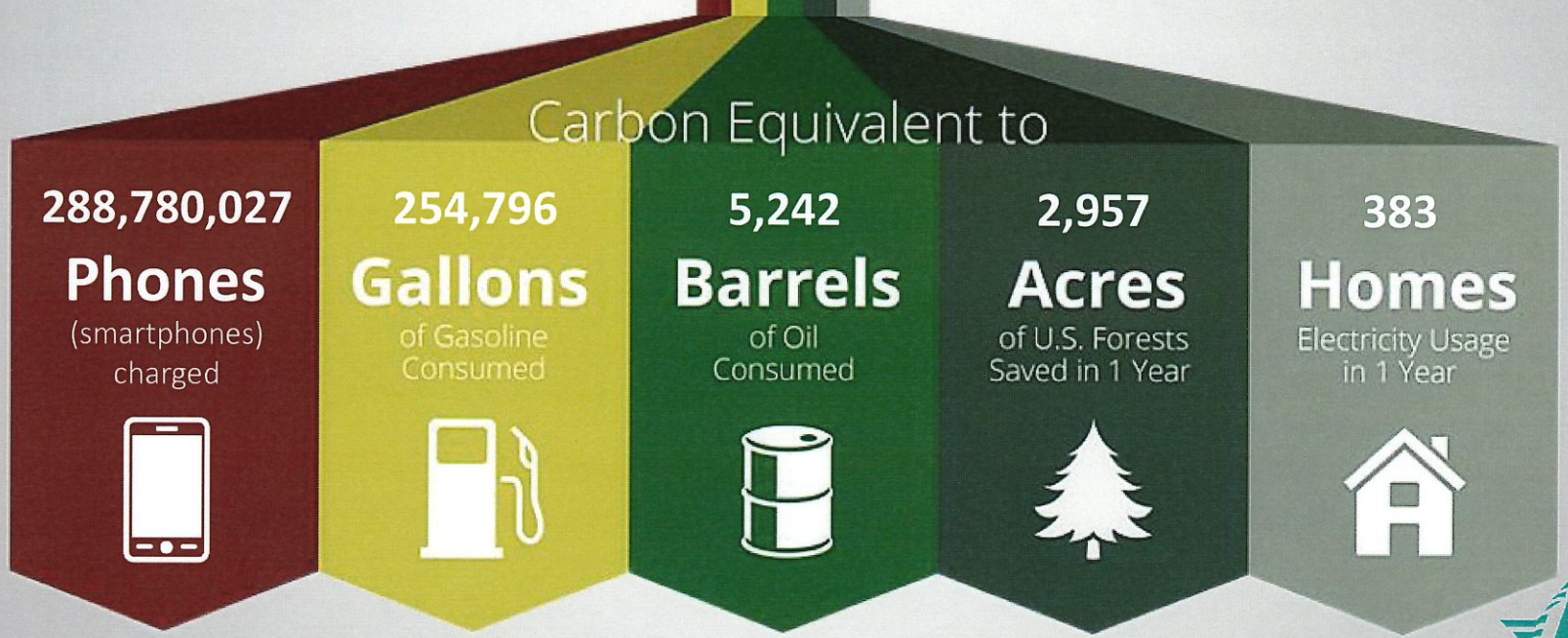
Reduction in use of energy from FY 2010 – FY 2020 for Windsor, CT

3,202,604 kWh



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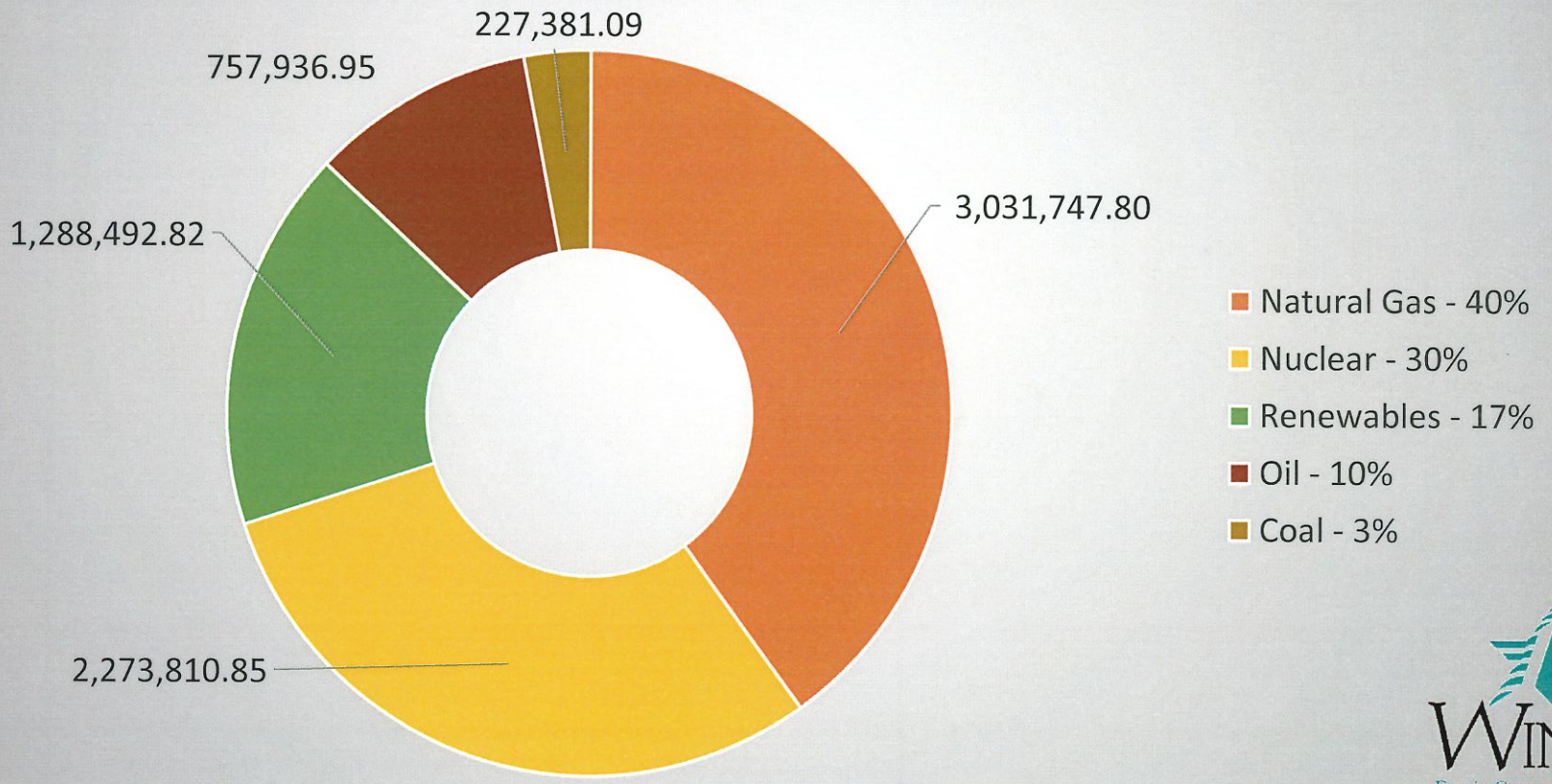
Electricity *(Electricity that is generated and supplied by Eversource)*

The make-up of our electricity that we use is a blend;



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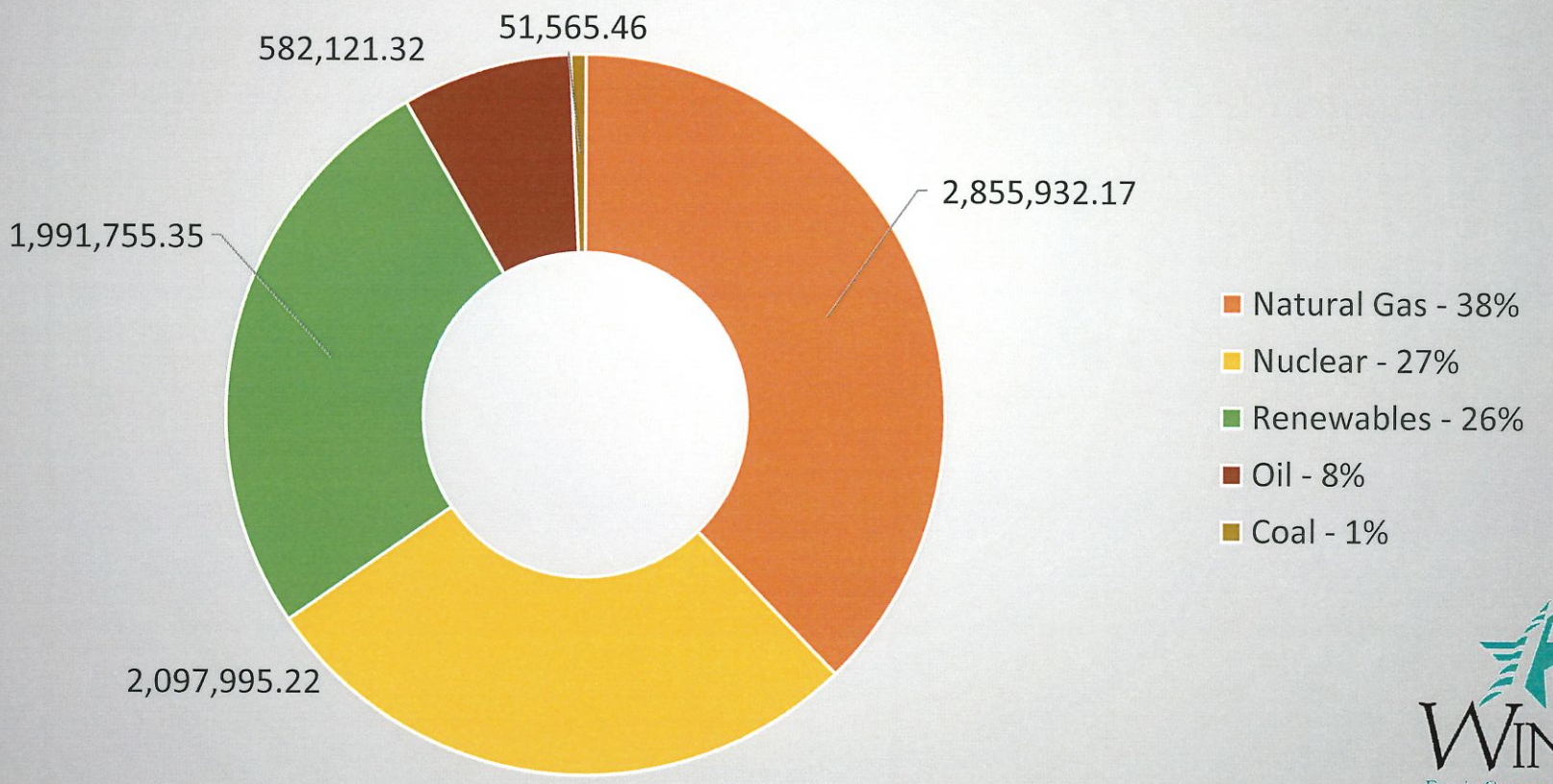
Electricity *(Electricity that is generated and supplied by Eversource with Town Solar included)*

The make-up of our electricity that we use is a blend;



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FY 2012

- Installed Low Condensing Boiler at Pequonock School
- Replaced HVAC at Town Hall with digital controls
- Replaced HVAC + installed digital controls
- LP Wilson Community Center LED conversion
- Converted LP Wilson Community Center & JFK School to Natural Gas

FY 2014

- Solar Panels installed at Oliver Ellsworth School – 150 KW
- Solar Panels installed at LP Wilson Community Center- 250KW
- Solar Panels installed at JFK School- 242KW
- Converted Sage Park & High School Exterior lighting to LED's
- Converted Windsor Volunteer Ambulance Ext./Int. to LED lighting

FY 2015

- Solar Panels installed at WVA - 20KW
- Solar Panels installed at 330 Windsor Community Center – 150KW
- Converted High School, Sage Park, Oliver Ellsworth School, & Clover School to Natural Gas

FY 2016

- Replaced Boiler at the Town Hall
- Replaced & Installed HVAC at Clover Street School
- Solar at Northwest Park Lang House

FY 2017

- Converted Town Hall to LED lighting

FY 2019

- Replaced & Installed HVAC at JFK School
- Converted High School to LED lighting
- Replaced furnace at the Stony Hill School & converted to Natural Gas

- Geothermal units were installed at the Northwest Park in 2010 and at the Wilson Library in 2011.

Energy Efficiency Projects Completed from FY 12 thru FY 19

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Energy Efficiency Projects in FY 2021 – FY 2026 CIP

FY 2021

Town Facility Improvements – Milo Peck HVAC, Electrical and Energy Improvements
Luddy House Windows
Wilson Firehouse HVAC Replacement
BOE – Sage Park Middle School – Alternative Energy and Efficiencies Upgrades
LP Wilson Boilers Replacement Project (Moved up from FY2023)

FY 2024

330 Windsor Avenue Community Center – HVAC & DDC Controls
Windsor High School HVAC Systems Replacement Project

Unscheduled Projects

LP Wilson - Window Replacement
Train Station - Boiler Replacement
LP Wilson - LED Lighting Conversion (Potentially in FY 2021)
LP Wilson - Gym Air Conditioning Project
Town Facilities Improvements – Poquonock Fire Station HVAC Replacement
Streetlight Replacement, Energy, and Maint. Cost Reduction Program

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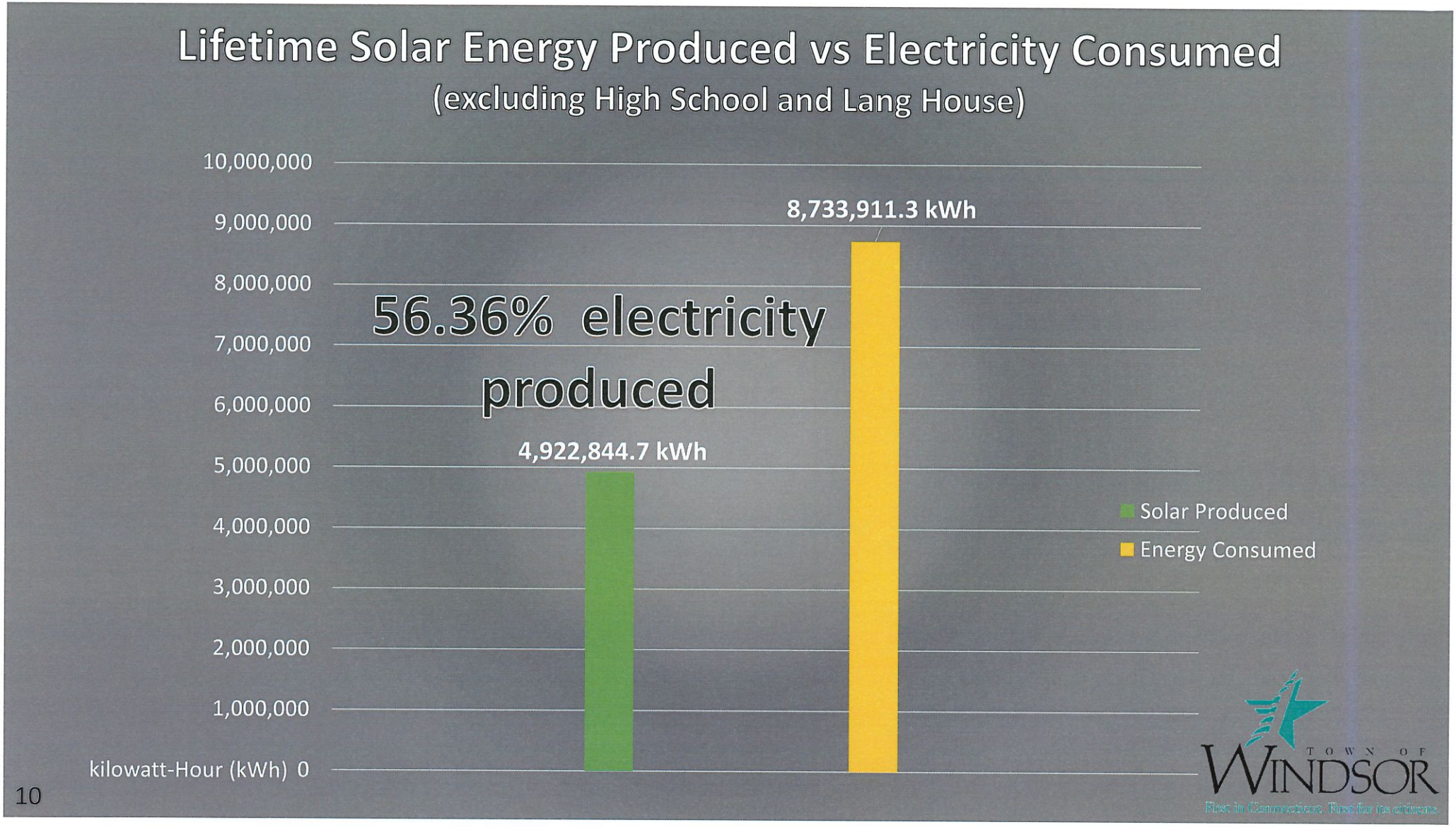
Solar Photovoltaic Systems for the Town of Windsor

Solar photovoltaic systems convert sunlight into direct current electricity. Solar photovoltaic systems have been installed at the following locations in 2014 and 2015;

- Windsor High School *(small demonstration system installed in 2011)*
- LP Wilson Community Center
- JFK Elementary School
- Oliver Ellsworth Elementary School
- 330 Windsor Community Center
- Windsor Volunteer Ambulance
- Northwest Park – Lang House

Total System Size 800.8KW


Lifetime Solar Energy Produced vs Electricity Consumed
(excluding High School and Lang House)
10,000,000
9,000,000
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
kilowatt-Hour (kWh) 0
8,733,911.3 kWh
56.36% electricity produced
4,922,844.7 kWh
Solar Produced
Energy Consumed
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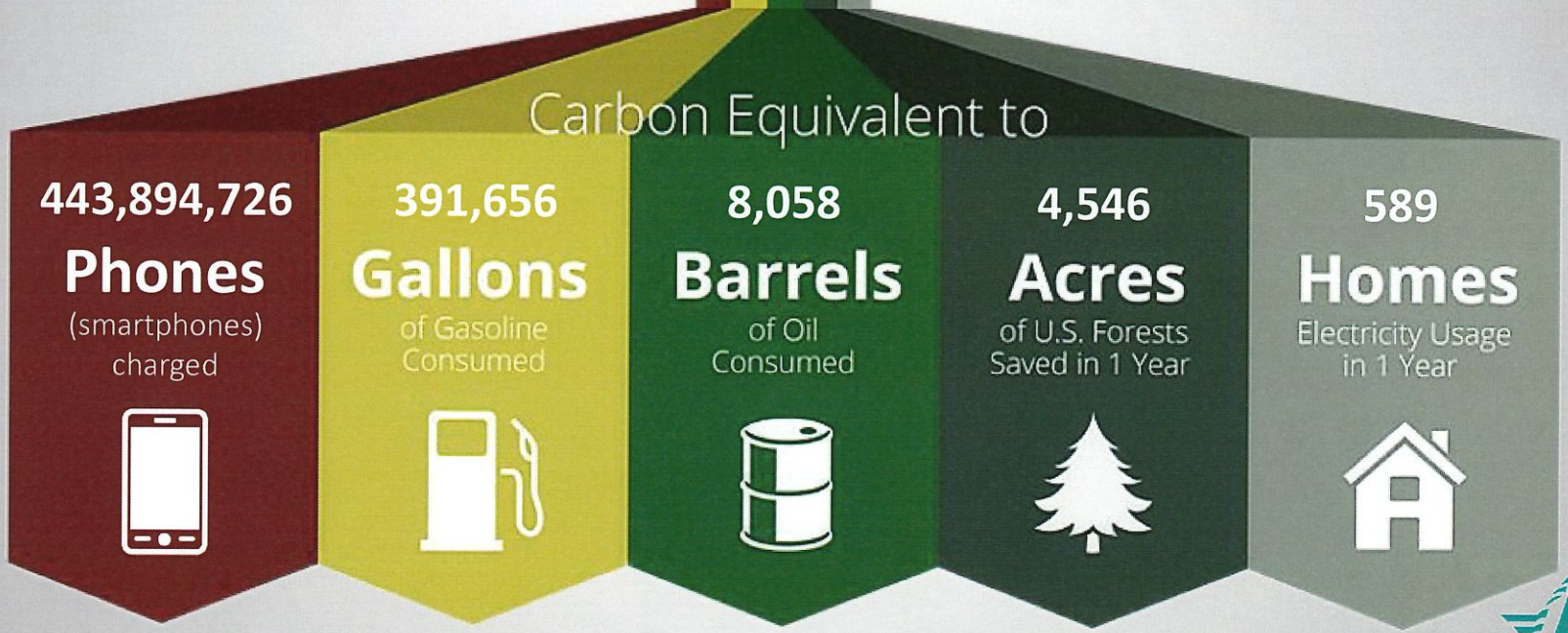
Energy created from solar FY 2014 – FY 2020 for Windsor, CT

4,922,844 kWh



FUN FACT: How many new housing units built in town over the same period of time?

397 housing units built between 2014 – June 2020 our energy reduction offset one year of electricity to 397 of those units

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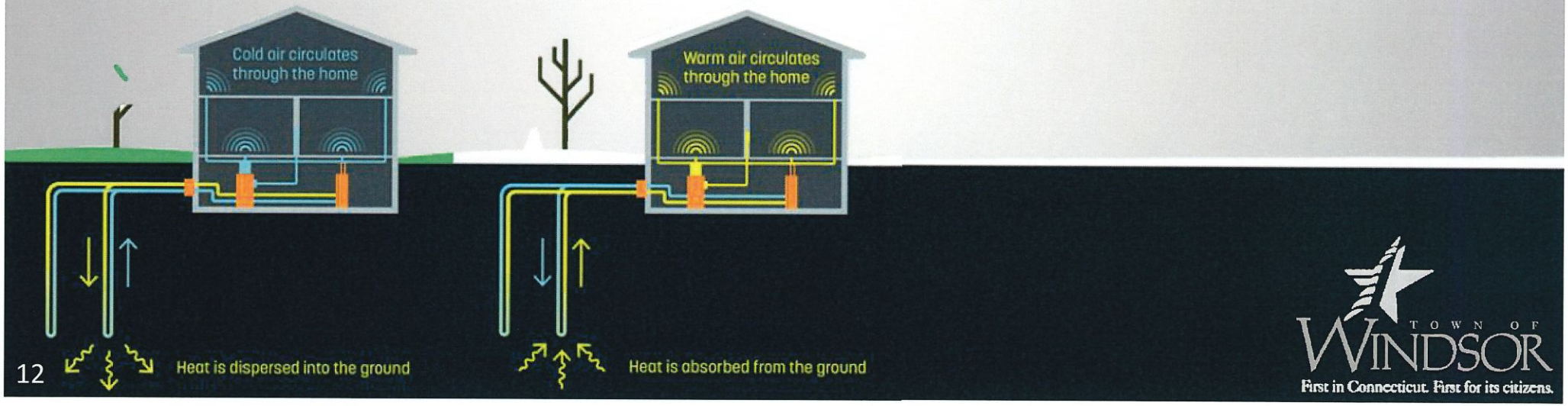
Geothermal Systems in Windsor

Geothermal energy is heat derived underground. Water and/or steam carry the geothermal energy to the surface. Geothermal energy can be used for heating and cooling purposes or be harnessed to generate clean electricity.

- Installed in 2010 at the Wilson Public Library
- Installed in 2011 at the Nature Center at Northwest Park



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Solar Photovoltaic Systems for Residential & Commercial

Solar photovoltaic systems have been installed throughout the town on both residential and commercial properties between FY 2005 and FY 2020;

- There are currently (715) residential properties that have solar installed
  - This is the equivalent to 9,738.30 kWh
- There are currently (17) commercial properties that have solar installed
  - This is the equivalent to 1,266,182 kWh

EV Charging Station

- In August of 2020 the Town Council approved funding for an Electric Vehicle (EV) Charging Station that will be located at the corner of Broad Street and Maple Street in the Town-owned parking lot.
- Installation is expected to begin once the Farmers Market ends in mid-October.
- This is a duel-port charging station.
- The Town Council voted that there be no user fee trough July 1, 2021 as a trial period.

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Light Bulb Exchange Program

There have been (2) Light Bulb Exchange Programs for residents free of charge.

All costs were supported by Bright Ideas Grants that the Town of Windsor received as a result in its participation in the Clean Energy Communities program.

- December 2015
  - 4,000 bulbs exchanged for LED's
- November 2016
  - 5,988 bulbs exchanged for LED's
- These two programs allowed for 1,997 residents to participate

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C-PACE

C-PACE (Commercial Property Assessed Clean Energy) is an innovative financing solution that makes green energy upgrades accessible and affordable for building owners across Connecticut.

C-PACE, administered by Connecticut Green Bank, offers 100% financing for a wide range of energy improvements, so building owners can modernize their buildings and lower their energy costs.

- Currently there are (2) C-PACE accounts on file with the Town of Windsor with a third account that has not yet been finalized.

- Owners repay CT Green Bank through annual assessment on tax bill

TOWN OF
Enfield
CONNECTICUT

COMPREHENSIVE ENERGY STRATEGY

Endorsed by the Town Council on December 1, 2014

Prepared by the Enfield Clean Energy Committee

Supported by Peregrine Energy Group, Inc.
with funds received from the State of Connecticut

Table of Contents

Endorsement Resolution by Enfield Town Council

WHEREAS, the Town Council of the Town of Enfield is dedicated to reducing energy use and increasing operational efficiency in its activities; and

WHEREAS, the Town Council encourages residents and businesses to become smarter energy users and incorporate use-reduction strategies into their operational activities; and

WHEREAS, the Town Council is dedicated to a structured energy use and reduction strategy advocated by the Enfield Clean Energy Committee;

NOW, THEREFORE BE IT RESOLVED, the Town Council of the Town of Enfield hereby formally endorses the Comprehensive Energy Strategy prepared by the Clean Energy Committee with support from Peregrine Energy Group, Inc., dated November 17, 2014.

Unanimously approved on December 1, 2014

Acknowledgements

The following groups and people worked to produce this energy strategy for the Town of Enfield and deserve recognition for their efforts:

Enfield Clean Energy Committee

http://www.enfieldcleanenergy.net

- Valerie Bak
- Ann Marie Dooley
- Melissa Everett, Ph.D., Chair
- Suzanne Giwoyna
- Dan Glogowski
- Doug Lombardi
- Greg Mark

Town of Enfield

http://www.enfield-ct.gov

- Tom Arnone, Town Council Liaison
- Donna Szewczak, Town Council Liaison
- Joel Cox, Staff Liaison
- Derrik M. Kennedy, Assistant Town Manager

Peregrine Energy Group, inc.

2 Oliver St, Boston, MA 02109
(617) 367-0777
http://www.peregrinegroup.com
Steven Weisman, Vice President, Energy Management Services

Overview

Today, energy costs are a significant budget item for many households and businesses, as they are for the Town of Enfield. This Comprehensive Energy Strategy has been developed by the Enfield Clean Energy Committee (ECEC) to encourage and assist the Town of Enfield to formally adopt policies and practices that reduce energy consumption and increase the use of clean renewable energy sources in municipal operations to the extent practical; and, further, to take action that facilitates increased energy efficiency and the use of renewable energy by Town residents and local businesses. The Strategy is divided into three separate sections, Municipal, Residential, and Commercial/Institutional. The Municipal Strategy is the most detailed of the three for a number of reasons: First, the ECEC has access to more detailed information about energy consumption for municipal operations than it would have for all residences and all businesses. Second, there is consensus that reducing energy expense is a shared objective for municipal operations. And third, there is more information available about opportunities and needs in Town facilities.

The Strategy targets the five-year period from 2015 – 2019, providing the most detail for the first two years. As we describe below, ECEC believes that focused action by Town government in this arena is critical to broad Town-wide success. We hope a commitment to this path by Town government can motivate near-term action in all sectors, while encouraging long-term planning and adoption of emerging opportunities. This will help ensure that Enfield thrives as an efficient, secure and sustainable community.

About the Enfield Clean Energy Committee

The Enfield Clean Energy Committee is composed of citizen volunteers appointed by the Town and supported by Town staff and representatives of Town Council. The Committee's mission is to support and encourage decisions that increase energy efficiency and use of renewables Town-wide, by Town residents and businesses, as well as in Town and school operations. In 2014, the ECEC began this initiative to encourage and assist municipal government to achieve immediate and long-term energy savings and increase its use of alternative and ideally renewable, sources of energy. It also wants Town government to be a resource to Town residents, businesses, and other organizations to help them adopt clean energy strategies, such as increased efficiency and use of energy resources to minimize greenhouse gas emissions. The Committee has been assisted by Peregrine Energy Group, Inc., a consulting firm specializing in municipal energy management solutions, that was competitively selected by the Town in Spring 2014 and engaged using a $15,000 Bright Ideas grant from the State of Connecticut, earned by the volunteer activities of the Enfield Clean Energy Committee. Peregrine attended ECEC meetings, did background research and walk-through analysis of Town buildings, prepared reports for Committee review, and facilitated discussion and decision making by the Committee.

A Sustainable Energy Vision for Enfield

The Enfield Energy Strategy is built on a four-point vision for our community:

- We can achieve town-wide cost savings and greenhouse-gas emissions reduction through an integrated strategy of conservation, energy-efficiency and the use of renewable energy.

- The Town and schools must lead by example in day-to-day operations, demonstrating best practices to the public and business community while generating savings for taxpayers every day.
- Plans need to be developed and put in play to ensure the continued provision of vital services in the event of energy supply disruptions, through the combination of renewable energy supply, high-efficiency backup power and energy storage, including micro-grids, and adoption of best practices in managing energy demand and grid interconnection.
- The Town, supported by the Clean Energy Committee, will provide ongoing, high-quality education about energy issues and options in the schools and to the public, building an energy-smart community with educated consumers and voters who understand the tools and tactics that contribute to a clean, efficient energy future.

This Energy Strategy provides a broad frame work to allow flexibility in rapidly changing circumstances. We developed our vision and approaches to achieving it, to guide the Town's management of energy resources through policy, infrastructure planning, government operations, Town services and public educational programming. The Energy Strategy provides the back bone for more detailed planning and ongoing action by town staff and the Committee, guided by Town Council. It provides a concrete path to advance a Town commitment to a clean, secure, affordable energy future.

Municipal Energy Strategy

Introduction

The Clean Energy Committee recommends that Town Council adopt and embrace the following goals and strategies to reduce greenhouse gas emissions associated with energy use by Town operations, including buildings and other facilities, street lighting, and transportation.

Overall, we suggest that Town Council mandate policies and practices that:

- Reduce energy consumption whenever practical without interfering with satisfying the Town's responsibilities and providing a comfortable work environment for employees
- Invest in more energy-efficient systems, equipment, and technology whenever it is cost-effective or if end-of-life equipment must be replaced
- Favor life cycle cost, including lifetime energy and maintenance expense, as a criteria in purchasing, rather than first cost
- Consider options for municipal operations to increase the use of energy sources that do not require combustion of conventional carbon based fuels nor result in greenhouse gas emissions.

The result of these policies and practices will not only be a cleaner environment, but also cost savings for taxpayers and better working condition for employees and students.

Further, we believe that the Town and Board of Education, by pursuing this course of action and publicizing its goals, strategies, and accomplishments, can lead by example and influence the actions of local residents and businesses.

Baseline for the Municipal Energy Strategy: Current Energy Use

Any plan of action involves establishing goals and strategies to achieve the objectives we have established for ourselves. In this case, with reduction of greenhouse gas emissions in addition to cost savings as the goals, we have selected two primary approaches: 1) reducing our use of energy overall and 2) make greater use of energy sources that do not create additional greenhouse gas emissions.

The best goals are quantitative. They allow us to measure our success over time by comparing where we are now to where we started when we set our goal. This point where we began our efforts is generally called the "baseline." We can select either of two metrics for our baseline: energy use or energy expense. We consider both of these in this analysis and both are important. While there are things we can and should do to influence the price we pay for energy, such as purchase in bulk, shop around and change suppliers, or use alternative fuel sources, prices are generally set outside of our community. On the other hand, Town government policies and practices can have a significant immediate and long-term effect on the amount of energy consumed to accomplish a specified amount of work (e.g. keep us comfortable in buildings, ensure that we have fresh air in classrooms, illuminate our streets at night).Therefore, the focus of our energy strategy is primarily on energy use.

The Town presently uses electricity, natural gas, fuel oil, gasoline, and diesel fuel as its energy sources, all of which are primarily carbon-based and contribute to greenhouse gas emissions. Non-carbon based energy sources used in Enfield's energy supply, generally in the mix of electricity received from Connecticut Light and Power, are nuclear power, solar-generated electricity (known as photovoltaic or PV power), hydropower generated by turning an electric turbine with moving water such as a river, and wind power which is generated by turbines that turn in the wind to generate electricity.

Other non-carbon energy sources are solar generated hot water (known as solar thermal);geothermal energy which is extracted from the ground or from groundwater using water or some other medium as a heat exchanger; air source heat pumps; and sustainably sourced biofuels including combustible pellets and natural gas produced by anaerobic digestion of biomass. Of all of these non-carbon sources, solar energy is the most generally available for use in Enfield: PV and thermal systems can be placed on structurally suitable, south facing roofs; PV systems can also be ground-mounted as renewable energy farms. To date, there has been little or no solar energy use in municipal operations.

Enfield's municipal energy use baseline is the amount of energy in native units (i.e. therms of natural gas; gallons of fuel oil, propane, diesel fuel, or unleaded gasoline; and kilowatt hours of electricity) the Town used for buildings, street lighting, and transportation in a baseline year. For this plan, the Clean Energy Committee has selected Fiscal year 2013, which began July 1, 2012 and ended June 30, 2013, as the Town's baseline year. This is the most recent year for which the Town had complete information for all energy sources when the ECEC began this initiative.

To make it easier to compare the use of energy for different purposes by the Town, Peregrine converted energy use from native units (i.e. kWh of electricity, CCF or therms of natural gas, gallons of fuel oil, and gallons of unleaded gasoline and diesel fuel) that energy is sold in to an equivalent scale based on heat value of the source (i.e. British thermal units) that allows the energy value of different energy types to be combined.[1]

- Energy use in buildings, based on information provided to Peregrine, was13,532,951 kWhof electricity (42,521 MMBtus), 608,130 CCF or therms of natural gas (62,455 MMBtus), and 9,651 gallons of fuel oil (1,338 MMBtus). Building energy use, including wastewater treatment, totals 106,314 MMBtus.

- Streetlights accounted for 2,228,627 kWh of electricity (7,604 MMBtus).

- Vehicles consumed126,536gallons of unleaded gasoline (15,721MMButus) and 119,182 gallons of diesel fuel (16,291MMBtus), for a total of 32,012MMBtus. [Note that vehicle information is for calendar year 2013.]

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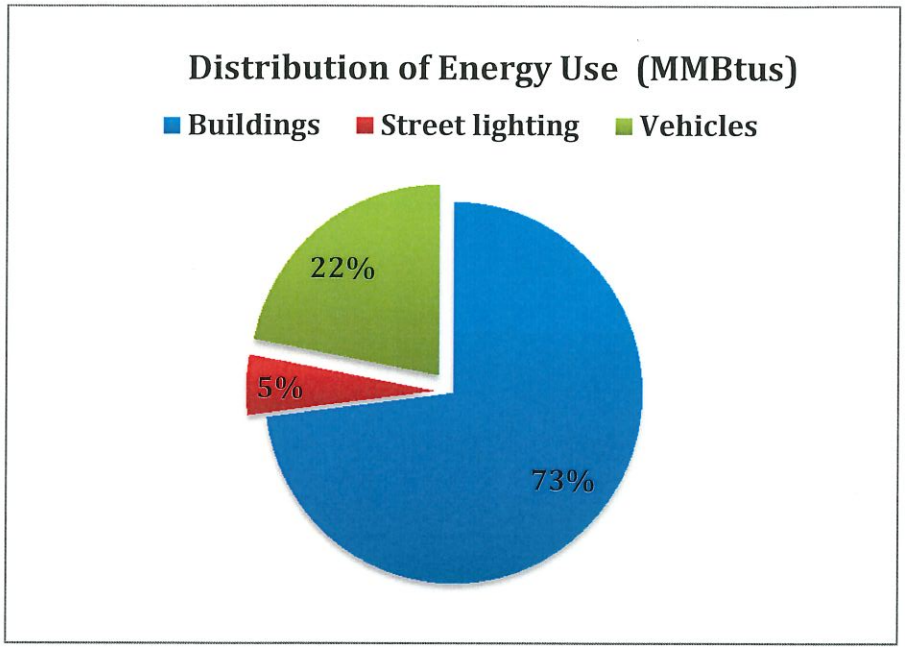
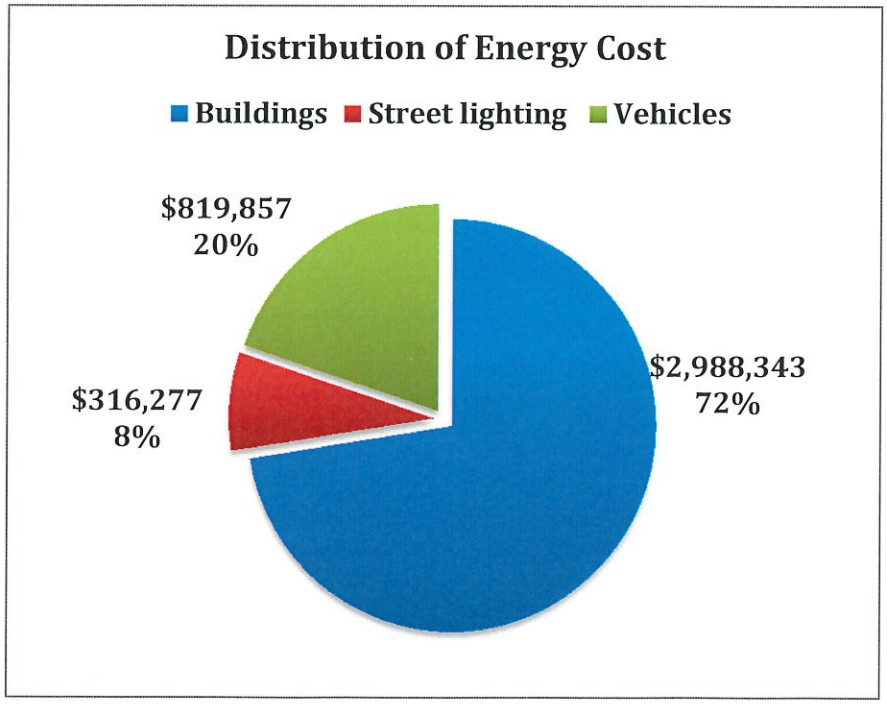
[1]Conversion factors from native units to British thermal units (Btus):
- A kWh or kilowatt hour of electricity equals 3412 Btus;
- A CCF or therm of natural gas equals 102,700 Btus, while a gallon of #2 fuel oil equals 138,690 Btus. This means that there is more heat value in a gallon of fuel oil than a therm of natural gas
- A gallon of unleaded gasoline equals 124,238 Btus, while a gallon of diesel fuel equals 138,690 Btus. This means that there is more heat value in diesel fuel per gallon than unleaded gasoline.

The percentage distribution of Town energy use, on a BTU basis, for buildings, vehicles, and street lighting is summarized in the following chart:



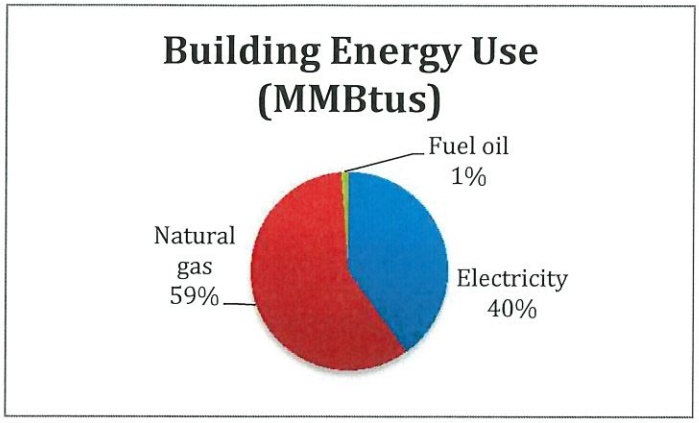
Compare this with the distribution of energy cost for the same end uses:

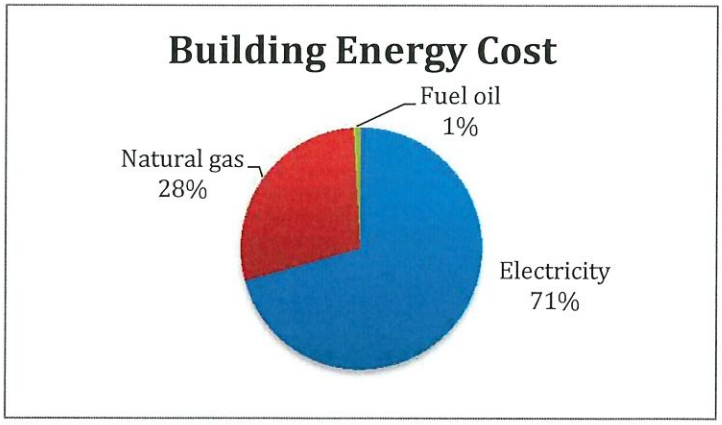


Achieving Energy Objectives in Town and School Buildings

Facility Energy Use and Cost

While natural gas delivers the majority of energy consumed in buildings on an MMBtu basis, electricity is the major expense. Electricity efficiency improvements will yield the greatest economic benefit.





Benchmarking the performance of Enfield facilities

Most of Enfield's public buildings were constructed in the middle of the 20th century, at a time of limited concern about energy efficient construction. In general, Town and school buildings have older equipment for lighting, cooling, heating, and other needs, resulting in higher energy use and expense.

The Town engaged Peregrine Energy Group in Spring 2014 to support the planning effort and conduct a "walk-through" analysis of buildings owned by the Town of Enfield and Enfield Schools and broadly assess them for energy-efficiency and renewable energy opportunities. Peregrine considered the natural energy-intensiveness of the activities in each building. They also considered building use patterns, hours of operation, and temperature settings. Peregrine benchmarked the relative performance of Enfield buildings compared to each other and to similarly purposed buildings in other communities with energy efficient equipment, building envelope, and usage patterns. For the

buildings comparison, Peregrine looked at energy use in kBtus (thousands of Btus) per square foot of building area. This shows the relative energy intensiveness of different buildings. Energy engineers call this the Energy Use Index or EUI. Electricity and heating fuel use are presented separately and then combined to look at the total building energy use. The following table, produced by Peregrine, includes provides a color key that shows where the greatest potentials for energy use reduction are likely to be.

TABLE: ENERGY USE BY ENFIELD BUILDINGS

	Building	SF	Electricity		Gas		Oil		EUI
			kWh	kBtu/SF	Therm	kBtu/SF	Gallons	kBtu/SF	kBtu/SF
Town Buildings	Emergency Medical Services	2,371	71,000	102	200	8	-	-	111
	Enfield Waste Water Control Facility	12,000	3,049,000	867	-	-	-	-	867
	Enfield Senior Center		320,000	NA	9,500	NA	-	NA	NA
	Pearl Street Library	4,982	39,000	27	2,300	46	-	-	73
	Central Library	18,244	284,000	53	-	-	4,380	34	87
	Angelo Lamagna Activity Center	15,000	242,000	55	12,100	81	-	-	136
	Enfield Town Hall	22,850	680,000	102	14,300	63	-	-	164
	Department of Public Works	29,850	326,000	37	16,700	56	-	-	93
	Enfield Police Department	22,358	657,000	100	11,000	49	-	-	149
	Adult Day Care	4,200	69,000	56	-	-	5,030	170	226
	Family Resource Center	4,865	328,000	230	1,800	37	-	-	267
	Village Center of Thompsonville	20,223	129,000	22	11,000	54	-	-	76
	Buildings and Grounds	10,800	59,000	19	5,500	51	600	8	77
School Buildings	Enfield High School	186,026	1,697,000	31	97,100	52	-	-	83
	Enrico Fermi High School	202,400	1,897,000	32	90,700	45	-	-	77
	JFK Middle School	157,152	1,097,000	24	102,900	65	-	-	89
	Eli Whitney School	58,633	266,000	15	27,100	46	-	-	62
	Hazardville Memorial School	54,316	298,000	19	49,200	91	-	-	109
	Nathan Hale School	46,295	285,000	21	30,300	65	-	-	86
	Henry Barnard School	70,182	503,000	24	38,500	55	-	-	79
	Edgar Parkman School	60,327	324,000	18	23,000	38	-	-	56
	Prudence Crandall School	60,417	362,000	20	34,500	57	-	-	78
	Enfield Street School	48,439	167,000	12	5,400	11	-	-	23
	Thomas Alcorn School	53,950	378,000	24	25,100	47	-	-	70
	Harriet Beecher Stowe School	49,234	6,000	0	-	-	-	-	0

Opportunity for Reduction

- High Potential
- Good Potential
- Moderate Potential
- Less Potential
- Unclear: missing or suspect data

The table shows that there are many buildings that have significant savings potential, determined based o on Peregrine's direct observation of equipment being used and from discussions with building staff about operations and maintenance practices, and based on the relative energy performance of Enfield buildings compared to what Peregrine has see in other communities,

The EUI scores for buildings in the table shows that different buildings in Enfield have different levels of energy intensiveness. Sometimes these relative differences are due to the purpose for which the building is used. For example, the Wastewater Control Facility is the largest energy user and, by far, the most energy intensive. This is because wastewater treatment is an industrial process that is, by its nature, a big energy user. The Town is embarking on a Wastewater Facility renovation that should result in significant energy use reductions.

But other times, these different scores for levels of energy intensiveness reflect differences in building efficiency that can be adjusted by a range of strategies. Among the causes of these

differences and where changes can be made are hours of operation, temperatures maintained for heating and cooling, and efficiency of equipment and infrastructure. Town Hall is particularly energy intensive, perhaps in part due to the IT server being hosted there and the cooling requirements this creates or perhaps due to extensive evening use. Also, different schools vary significantly in their intensiveness of energy use. Peregrine believes that most schools use more energy than they could, with some schools appearing to be particularly inefficient.

Peregrine has advised the ECEC that a goal of 20% reduction[2] in building energy use is realistic and achievable with commitment and high-quality technical guidance. Benefits created for the Town would include saving money, improving occupant health and comfort, increasing building control, and reducing repairs. Three investment strategies were recommended to achieve these benefits:

- Immediately and continuously pursue low-cost and no-cost energy conservation measures that can be easily implemented, such as controlling lights, managing building schedules and temperatures, and installing weatherization improvements;
- Over the next two years, plan for, fund, and complete efficiency upgrades to many pieces of energy equipment, as well as buildings themselves, resulting in a large combined reduction in consumption and other related benefits; and
- Going forward, whenever replacing major energy consuming equipment at the end of its design life, invest in the most energy-efficient alternative possible.

Goals and Strategies

To translate this vision into measurable results, a series of goals were set for Town operations, and strategies for achieving them were identified.

Goal #1: Reduce energy use in Town and school buildings by 20% within five years.

Using the energy baseline for FY 2013 as a starting point, the Town can reduce the total energy requirement for Town and school buildings using a variety of strategies. In doing so, the Town will not compromise the quality of service it provides and will, in fact, achieve energy and cost savings while:

- Upgrading and replacing older building energy infrastructure and equipment
- Increasing the reliability of building systems and reducing the threat of system failures
- Lowering repair and maintenance costs
- Improving occupant comfort

Strategy 1.1: Confirm the potential for energy use reduction in current operations and pursue approaches to achieve that potential

Confirming the potential for energy use reduction involves both determining what the technical potential is (i.e. is there technology available for this purpose) and evaluate that potential in light of future plans for buildings (staying open indefinitely/closed soon/use changing/unknown) and financial capabilities (availability of capital funds, utility incentives, alternative financing strategies, etc.).

[2] Compared to baseline year of July 1, 2012 through June 30, 2013.

Actions required:

1. Evaluate performance of all buildings
2. Confirm the 10 year plans for each building to ensure investments are aligned with future use
3. Identify opportunities for energy reduction and analyze the economics of changes in terms of costs and savings achieved
   - improvements to operations and scheduling
   - replacement of equipment with more energy efficient alternatives
   - improved maintenance practices
4. Evaluate alternative approaches to financing the energy reduction initiatives and weigh the merits of each in terms of cost, savings, and other benefits over time
   - Use of incentives and services from Connecticut Light and Power and Energize-CT
   - Replacing failing equipment with the most efficient possible upgrades
   - Financing projects proactively through operating budgets and CIP process
   - Performance contracting
5. Establish a detailed plan for proceeding with each project
   - Assign responsibilities
   - Confirm budget
   - Establish a timeline
   - Agree on performance indicators
   - Implement
   - Commission new equipment installations as appropriate
6. Measure and report regularly on progress and adjust approach as needed to optimize results

Current status:

As noted earlier, the Town secured Peregrine Energy Group's services in Spring 2014 to develop an Opportunities Assessment for Energy Reduction in Town and School Buildings. Peregrine completed a high-level performance evaluation of all buildings, which is included above in the baseline discussion.

With respect to the Town's current ten year plans, near term plans for buildings include:

- The combination of Enfield High School and Enrico Fermi High School into a single modernized and expanded facility at Enfield High School. Peregrine recommends that no improvements be made at Fermi until the future use of the school is determined. While there are certainly opportunities for energy reduction long term, given the building's age and construction, any changes to energy systems should be driven by the ultimate needs of the Town. In the meantime, planning should begin for how that building will be maintained and operated, in terms of energy use, until a decision about its final disposition is finalized. Empty buildings need some space conditioning to avoid their deterioration and the emergence of a mold problem. On the other hand, the Town may not want to run an empty building at the same cost it had when it was occupied.

- A planned Wastewater Facility renovation. State-of-the-art energy improvements should be integrated into the Wastewater Facility renovation project, removing the need for a separate energy reduction program for that building.

Peregrine found that there are significant opportunities for energy savings across Enfield's building portfolio. Excluding, for the most part, the energy use at Enfield High School, Fermi High School, and the wastewater facility, they identified opportunities to reduce energy consumption in buildings by over20%.Closure of Fermi High School after the high school consolidation would result in over 5% in additional reductions.

Peregrine proposed a three-pronged strategy for energy use reduction:

- Pursuing relatively low cost and no cost improvements to buildings and operations ("Priority 1"),
- Investing in energy efficient technology that would pay for themselves relatively quickly ("Priority 2"), and
- Replacing old and end-of-life building equipment and systems with state of the art systems that would also create some energy savings ("Priority 3").

The following table summarizes the impact of energy reductions suggested by Peregrine by building. A Report summarizing Peregrine's findings is attached to this plan.

SAVINGS OPPORTUNITIES BY BUILDING – PRIORITIES 1, 2, AND 3

Priority 1 - Building Summary

Building	Approximate Implementation Cost	Utility Incentive Available	Potential Utility Savings				Annual Cost Avoidance	Baseline EUI kBtu/sf	Projected EUI kBtu/sf	Overall Savings	Simple Payback Yr
			Demand kW	Electric kWh/yr	Gas Therm/yr	Oil Gal/yr					
Enfield High School	$0	TBD	(1,100)	180,000	31,100	-	$61,200	83	63	24.0%	-
Enrico Fermi High School	$0	TBD	-	-	-	-	$0	77	77	0.0%	NA
JFK Middle School	$289,500	TBD	400	192,400	12,100	-	$42,300	89	77	13.3%	6.8
Henry Barnard School	$23,000	TBD	-	77,000	8,000	-	$20,300	79	64	19.1%	1.1
Prudence Crandall School	$78,250	TBD	100	48,600	3,900	-	$11,600	78	68	11.9%	6.7
Enfield Street School	$54,500	TBD	50	24,100	1,100	-	$4,800	62	58	6.4%	11.4
Nathan Hale School	$89,000	TBD	110	55,000	5,700	-	$14,500	86	70	18.9%	6.1
Hazardville Memorial School	$95,000	TBD	110	56,000	6,700	-	$15,700	109	93	14.5%	6.1
Adult Day Care	$7,500	TBD	32	10,500	-	230	$2,500	226	210	7.2%	3.0
Family Resource Center	$5,000	TBD	3	9,000	480	-	$1,800	94	78	17.1%	2.8
Angelo Lamagna Activity Center	$25,250	TBD	21	9,600	200	-	$1,690	136	132	2.6%	14.9
Department of Public Works	$85,000	TBD	214	80,400	(500)	-	$11,500	93	86	8.1%	7.4
Enfield Police Department	$28,250	TBD	-	15,400	800	-	$3,300	149	143	4.0%	8.6
Enfield Senior Center	$20,500	TBD	27	18,500	-	-	$2,800	102	118	-15.5%	7.3
Enfield Town Hall	$26,000	TBD	515	357,000	-	-	$53,500	164	111	32.5%	0.5
Total	*$826,750*	*$0*	*482*	*1,133,500*	*69,580*	*230*	*$247,490*	*88*	*77*	*13.0%*	*3.3*

Priority 2 - Building Summary

Building	Approximate Implementation Cost	Utility Incentive Available	Potential Utility Savings				Annual Cost Avoidance	Baseline EUI kBtu/sf	Projected EUI kBtu/sf	Overall Savings	Simple Payback Yr
			Demand kW	Electric kWh/yr	Gas Therm/yr	Oil Gal/yr					
Enfield High School	$0	TBD	-	-	-	-	$0	63	63	0.0%	NA
Enrico Fermi High School	$0	TBD	-	-	-	-	$0	77	77	0.0%	NA
JFK Middle School	$181,000	TBD	10	90,000	900	-	$14,500	77	75	3.3%	12.5
Henry Barnard School	$25,000	TBD	-	15,000	800	-	$3,100	64	62	2.9%	8.1
Prudence Crandall School	$0	TBD	-	-	-	-	$0	68	68	0.0%	NA
Enfield Street School	$10,000	TBD	54	3,400	(100)	-	$400	58	58	0.1%	25.0
Nathan Hale School	$5,000	TBD	-	4,000	(100)	-	$500	70	70	0.1%	10.0
Hazardville Memorial School	$50,000	TBD	100	7,000	-	-	$1,000	93	93	0.5%	50.0
Adult Day Care	$56,000	TBD	-	-	(6,200)	4,900	$10,300	210	192	8.6%	5.4
Family Resource Center	$0	TBD	-	-	-	-	$0	78	78	0.0%	NA
Angelo Lamagna Activity Center	$70,800	TBD	-	13,000	2,400	-	$4,600	132	113	14.3%	15.4
Department of Public Works	$107,500	TBD	-	29,000	1,100	-	$5,550	86	79	8.2%	19.4
Enfield Police Department	$0	TBD	-	-	-	-	$0	143	143	0.0%	NA
Enfield Senior Center	$207,000	TBD	33	47,000	1,300	-	$8,500	118	110	6.8%	24.4
Enfield Town Hall	$535,000	TBD	10	72,000	2,800	-	$13,800	111	88	20.8%	38.8
Total	*$1,247,300*	*$0*	*207*	*280,400*	*2,900*	*4,900*	*$62,250*	*77*	*76*	*1.7%*	*20.0*

Priority 3 - Building Summary

Building	Approximate Implementation Cost	Utility Incentive Available	Potential Utility Savings				Annual Cost Avoidance	Baseline EUI kBtu/sf	Projected EUI kBtu/sf	Overall Savings	Simple Payback Yr
			Demand kW	Electric kWh/yr	Gas Therm/yr	Oil Gal/yr					
Enfield High School	$0	TBD	-	-	-	-	$0	63	63	0.0%	NA
Enrico Fermi High School	$15,500,000	TBD	30	109,000	23,800	-	$42,500	77	63	17.7%	364.7
JFK Middle School	$1,400,000	TBD	-	11,000	6,000	-	$10,500	75	70	7.1%	133.3
Henry Barnard School	$800,000	TBD	3	2,000	3,300	-	$3,900	62	57	7.7%	205.1
Prudence Crandall School	$455,000	TBD	-	3,000	4,600	-	$5,600	68	61	11.4%	81.3
Enfield Street School	$750,000	TBD	(10)	(2,600)	4,300	-	$4,300	58	50	14.9%	174.4
Nathan Hale School	$640,000	TBD	-	-	5,500	-	$6,100	70	58	17.0%	104.9
Hazardville Memorial School	$1,400,000	TBD	-	(6,000)	14,000	-	$14,500	93	68	27.3%	96.6
Adult Day Care	$0	TBD	-	-	-	-	$0	192	193	-0.5%	NA
Family Resource Center	$0	TBD	-	-	-	-	$0	78	78	0.0%	NA
Angelo Lamagna Activity Center	$300,000	TBD	-	-	1,900	-	$2,100	113	101	11.2%	142.9
Department of Public Works	$20,000	TBD	-	-	800	-	$900	79	76	3.4%	22.2
Enfield Police Department	$75,000	TBD	-	-	1,600	-	$1,800	143	136	5.0%	41.7
Enfield Senior Center	$0	TBD	-	-	-	-	$0	110	110	0.0%	NA
Enfield Town Hall	$0	TBD	-	-	-	-	$0	88	88	0.0%	NA
Total	*$21,340,000*	*$0*	*23*	*116,400*	*67,800*	*-*	*$92,200*	*76*	*68*	*10.1%*	*231.5*

Priority 1, 2 and 3 - Building Summary

Building	Approximate Implementation Cost	Utility Incentive Available	Potential Utility Savings				Annual Cost Avoidance	Baseline EUI kBtu/sf	Projected EUI kBtu/sf	Overall Savings	Simple Payback Yr
			Demand kW	Electric kWh/yr	Gas Therm/yr	Oil Gal/yr					
Enfield High School	$0	TBD	(1,100)	180,000	31,100	-	$61,200	83	63	24.0%	-
Enrico Fermi High School	$15,500,000	TBD	30	109,000	23,800	-	$42,500	77	63	17.7%	364.7
JFK Middle School	$1,870,500	TBD	410	293,400	21,000	-	$67,300	89	70	22.1%	27.8
Henry Barnard School	$848,000	TBD	3	94,000	12,100	-	$27,300	79	57	27.5%	31.1
Prudence Crandall School	$533,250	TBD	100	51,600	8,500	-	$17,200	78	61	21.9%	31.0
Enfield Street School	$814,500	TBD	94	24,900	5,300	-	$9,500	62	50	20.4%	85.7
Nathan Hale School	$734,000	TBD	110	59,000	11,100	-	$21,100	86	58	32.8%	34.8
Hazardville Memorial School	$1,545,000	TBD	210	57,000	20,700	-	$31,200	109	68	38.1%	49.5
Adult Day Care	$63,500	TBD	32	10,500	(6,200)	5,130	$12,800	226	192	15.2%	5.0
Family Resource Center	$5,000	TBD	3	9,000	480	-	$1,800	94	78	17.1%	2.8
Angelo Lamagna Activity Center	$96,050	TBD	21	22,600	4,500	-	$8,390	136	101	25.9%	11.4
Department of Public Works	$492,500	TBD	214	109,400	1,400	-	$17,950	93	76	18.4%	27.4
Enfield Police Department	$48,250	TBD	-	15,400	2,400	-	$5,100	149	136	8.8%	9.5
Enfield Senior Center	$302,500	TBD	60	65,500	1,300	-	$11,300	102	84	17.3%	26.8
Enfield Town Hall	$561,000	TBD	525	429,000	2,800	-	$67,300	164	88	46.5%	8.3
Total	*$23,414,050*	*$0*	*712*	*1,530,300*	*140,280*	*5,130*	*$401,940*	*88*	*68*	*23.1%*	*58.3*

Strategy 1.2: Establish performance standards for new equipment purchases and for new building construction and major renovations

Reducing energy consumption by 20% over the next five years and sustaining and increasing those reductions beyond that will require that Town government and the Board of Education commit to a set of policies that ensure that future energy use is a criteria in purchasing and design decisions for buildings.

Actions:

1. Identify and implement policies to guide future purchases of equipment
   - Make life cycle energy use a criterion in product selection
   - Require that all new equipment meet a minimum energy standard (e.g. Energy Star)
   - Identify who is making buying decisions now and what their criteria are
   - Determine who will have authority to make future buying decisions and educate them as to the policies that have been adopted
   - Establish a mechanism for reporting and measuring adherence
2. Establish policies that govern energy performance of all new construction and major rehabilitation of buildings
   - Require that all new construction meets a documented and measurable performance standard (e.g. Energy Star, LEED, etc.)
   - Incorporate the performance standard in requirements documents for new construction
   - Engage an independent engineer to complete design reviews of all projects prior to construction
   - Engage a clerk of the works to oversee construction to ensure it is consistent with designs
   - Engage a commissioning agent to oversee building commissioning prior to acceptance and final signoff and payments

Current status:

The Town has not adopted formal policies regarding energy and new construction.

That being said, the design for the High School renovation is an example of savings that can be achieved by a forward-looking strategy and how building upgrades must be managed to preserve those savings. As a result of changes to state building codes and the advocacy of the Building Committee, the renovated High School incorporates technology that potentially will make it significantly more energy efficient than either of the two current high schools. On the other hand, the decision to include building-wide air conditioning capacity in the building creates the potential for the erosion of the energy reductions achieved. Effective energy management requires a combination of attention to equipment selection and operation. Putting appropriate schedules and controls in place to avoid unnecessary energy use will be critical to achieving the building's design potential.

Goal #2: Maximize the Town's cost-effective use of available renewable and non-greenhouse gas producing energy sources in Town and school buildings

As buildings are becoming more efficient, the Clean Energy Committee recommends that the Town investigate where and how renewable energy sources and particularly those sources that do not contribute to greenhouse gas emissions can be incorporated into energy supply strategies.

Strategy 2.1: Identify and pursue opportunities to incorporate renewable energy generation into the design of existing and future buildings

The Clean Energy Committee believes that the primary opportunities for using renewable energy sources in buildings are with solar electric and solar thermal technologies, ground-source heating and cooling, and recovery and use of methane generated by wastewater treatment.

Actions:

1. Inventory the availability of renewable energy sources to help supply the energy needs of individual buildings
2. Determine the feasibility of using the sources, including identifying any site constraints that might impact the appropriateness of using available sources and whether those constraints can be resolved (e.g. structural limitations to adding the weight of a solar system to a roof)
3. Where the project is feasible and constraints have a solution (e.g. increasing the structural capacity of a roof), evaluate the economics of adding the technology required to tap the renewable energy source
4. Identify funding sources for the project (e.g. grants, bond issues, developer financing and ownership with a power purchase agreement)
5. If the project is feasible and there is an acceptable financial path forward, develop a plan to proceed, as with any other construction project
6. For new construction, even if there are no funds available for including solar as part of the original construction, all buildings should as a minimum be designed as "solar ready."

Current status:

The Town has yet to complete a comprehensive inventory of renewable potential and opportunity. However, the design for the High School renovation project now in process did include elements that make that building "solar ready" in terms of having sufficient structural strength to carry solar panels and having considered where solar can be placed and including pathways for necessary electrical interconnections. Adding solar photovoltaic to the High School can be straightforwardly done using either ZREC financing from Connecticut Light and Power, or the Municipal Solar Lease program of Energize-CT. This should be done as soon as possible.

Strategy 2.2: Identify and pursue opportunities to develop renewable energy generation on Town land (but not associated with buildings or facilities) and then use the energy produced in Town buildings

It is possible to move electricity generated from renewable energy sources from a location where it can be produced to a location where it can be consumed. Transmission of this electricity uses the

electric distribution lines owned by CL&P, and interconnection procedures are regulated by the State. Many communities are capitalizing on the availability of municipally-owned brownfield sites within their boundaries (primarily capped former landfills) for repurposing as solar energy "farms." Most often, these farms are developed, owned, and operated by a private developer who sells the power produced to the community at an advantageous rate. Some communities have identified other excess property that is suitable for this purpose.

Actions:

1. Inventory potential locations for renewable energy generation to be sited and developed within the Town's boundaries
2. Consider other possible uses of the property under consideration to determine if there are other potential uses that are more attractive or create more value for the Town
3. Consider the technical feasibility of siting renewable energy generation at specific locations
4. Where renewable energy generation seems feasible and is potentially the best use for the site, engage in a public dialogue to gauge public opinion and particularly the perspectives of abutters and other nearby residents
5. If the project appears to be feasible and the site is acceptable to the community, proceed with identifying potential developers who would be interested in entering into a long-term ground lease and power purchase agreement with the Town

Current status:

To date, Enfield has taken no actions to pursue this strategy.

Financing Building Improvements

State and Utility Programs

Fortunately, in many cases where savings can be documented, there will be utility incentives available from CL&P. Connecticut's electric ratepayers have contributed surcharges into a fund that now provides financial assistance for municipalities (as well as homes and businesses) to improve their energy-efficiency and lock in long-term savings. Connecticut's Green Bank (the first in the nation) also provides well-designed financing programs with favorable terms for municipal and business energy upgrades. State and utility incentives can offset costs of most of the energy improvement priorities recommended by Peregrine, such as:

- High Efficiency Lighting
- HVAC Upgrades
- New automated building and HVAC controls
- Variable speed drives (VSDs) on motors fans and pumps
- High efficiency chillers, boilers, and furnaces
- High efficiency hot water heating systems
- Combustion and burner upgrades
- Water conservation
- Renewable energy systems

Also, with respect to renewables, Connecticut provides a leasing program for solar power systems on public buildings and schools, and an annual auction of financing known as ZRECs (Zero Emissions Renewable Energy Credits). A special funding program also supports micro-grid development, which might be able to support investment in energy upgrades for a cluster of buildings close together. As no-cost financing resources, these should be given priority to defray energy investments.

Local Capital Improvement Program

Unfortunately, these programs will not cover all of the costs for energy efficiency, renewable energy development, and replacement of major energy conversion equipment like boilers and chillers. Achieving the full, long-term savings potential by upgrading the Town's buildings will require significant investment. Building repairs and equipment replacement is inevitable over time, and funding these major improvements may require tapping the Town's CIP over a number of years. These improvements will need to compete with all other requests for capital, which could mean that savings from energy upgrades will come slowly. Pursuing these options in a piecemeal fashion means the Town will remain vulnerable to catastrophic equipment failures and rising repair costs.

Performance Contracting

An alternative, which the Town is exploring in detail, is to enter into an Energy Savings Performance Contract or "ESPC." The ESPC bundles together multiple projects into a single package and uses savings from efficiency improvements to pay for capital improvements. In such contracts, savings are guaranteed by the energy services company (or "ESCO") that does the work. By reinvesting guaranteed annual savings to pay for the project, the Town can reduce energy use and replace old and out-of-date equipment without raising taxes.

Enfield's Clean Energy Committee believes that the performance contract mechanism could be an excellent fit for the Town. This proven strategy has been and is currently being used by many Connecticut cities and towns, by the State of Connecticut, by the Federal government, and by others elsewhere in New York, New England, and across the country. Nationally, energy saving performance contracting is a decades-old, $4.1 billion industry. Since 1990, performance contracts have led to $40 billion in completed projects and $50 billion in savings for the building owners. They have provided 330,000 person-years of direct employment for engineers, technicians, finance and administrative professionals and others, while cutting CO^2emissions by 420 million tons.

Connecticut has recently kicked off its own statewide Energy Savings Performance Contracting program, developed by an inter-agency workgroup and run by CEFIA and DEEP. Performance contracting is available to school systems as well as municipal governments. The program's resources include a pre-qualified vendor list, technical support, financing, and standardized contracts to provide a repeatable, transparent process for towns and vendors alike. A well-managed performance contract will allow Enfield to capture energy savings, increase building comfort, and protect against maintenance crises, while making the best use of resources by bundling building upgrades together for focused professional attention.

The following Connecticut communities have or are currently using performance contracts: Bethel, Bolton, Bridgeport, Bristol, East Hartford, Fairfield, Farmington, Middletown, Milford, Naugatuck, New Britain, Norwalk, South Windsor, Stamford, Stratford, Waterbury, West Hartford, Windham.

Energy Savings Case Study[3]

The Town of Fairfield received the 2014 Power of Change Award (a public-private partnership between the state and three foundations) for Overall Excellence for its leadership in municipal building upgrades. The highest efficiency HVAC equipment was installed through a $7 million performance contract with Johnson Controls. Large buildings were equipped with dual fuel capability, lighting upgrades, and a fully automated computerized system for energy maintenance. Town employees were trained to operate the new equipment. Two new energy generation facilities were constructed - one producing 590kW and the other 50kw, through multiple means of alternative energy production. Adding to the town's carbon emissions reduction was a purchase of 20% green power through Renewable Energy Credits, and an improvement in recycling to achieve a 50% rate.

Through these measures, Fairfield was able to reduce electricity use by 22% and fuel oil consumption by 86% while cutting building maintenance costs 20%. As a result, the town's total heating bill (paid for by taxpayers) is now less than it was in 1996.

[3] Source: www.sustainablect.com, used with permission.

Achieving Energy Objectives for Town and School Vehicles

Baseline

During calendar year 2013, Town of Enfield vehicles used 126,536 gallons of unleaded gasoline and 119,182 gallons of diesel fuel. Vehicles accounted for 22% of Town energy use on an MMBtu basis and 20% of Town energy expense during this period. The distribution of this fuel use by department, with cost, is as follows:

Department/Division	Gas/Gallons	Total Cost/Gas	Dsl/Gallons	Total Cost/Dsl	Total Fuel Cost
B & G	12,843	$ 40,150	12,440	$ 38,489.44	$ 78,639
Building Code Enforcement	750	$ 2,345	0		$ 2,345
Community Dev. Block Grant	446	$ 1,404	0		$ 1,404
Custodial	899	$ 2,816	53	$ 164.73	$ 2,981
Dial-A-Ride	21,935	$ 68,540	0		$ 68,540
Emergency Management	252	$ 776	0		$ 776
Emergency Medical Services	1,677	$ 5,243	18,640	$ 57,654.82	$ 62,898
Engineering	0		0		
Equipment Maint. & Repair	805	$ 2,515	251	$ 776.88	$ 3,292
Highway Maintenance	2,866	$ 8,943	14,555	$ 45,043.34	$ 53,987
Information Technology	438	$ 1,369	0		$ 1,369
Magic Bus	11,426	$ 35,822	0		$ 35,822
Planning	28	$ 89	0		$ 89
Enfield PD	68,251	$ 213,277	55	$ 168.44	$ 213,446
Public Works Admin	756	$ 2,369	0		$ 2,369
Recreation Administration	121	$ 374	0		$ 374
Refuse Collection & Disposal	1,023	$ 3,191	63,231	$ 195,590.15	$ 198,781
WPC (DIESEL)	0		9,957	$ 30,796.71	$ 30,797
WPC (GAS)	2,020	$ 6,297	0		$ 6,297
TOTAL	**126,536**	**$ 451,172**	**119,182**	**$ 368,684**	**$ 819,856**

Opportunity Assessment

The Town of Enfield has both special purpose vehicles with limited opportunity for replacement with more efficient models, as well as a number of more-or-less general-purpose vehicles. Special purpose vehicles include Public Safety pursuit vehicles, snowplows, construction equipment, heavy trucks, street cleaning vehicles, etc. Many of these vehicles use diesel fuel.

While fuel-efficient alternatives are not available for some of these vehicles, their operating efficiency can generally increase through the adoption of energy efficient operating and maintenance practices.

Goals and Strategies

Goal #1: Reduce energy use by Town vehicles by at least 20% in five years

The Clean Energy Committee recommends that the Town make every effort to continuously improve the overall fuel efficiency of its vehicle fleet. We suggest three strategies to consider in pursuing this goal: adherence to proven energy efficient operations and maintenance practices and replacement of vehicles with more fuel-efficient models.

Strategy 1.1: Adopt operations and maintenance policies and practices that reduce fuel use

Driving habits, route selection, maintenance practices, and motor oil and tire choices all affect fuel efficiency.

Actions:

1. Acquire a fuel management system that tracks fuel use by vehicle and driver and review reports for patterns that indicate opportunities for improvements
2. Adopt maintenance procedures, in terms of when vehicles are serviced, what service they receive, and what supplies are used, that improve fuel efficiency and extend vehicle life
3. Provide training as appropriate for employees that drive Town-owned vehicles in energy-conscious driving habits
4. Develop policies to reduce vehicle idling and conserve fuel
5. Review vehicle routes for plowing, pick-up and drop-off of bus and van passengers, refuse pick-up etc. to determine if there are more efficient alternatives
6. Encourage contractors who provide transportation or other vehicular services to the Town to adopt practices and procedures that will reduce fuel use
7. Continue to monitor the fuel efficiency performance of all vehicles to identify further opportunities for improvements.

Current status:

Town-owned vehicles are managed and maintained by the Public Works department under the direction of the Town's Fleet Manager. Public Works provides centralized maintenance services for vehicles and maintains a central fuel depot where all Town vehicles get their unleaded gasoline or diesel fuel.

The Town has had a fuel management system for a number of years that was recently upgraded to FuelMaster, one of the leading products available, which has the capability for detailed reporting by department, fuel, vehicle, and by driver, if needed. The Town also employs a vehicle maintenance software package to track mileage and service of individual vehicles.

To date, there is no idling policy in place, though it has been the subject of discussion. So far, the Town has not included fuel efficiency as a criterion for selecting replacement vehicles, but should start using these considerations going forward.

Strategy 1.2: Replace vehicles with the most energy efficient models available to accomplish the purpose for which the vehicle is to be used.

Given tight municipal budgets, low first cost is often a criterion for vehicle purchase, and finding the most expeditious solution is a typical operating procedure for providing vehicles and transportation. When energy-inefficient police department pursuit vehicles are retired after some number of years, those that still run may be passed on at no cost to another department even though that department's driving needs may be very different. Similarly, large, less energy-efficient multi-task vehicles may be purchased when a sedan may do as well, just in case the occasion comes up when more space is needed.

Action:

1. Inventory vehicle needs and performance for all departments
2. Establish a plan for vehicle replacement based on vehicle age, performance, and number of annual vehicle miles

3. When the need arises to replace an existing vehicle or add a new one, evaluate what the vehicle requirements are and match those needs to the specifications of available vehicles
4. Purchase a replacement vehicle that meets that need that is as fuel efficient as possible

Current status:

To date, the Town has not taken a comprehensive approach to vehicle purchasing with an eye toward reducing fuel use.

Achieving Energy Objectives for Street Lighting

Streetlights

The Town of Enfield owns its streetlights, having purchased them from CL&P more than five years ago. There are 3,691 high-pressure sodium (HPS) cobra head style streetlights with wattages of 70W, 100W, 250W, and 400W. The majority of the lights are 70W. In addition, there are a total of 9270W decorative streetlights, two with double heads, in Hazardville and Thompsonville. These are HPS technology.

Streetlight use is typically not metered; consumption is calculated using an average number of hours of operation assumed for each month from sunset to sunrise that is multiplied by the wattage of individual lights. Total annual energy use for streetlights billed to Enfield in FY2014 was $316,277.

Streetlight maintenance is supervised by the Public Works department and contracted out to Siemens. The current contract has just been awarded and is for a single year with the option of two one-year extensions. The contract value is $61,500 annually plus additional charges for emergency costs.

Traffic signals

Traffic signals are owned and maintained by the Town. Each of these signals is metered. They are mostly incandescent technology. Eight local intersections are signaled with Town equipment, with a total of 31 sets of lights, all with multiple signals. There are additional blinking yellow signals, which are state-owned.

Goals and Strategies

Goal #1: Reduce energy use by streetlights by 50% over the next five years

The Town should apply its policy of replacing older equipment with more energy efficiency state-of-the-art technology to streetlights as well. CL&P has, in the last couple of years, adopted new rate structures that will apply to the latest light emitting diode (LED) streetlights. Like the current streetlight rates, these new rates are based on calculated consumption by streetlights of various wattages.

Strategy 1.1: Review the current streetlight inventory to identify lights that could be eliminated and locations where reduced lighting levels might be appropriate and desirable

Streetlight placement typically occurs in a gradual, organic way without an overall plan. Intersections at lit as are long stretches of roadway. Streetlights are included in new subdivisions and other developments and then ownership passes to the Town. Lighting levels are established with particular objectives in mind which may or may not still be appropriate. Changes in technology over time may not have been reflected in lighting designs. Technology available today may create opportunities for reassessment of what the requirements are for "effective" lighting.

Strategy 1.2: Convert all street and parking lot lighting owned by the Town to LED

Conversion of streetlights to state-of-the-art light emitting diode technology will reduce energy use by 50% on average. LED streetlights last more than twice as long as older high-pressure sodium technology, reducing maintenance expense. LED technology provides much more natural color rendition (which is an aid to law enforcement), and LED lighting can be configured to eliminate the shadowing effect that is common to HPS streetlights.

Goal #2: Convert all traffic signals to best available technology to achieve reductions

If the Town has any traffic signals that have not yet been converted to LED from incandescent, these conversions should be implemented as soon as possible. Savings from conversions from incandescent to LED are around 90% of energy use.

Residential Energy Strategy

Enfield's residential energy strategy supports improvements to existing homes and new construction with all forms of ownership and residents with all income levels. Enfield's housing stock includes owner-occupied detached homes and multi-unit condominiums, as well as a range of rental housing types. Households have a broad spectrum of incomes, with the majority middle income. The Enfield population is stable, but there is ongoing new home construction.

Benchmarking Residential Properties

Primary energy end-uses include heating, cooling, hot water, lighting, and various plug loads, including appliances. Energy use in Enfield residences is assumed to be typical of other Connecticut housing stock of comparable age and construction. Newer residential property is assumed to be more efficient by design than older properties due to evolution in building practices and codes to include more insulation and better windows and doors and due to the fact that heating and cooling equipment and appliances are newer and subject to increased government standards.

Opportunity Assessment

Energy-efficiency and renewable energy are equally important priorities. Opportunities for energy efficiency improvement include weatherization (wall and ceiling insulation and whole building air sealing), adding mechanical ventilation, replacing older heating systems with more energy efficient technology, replacing older cooling equipment with more energy efficient technology, temperature setbacks and scheduling through automated controls, improving hot water heaters and better managing hot water use, making lighting upgrades to more efficient technologies, and replacing older inefficient appliances with Energy Star products. Additional benefits of these actions, beyond energy cost reduction, are improved household comfort and health. Energize-CT, a state program supported by electric rate surcharges and operated in partnership with the local investor-owned utility, offers a range of economically priced energy efficiency programs and services to assist residential customers to use energy supplied as efficiently as possible. Special government-subsidized programs are also available from Community Action Agencies to assist income-eligible residents.

Renewable energy opportunities in residential properties are primarily the installation of solar photovoltaic (electricity generating) systems and solar thermal (hot water generating) systems on south facing roofs. Some biomass options also exist, such as self-feeding pellet stoves. Air-source heat pumps, also known as "ductless mini-splits," can greatly reduce fossil fuel use; ground-coupled heat pumps can also be cost effective in some situations. The economics of renewable energy systems for households are different from utility-generated power in that the entire system is purchased upfront and owned by the user; even when the systems are highly cost-effective over the long term, financing is an issue. Group purchasing programs and state-sponsored loans are beginning to make these purchases more economical.

Goals and Strategies

Existing homes

Goal #1: Assist at least 20% of households to achieve 20% energy reductions over five years

The Town and ECEC will develop an effective methodology for expanding household participation in energy upgrades, targeting residents of existing housing stock and assisting them to use programs, services, and methods, as appropriate to their ownership status to reduce energy consumption and expense.

Strategy 1: Make energy information and inspiration available to all residents on a regular basis.

Create a formal public outreach initiative that is organized as appropriate by market segments, such as owner-occupied single-family homes, tenants and landlords, condominiums, and low-income households.

Specific actions can include:

- Incorporate creative educational and social marketing strategies to help people understand energy-saving opportunities and inspire them to act. Use Challenge campaigns, Energy Expos, Town website, Town-sponsored events, newsletters, etc., and address resident groups such as homeowner and neighborhood associations.
- Promote websites such as Energizect.com, EPA.gov, Department of Energy's Energy Saver section
- Engage local vendors of energy products and services in events to make presentations.
- Engage community volunteers who already have installed energy-efficiency measures, solar or geothermal systems, heat pumps and other new technologies as "ambassadors" to answer questions and address concerns of prospective buyers.
- Collaborate with local non-governmental organizations engaged in energy outreach.

Strategy 2: Encourage residents to use existing resources for energy efficiency and track participation

1. Partner with utilities and agencies to bring certified auditors and technicians from established efficiency programs to Enfield's homes, and target groups with specific needs and opportunities.

    - **Owner-occupied homes:** Supplement direct outreach by service providers with locally initiated neighborhood, block-based, market channel outreach strategies, partnering with Home Energy Solutions contractors, civic associations and other membership organizations to engage households at a significant scale. Consider organizing a neighborhoods competition to spark interest in home energy audits throughout the neighborhoods in town.
    - **Tenants:** Develop specialized service packages for tenants based on steps they can take on their own with landlords on energy initiatives. Reach out to and educate larger landlords.
    - **Condominiums:** Approach condominium associations to identify opportunities and mitigate constraints for energy efficiency upgrades that benefit entire buildings as well as individual units. Bring educational presentations to condominium residents in a coordinated manner.
    - **Low-income residents:** Help publicize the Home Energy Solutions-Income Eligible (HES-IE) program of Energize-CT that provide free home assessments and energy-

saving services; collaborate with Neighborhood Services to bundle and integrate energy outreach with healthy home services such as asbestos and mold removal.

2. Supporting energy-efficiency upgrades in renovations by providing information through the building department when permits are issued. If possible, fast track those permits and inspections involving energy efficient upgrades.

3. Track and publicize how much and what has been done by Enfield residents by market segment to reduce their energy use.

Goal #2: Increase the number of solar installations in town by at least 50% per year

The ECEC had a successful Solarize Enfield campaign in 2013 and 2014, tripling the penetration of photovoltaic systems in the Town. As solar systems become more widespread, familiar with their appearance and public acceptance should grow, with early adopters being joined by "just plain folks".

Strategy 1: Evaluate success and challenges of Solarize Enfield 2013-14 and develop an annual outreach campaign incorporating lessons learned and new incentives.

Strategy 2: Integrate outreach for solar PV with complementary technologies that reduce fossil fuel consumption such as air source heat pumps.

There are electric-based heating and cooling technologies that can be cost effective alternatives to conventional fuels if the electricity required is generated from a renewable source. Integrating PV with such technologies can be attractive.

Strategy 3: Investigate and market cost-effective solar thermal technologies for dedicated outreach campaigns.

Solar thermal is widely in use in many countries and even other areas of the U.S. It was a growing technology here in the 1980's and 1990's until market changes caused vendors and suppliers to disappear. New technologies and vendors are bringing solar thermal back, but outreach is needed to bring consumers back to it.

Strategy 4: Address any zoning or regulatory barriers to PV installation

Examples include: working with the Planning and Zoning Commission to establish guidelines for virtual net metered solar installations on farms and the Historic District Commission to establish guidelines for renewable energy installation in the historic district.

New Construction

Goal #1: Have all new residences constructed in Enfield going forward qualify for ENERGY STAR status

In Connecticut, there have been **9,750** ENERGY STAR certified homes built to date. **432** ENERGY STAR certified homes have been built in 2014 thus far, and **361** ENERGY STAR certified homes were built in 2013. To earn the ENERGY STAR, a home must meet strict guidelines for energy efficiency set

by the U.S. Environmental Protection Agency (EPA). Homes achieve this level of performance through a complete package of building science measures including:

- A Complete Thermal Enclosure System – Comprehensive air sealing, properly installed insulation, and high-performance windows work together to enhance comfort, improve durability, reduce maintenance costs, and lower monthly utility bills.
- A Complete Heating and Cooling System – High-efficiency systems are engineered and installed to deliver more comfort, better moisture control, improved indoor air quality, quieter operation.
- A Complete Water Management System – A comprehensive package of best building practices and materials protects roofs, walls and foundations from water damage, provides added protection, and reduces the risk of indoor air quality problems.
- Energy-Efficient Lighting and Appliances – ENERGY STAR certified lighting, appliances, and fans are commonly installed throughout ENERGY STAR certified homes, helping to reduce monthly utility bills, while providing high-quality performance.

To ensure that a home meets ENERGY STAR guidelines, third–party verification by a certified Home Energy Rater (or equivalent) is required. This Rater works closely with the builder throughout the construction process to help determine the needed energy-saving equipment and construction techniques and conduct required on-site diagnostic testing and inspections to document that the home is eligible to earn the ENERGY STAR label.

Strategy 1: Identify who is building residential properties in Enfield, educate them about ENERGY STARhomes, and encourage them to join the program and follow Energy Star guidelines in new projects.

Strategy 2: Provide incentives such as accelerated and/or streamlined permitting, discounted or delayed permit fees, priority field inspections, priority with code processing, increased density allowance, and reduced grid hookup fees for ENERGY STAR certified homes.

Goal #2: Make all new construction "solar-ready"

Solar-ready homes have been built with roofs facing south, roof structures strong enough to accommodate the weight of solar equipment, and plans for wiring requirements of systems. Enfield can facilitate solar adoption in new construction by establishing solar-friendly zoning and design guidelines that are in line with community aesthetics and that require solar-readiness in new construction.

Resources for Financing Residential Energy Improvements

Small loan pilot: CL&P customers can borrow$1000-$3000, 0% interest for insulation, certain water heaters. Repayment is on electric bill. No credit check is required if electric bill has been paid on time.

Insulation and Appliances: (CL&P offers low-interest (2.99% to 6.99%) loans for measures recommended by Home Energy Solutions. $3000 to $25,000 loans for insulation, heating/ cooling systems, water heaters. Up to 20% for necessary non-energy improvements.

CT Housing Investment Fund Energy Conservation Loans: Low interest, income guidelines apply. Info: http://www.chif.org/page/energy-conservation-loan-program.

Smart–E: http://www.energizect.com/smartefinances many energy efficiency or renewable energy measures. Up to 20% of the borrowed amount can be used for health and safety upgrades (i.e. asbestos or lead remediation), roof repair, EnergyStar small appliances, or other related measures.

Cozy Home: This program has same rules as Smart-E, but designed for residents earning below 80% of Area Median Income. Details at http://hdf-ct.org/lending-products/cozyhome or call (888) 232-3477.

Commercial & Institutional Energy Strategy

Enfield's commercial and institutional energy strategy targets commercial buildings occupied by businesses and by institutional users such as private schools, health-care, and other non-profit organizations. Occupants may be owners of properties or tenants within those properties. This market sector includes older existing properties, as well as recent or future new construction. For nonprofit institutions, the benefits of energy improvements are compelling because energy cost savings are available to be invested in service offerings and in other areas of business operations.

Benchmarking Commercial and Institutional Properties in Enfield

Primary energy end-uses in this market sector include heating, cooling, hot water, lighting, and various plug loads, and may also include business-specific process energy use. Energy use by Enfield's commercial and institutional buildings is assumed to be typical of other Connecticut properties of comparable age and construction.

Opportunity Assessment

Opportunities for energy efficiency improvement include weatherization (wall and ceiling insulation and whole building air sealing), adding mechanical ventilation, replacing older heating systems with more energy efficient technology, replacing older cooling equipment with more energy efficient technology, temperature setbacks and scheduling through automated controls, improving hot water heaters and better managing hot water use, making lighting upgrades to more efficient technologies, and replacing older inefficient equipment with Energy Star products. Energize-CT offers a range of economically priced energy efficiency programs and services to assist commercial customers to use energy as efficiently as possible.

Goals and Strategies

Goal: Reduce energy use by as many businesses as possible by 20% over the next five years

Strategy 1: Outreach and education

The Town, through its committee structure and in cooperation with the Clean Energy Committee, should develop and implement an outreach program for energy-efficiency and renewable energy upgrades, including business-oriented outreach through the Chamber of Commerce, Rotary and other service organizations, and town-sponsored events such as business breakfasts.

Strategy 2: Publicize local success stories

Engage local businesses and institutions that have implemented energy improvements as "energy ambassadors" who can inspire others to do the same. Focus on high-impact businesses such as restaurants, health clubs and other gathering places; hardware stores and other points where the building trades come together; high-profile commercial centers such as the malls; and well established institutions such as houses of worship. Develop case studies, gather testimonials, and wherever possible, involve business leaders as peer mentors with their colleagues.

***Strategy 3*: Encourage participation in utility programs and services and available financing programs**

Advise businesses to take advantage of utility services and targeted financing options such as the Connecticut Green Bank's loan program, C-PACE, and integrate education about these options with the overall package of business services provided by the Town of Enfield.

***Strategy 4*: Encourage use of renewables**

Recognizing that public policies can affect the ability of building operators to use renewable energy, the Enfield Clean Energy Committee will work with relevant agencies, boards and commissions to prepare for the Town Council specific policy recommendations to overcome barriers, and specifically to:

- Identify and remove any zoning barriers to the utilization of renewable energy for business sectors, such as agriculture
- To support local joint ventures in renewable energy and expand access for commercial and institutional building owners regardless of their orientation and shading conditions, advocate for expanded virtual net metering without restriction among Connecticut electric customers.

Resources for Financing Commercial and Institutional Energy Improvements

C-PACE: Commercial and Industrial Property Assessed Clean Energy: C-PACE is a financing program of Connecticut's Green Bank, designed to reduce energy costs and greenhouse gas emissions. It offers affordable financing to property owners to undertake energy efficiency and clean energy improvements on their buildings. Businesses who are approved for the program repay investments through a benefit assessment on their property tax. C-PACE requires no money down, providing 100% upfront financing to the owner for various energy efficient upgrades.

C-PACE payback schedules are specifically structured so that projects will be cash flow positive. The dollars saved through energy upgrades are sufficient to cover the loan payments. C-PACE repayment obligations are attached to the property, not the owner. If the facility changes ownership, the new owner takes on both the payback responsibility and the energy-saving benefits including permanent savings after the loan is repaid.

SBEA: Small Business Energy Advantage Program: Businesses interested in reducing energy usage and upgrading to energy efficient equipment can also take advantage of SBEA. The program offers no-cost, no obligation audits of business facilities and makes recommendations to save energy and money through energy efficient upgrades. The program offers incentives from Connecticut Light and Power, and low interest on-bill payment plans to make energy efficiency an achievable goal.

Next Steps

Guiding Principles

The ECEC recommends that the Council follow these guiding principles as it manages the Town's resources and addresses the needs and interests of Town residents and businesses.

Plan for our Energy Future

We suggest that energy considerations can be formally integrated into future planning, decision-making, and operations. This will ensure that energy impacts of decisions made are naturally and proactively addressed, rather than treated as a separate topic.

Specifically, we recommend:

1. Increasing energy efficiency and using clean energy sources is a formally addressed and considered in all Town planning and development efforts, focusing on life cycle cost benefits and other advantages that can be gained by this approach, and that all public sector building or renovation projects include renewable backup power and energy storage, to the extent that this is cost-effective.
2. Requiring an opportunity assessment for micro-grids in all neighborhood and district development plans, preparing to make full use of Connecticut's micro-grid funding program and attract private investment. The Town should make it a priority to develop a community-based energy security plan using renewable energy in combination with backup generators and energy storage, to ensure reliable access to electricity in any extended power outage.

Avoid lost opportunities for increasing energy efficiency and renewables in operations

The Town should make every effort to maximize energy efficiency and renewable energy deployment in new construction and renovation of schools and public buildings, and make results and benefits visible through performance monitoring, exhibits, and signage. To that end:

- Reduce lighting ,heating, cooling, and other electricity consumption wherever possible through improvements to operations and maintenance, the use best available energy technology, and the replacement of aging energy infrastructure with equipment with the lowest life cycle cost
- Embrace the use of natural lighting and green infrastructure (green, light or reflective roofs, living walls, rain gardens near usable outdoor spaces for natural cooling), and passive solar design in buildings
- Set a standard of solar-readiness for new buildings, and secure increasing percentages of energy from renewables from any workable combination of onsite generation, virtual net metering and purchase of Renewable Energy Credits.

Commit to Making Enfield an Energy-Smart Community

Energy improvements should not be made only once. There are continuous opportunities for improvement as technologies and project economics change. Enfield can distinguish itself by, not only promoting widespread participation in current state and utility-sponsored energy programs,

but also helping citizens become wiser users of energy and discriminating customers in the energy marketplace.

Partner with the schools for energy education at every learning level

The Town's investment in its schools is great and growing. We suggest that the Town create an energy curriculum that encourages and highlights energy topics in STEM education for K-12 and adult education, as well as providing community-based programs through the Enfield Clean Energy Committee.

Help Educate Consumers

Consumer education and fact-based advocacy should be a priority in the Enfield Energy Strategy. The marketplace is filled with energy products and services of inconsistent quality and claims. The Town should broadly distribute the useful educational resources available through Energize-CT, for "101 level" introduction to energy concepts and resources and build on these with advanced materials collected and developed by the Enfield Clean Energy Committee that address community needs and opportunities.

Implementation

The Clean Energy Committee recommends that Town Council formally endorse the vision and goals presented in this document.

Implementing Enfield's Energy Strategy will be a shared responsibility.

- Political leadership at the highest levels of town government will be required to encourage the use of sound energy criteria in government operations. Town Council approval is needed for policies and major investments.
- Town staff will make decisions that concretely integrate energy criteria into purchasing and operations, as well as developing recommendations for our future energy infrastructure, in consultation with the Council and Clean Energy Committee.

Enfield's Energy Strategy addresses not only government operations, but also making energy savings and cleaner choices easily available to the entire Enfield community. The Enfield Clean Energy Committee, tasked with promoting energy efficiency and renewable energy town-wide, envisions having an ongoing role in implementation.

Full implementation will include:

- Town Council by resolution applying the strategy to government operations, planning and development, and programming, and directing town staff accordingly;
- The Enfield Clean Energy Committee establishing implementation plans for the aspects of the strategy that involve residents, businesses and institutions;
- Committee, Council, and staff creating a timeline for actions, metrics for outcomes, and a mechanism for periodic evaluation of successes and refinement of strategies.

The research and conversations carried out to create the Enfield Energy Strategy have established a clear, realistic set of opportunities to pursue. The walk-through assessment conducted by Peregrine made it clear that more detailed, investment-grade building assessment is worthwhile, and the recommended savings goal of 20% should be pursued without delay. Fleet energy use is significant, and controllable, through the simple recommendations made by Peregrine. The same is true for street lights. Purchasing policy and facility use behavior are choices within the control of the Town that can build momentum for serious implementation of the Energy Strategy. In the residential and commercial/ institutional sectors, the Committee will continue developing and implementing outreach programming with a special focus on helping to stabilize energy costs for Enfield's low and moderate income residents, and establishing the foundation for "energy smart community" initiatives.

Energy planning is a powerful exercise in building consensus about local priorities and taking responsibility for the economic use of resources as a community. The Enfield Clean Energy Committee is pleased to endorse this Strategy and eager to support its implementation.

City of Middletown 2019

Energy Plan

City of Middletown Energy Coordinator
Middletown Clean Energy Task Force
August 2019

ACKNOWLEDGEMENTS

MIDDLETOWN ENERGY PLAN

The following people were instrumental in creating, editing, and finalizing this energy plan:

Michael Harris, Energy Coordinator
Middletown Clean Energy Task Force members, especially Erin Dopfel and Jen Kleindienst
Ingrid Eck, Sustainability Fellow

This plan would only be a boring word document without the incredible graphic design work of Addision Kenney.

Thank you!

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MIDDLETOWN ENERGY PLAN

In 2018, the State of Connecticut set a goal of producing 40% of its electric power through renewables by 2030. This energy plan recommends this goal for Middletown as well. Our ultimate goal should be to get to 100% renewable energy for by 2050, consistent with State goals.

Energy is one of the most important dynamic forces in Middletown. We use it to illuminate, heat and cool our city buildings, schools, homes and businesses; to run appliances and to travel to work and play. It is also one of the largest expenditures for our citizens.

Sources of energy and the use of energy are at the crux of concerns regarding sustainability and environmental impacts. Middletown has the opportunity to optimize its use and procurement of the energy needed to sustain a robust, healthy community with equitable access for all. This can be accomplished by achieving energy efficiency and implementing renewable energy in both town buildings and also among residents and businesses.

INTRODUCTION AND OVERVIEW

BENEFITS

The Middletown Clean Energy Task Force has prepared this energy plan to help guide the city toward greater energy efficiency and sustainability. Carrying out this plan will yield many benefits to city residents and businesses, including:

SAVINGS

We estimate that the city can reduce its energy expenditures by more than half. And we can keep more of the money we spend right here.

HEALTH

By reducing our reliance on fossil fuels, we will improve air quality, leading to a range of health benefits, including notably lower asthma rates.

COMFORT

By making our homes and businesses more energy efficient, they also become more comfortable.

RESILIENCY

Through greater reliance on local energy generation and a more modern electric grid, the city can safely weather outages and natural catastrophes.

KEY ELEMENTS

The key elements of this energy plan are:

1

Reduce energy usage by improving the efficiency of our buildings, both public and private.

2

Strategically electrify by transitioning transportation to electric vehicles and heating and cooling to high-efficiency heat pumps.

3

Develop an optimal mix of locally supplied renewable energy by promoting the responsible development of solar energy, including residential rooftop solar, community shared solar, commercial solar and solar carports.

INTRODUCTION AND OVERVIEW

A FRESH NEW LOOK

The City of Middletown Energy Plan is referenced in the current Plan of Conservation and Development. By being incorporated by reference into the POCD, the plan may remain dynamic and evolving within the 10-year POCD cycles while offering a foundation of vision and process. The Middletown Energy Plan has also been formally recognized as an important guiding document through a resolution passed by the Middletown Common Council in June of 2019. Both its positioning within the POCD and the Common Council's resolution support the plan's capacity to help create the City of Middletown's optimal energy future.

The 2019 City of Middletown Energy Plan incorporates wisdom and content from previous energy plans. Moreover, the current plan provides the framework of an overarching vision and discussion of process to move toward the ideal expressed by the vision statement.

The plan offers the following organization:

Section I Discussion of a framework of vision and process

Section II Approach to municipal energy use, reduction and conversion to renewable energy

Section III Approach to residential and business sector energy use, reduction and conversion to renewable energy

Appendices 1. 2018 Letter to Clean Energy Task Force, 2. 2017 Energy Action Plan, 3. 2010 Middletown Energy Plan

SECTION I

Middletown Energy Vision and Process Overview

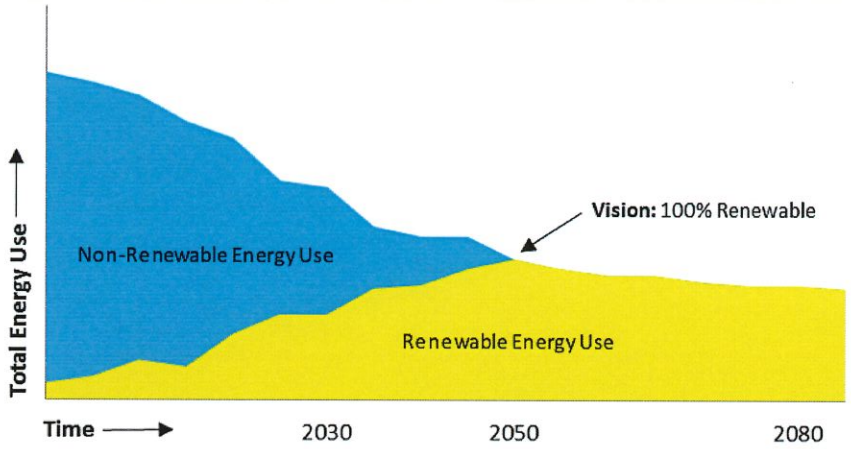
SECTION I:

MIDDLETOWN ENERGY VISION AND PROCESS OVERVIEW

The City of Middletown aspires to transition our entire community to 100% renewable energy by 2050

SECTION 1

MIDDLETOWN ENERGY VISION AND PROCESS OVERVIEW



This section describes an energy vision for the City of Middletown Energy Plan and strategic framework for achieving it, including key process elements and supporting policy recommendations. The vision for Middletown's is based on the ideal of providing all of the needed energy within city boundaries through renewable sources.

The graph illustrates the principle of energy reductions through efficiency gains prior to sourcing energy from renewable sources.nThe key to the vision of 100% renewable energy is recognizing the inherent efficiency gains achieved through strategic electrification. Broadly, these gains include the superior coefficients of performance (COPs) of heat pumps, as well as the more efficient translation of electrical energy into transportation energy.

PEAK RESOURCES

A realistic vision acknowledges the energy and environmental realities currently unfolding, as well as changes expected. This reality includes the finite nature of fossil fuels including the concept of peak fossil fuels in which continued reliance and the resulting depletion is characterized by a decreasing Energy Return on Investment (EROI), and ever-increasing economic and environmental costs.

While the concept of peak fossil fuels is complicated and extremely difficult to predict with regard to timing, the analysis is simplified by the fact that climate disruption will likely overtake depletion concerns due to the emergence of reinforcing, climate feedback loops.

The feedback loops are raising the concerns over carbon concentrations in the atmosphere such that the elimination of fossil fuel use is increasingly seen as an unavoidable necessity. These loops include ocean temperature rise and acidification, methane releases due to melting permafrost and exposure of undersea methane hydroxides (clathrates).

It is, however, key to remember that the longer we expect to obtain fossil fuels through increasingly unconventional methods, the greater the environmental and economic damage.

100% RENEWABLE VISION

Given the above discussion, holding the ideal vision of 100% renewable energy is not only a worthy endeavor, but perhaps an essential one. A 100% renewable energy plan goes beyond generating, procuring or offsetting energy needs with renewables.

It represents a holistic, comprehensive approach to managing the supply and demand for energy, including:

- deep efficiency and conservation
- generation of renewable energy
- energy storage
- electrification of transportation, heating, and cooling
- active load management (i.e., "demand response")
- a modern community microgrid
- a new utility rate structure and business model

100% RENEWABLE VISION

(continued)

Such a program would seek to answer the following questions pertinent to a comprehensive vision:

- How much energy do we currently use, including electricity, heating, cooling and transportation?
- How much could we reduce energy usage through conservation, efficiency and electrification of all heating, cooling (i.e., heat pumps) and transportation (i.e., electric vehicles)?
- How much renewable energy could we produce in town?
- How do we re-think and redesign the electric grid using community microgrids to accommodate a higher level of distributed energy resources?
- How do we constructively engage with the electric utility to develop new technical, business, and financial models?

Finally, the 100% effort can help develop a citywide picture of deployed, decentralized, renewable infrastructure such as windmills on brownfield sites, solar arrays on roadway medians, coordinated microgrid systems and other examples of the localization of energy generation and delivery. To the extent that these elements are reflected in the Energy Plan, they have a much better chance of being brought to fruition.

POLICY

Through the effort to develop a useful vision as the context for an energy plan, the City will become much more capable of articulating guiding ideals that are broadly supported by City leaders and constituents. In order to better serve these ideals, the City should consider codifying them in the form of policies, resolutions and ordinances. As the environmental and economic challenges of the energy future reveal themselves more fully, it will be increasingly important to install a framework of acceptable and not acceptable responses.

Examples include:

- Requiring minimum efficiency standards for vehicles and buildings
- Prioritizing the use of otherwise unusable land, such as brownfields, for the siting of renewable energy infrastructure
- Requiring all new buildings to meet 'net zero' criteria
- Subsidizing the installation of 'ground-couple' components to improve the efficiency of high-efficiency air-cooled heat pumps
- Banning/limiting plastic bags and other forms of plastic
- Eliminating single use plastic water bottles and prioritizing the availability of clean water for everyone within city boundaries

Well-developed policies can provide important support to the implementation of the energy plan.

ENERGY TRACKING AND MANAGEMENT

Category	2017	2018	Change	% Change
Total Household Electric - kWh	142,578,842	145,066,736	2,487,894	2%
Total Household Natural Gas - CCF	4,715,174	3,758,283	-956,891	-20%
Total Business Electric - kWh*	884,358,396	884,358,396	0	0%
Total Business Natural Gas - CCF	14,894,388	11,329,484	-3,564,904	-24%
Totals (MWh equivalent)	1,601,661	1,471,622	-130,038	-8%

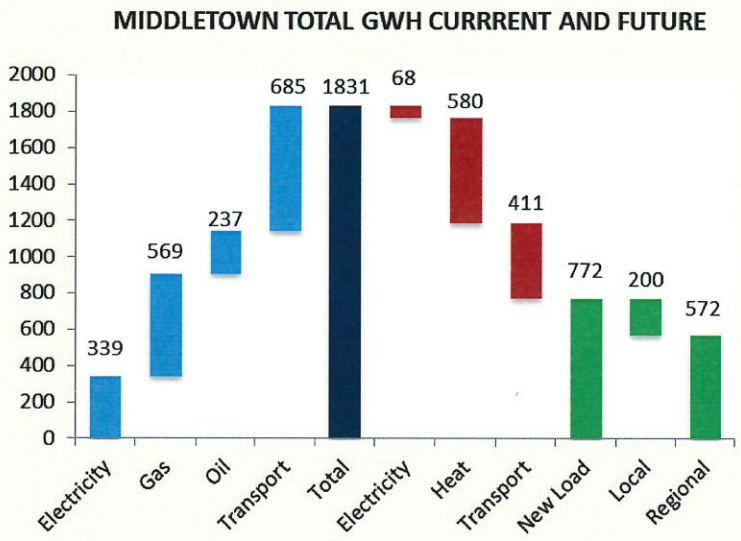
*2017 data was erroneous; this table assumes no change from 2017 to 2018

Table 1. Summary of Electricity and Natural Gas Use

Municipal energy is tracked by Middletown's Energy Coordinator through utility company billing and through the Energy Star benchmarking program. Residential and business usage is tracked through the Clean Communities Dashboard, offering a high level view of all energy consumed within town boundaries.

Table 1. illustrates the high level tracking available through the Clean Communities Dashboard. The data is categorized by household energy and all else. Municipal energy – representing about 2% of the total shown below - is discussed in more detail in the next section.

ENERGY REDUCTION GOALS AND ACTIONS



Total energy use within city boundaries includes oil used for heating and transportation energy. **Figure 1** above summarizes estimated totals for all energy use in the city, and also projects potential efficiency reductions.

The graph Indicates a total of 1,831 Giga-watt hour (GWh) equivalent energy. This total consists of 339 GWh of electricity, 569 GWh or natural gas, 237 GWh of heating oil and 685 GWh of transportation energy.

The right side of the graph indicates potential efficiency reduction resulting from a combination of conservation/efficiency efforts and strategic electrification. The total project future energy needs of the city, disregarding growth for the moment, is 772 GWh. This value represents the ideal for which the city might seek to provide through renewable source. The breakdown of 200 and 572 GWh respectively indicated reasonable estimate of renewable production that might be available within city boundaries, and more regionally.

The assumptions included in the above projects include 20% in efficiency gains for lighting and appliances, current heating efficiency at 85%, 100% conversion of heating to heat pumps that provide 3:1 energy output versus input. Transportation is similarly estimated because the translation of electrical energy to transportation energy is significantly better than fossil fuel energy to transportation.

CLEAN ENERGY GOALS

Basic Principles

Based on the analysis, a long-term goal for the City of Middletown to achieve 100% renewable energy would require clean energy production of about 772 GWh. This would require 88 mega-watts (MW) running 24/7, or roughly a solar installation of about 600 MW. However, this analysis is still quite preliminary for several reasons, the most important of which is probably the sizing and interaction of energy storage with generating capacity. This analysis is currently beyond this Energy Plan.

PEAK DEMAND GOALS AND ACTIONS

Peak demand represents an additional dimension of energy use that significantly impacts energy costs and the need and size of energy infrastructure. Reducing peak demand implies that the use of energy is spread over a longer span of time; therefore the 'peak' requirement is reduced. The ideal relationship between peak demand and use is a flat load in which the energy needed is spread equally over all hours.

Peak demand drives the capacity and sizing of energy infrastructure needed to safely serve an energy load. If the ideal were met in which the energy needed could be provided in equal parts over time, the infrastructure needed would be minimized. However, the ideal is seldom the case. Most energy needs occur during certain times of the day (ie., 'diurnal'), during which more energy is needed at certain times, and less energy at other times. An example of this is a school for which energy needs are minimal at night and maximal during the day.

The extent to which energy need, or 'demand' is concentrated during certain times drives the need for infrastructure and is reflected in the cost to deliver energy. As energy grows, there is a tension among energy users (concurrent demand) and the capacity of the system to serve the concurrent demand. As the infrastructure system ages and energy use continues to grow, the cost of demand is receiving more and more focus.

PEAK DEMAND GOALS AND ACTIONS

(continued)

Clean, renewable energy has the potential to distribute the production of energy and reduce the load that needs to be served by energy infrastructure. To the extent that Middletown energy needs are concentrated during the daylight hours, the application of renewable energy can reduce peak demand.

It is important to recognize that such reductions are subject to the variability of renewable energy due to weather and other operational characteristics.

The City of Middletown continues to work to develop a culture of awareness of peak demand. This awareness is most acute during system demand days in which the current infrastructure is most burdened due to, for example, high outdoor temperatures and wide-spread need for air-conditioning. Middletown participates in demand management programs in which we can respond to request to reduce energy demand. The City also maintains awareness of peak systems days during which 'captag' assignments are made by energy suppliers. Captag is an indication of the amount of infrastructure needed to supply the city accounts and is a component of energy cost that is constant throughout the year. Managing energy to reduce captag during the annual system peak can produce energy cost savings year round.

CONCLUSION

The above discussion applies to both the Municipal sector and the Residential/Business sectors, both of which are discussed below in their respective sections. These sections will address the application of the City's vision of an energy future, and how to achieve it through goal-setting, policy, energy tracking, and a process of actions to impact both energy consumption and peak demand.

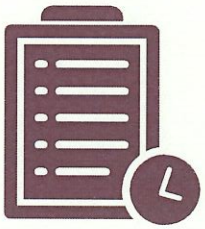
SECTION II

MUNICIPAL APPROACH

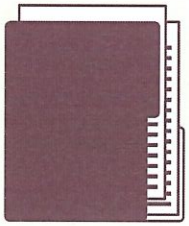
SECTION II:
MUNICIPAL APPROACH

The approach to meeting energy goals for the Middletown municipal and school buildings includes:

Energy Auditing



Screening and Prioritizing Opportunities



Bundling and Implementing Projects

ENERGY AUDITING

In order to take a strategic approach to financing energy-related improvements and pursuing energy efficiency goals, the City has implemented an Energy Efficiency Program to fund comprehensive energy auditing of all energy consuming buildings and systems in the City.

This includes:

- Municipal buildings
- School buildings
- Street lights
- Water and sewer plants and pumping stations
- Telecommunications and security system
- Transportation

Middletown's Energy Coordinator uses energy auditing to identify energy opportunities and provide initial characterizations of the costs and benefits of the individual projects. Benefits include hard savings estimates, but also softer considerations such as the avoidance of repair, maintenance or capital replacement. All of the project information gathered is compiled on a single spreadsheet that then drives the strategic planning across all buildings and systems.

The single spreadsheet can be thought of as the 'universe' of opportunities. While it will describe a gross savings potential, this total or 'goal' will be overstated as not all projects will meet the criteria for implementation.

SCREENING AND PRINTING OPPORTUNITIES

Once all of the needs and opportunities are understood, the City plans on taking a strategic approach to implementing those projects that meet a minimum cost/benefit ratio. This ratio will include the relationship between hard costs and estimated savings, as is often described by a simple payback analysis. However, other benefits may accrue from any given project. The City has the opportunity to include those benefits in the analysis as well.

Other benefits may include improvements to comfort and reliability, or reduced or avoided repair, maintenance or replacement costs. While the above analysis is typical of large integrated energy projects, this evaluation is often performed by a third party in which many assumptions are not made obvious. The City plans to maintain control of the analysis, and the controlling assumptions, in order to gain the most value from the energy efficiency approach. The resulting aggregate screened and prioritized project list will offer a realistic energy reduction goal. Estimates of the magnitude of the energy reduction goal are discussed in the following sections.

BUNDLING AND IMPLEMENTING PROJECTS

Bundling and Implementing Projects
To achieve a balanced approach to implementing the myriad opportunities, the screened and prioritized project list will be sorted into bundles that will represent phases of the larger energy project. Bond funding is envisioned for the phases of the aggregate project. A multi-million dollar project may require several phases and a few years to implement.

The bundles will be assembled based on respective urgency of various projects, as well as the ability to blend stronger and weaker financially performing projects to arrive at a bundle with a weighted average financial performance that meets a pre-determined metric. For example, bundle projects with gross paybacks of about six years can be financed with the savings (ie. neutral cash flow) over a term of 10 years and at the typical – though competitive - bond interest rate available to the City of Middletown. Bond interest rates are affected by the City's financial strength that has been excellent over the last several years with our AAA bond rating.

ENERGY TRACKING AND MANAGEMENT

Energy tracking and management is currently addressed through a variety of systems. In general, the purpose of tracking and management is to facilitate an understanding of energy use year-over-year, to identify unexpected changes in this use, and to use the information to improve energy strategy.

While efficiency and the quantity of energy used – sometimes adjusted for weather – are primary concerns, management activities include monitoring pricing, optimizing procurement and prioritizing investments. Cost savings derived from more competitive procurement strategies can be applied to efficiency efforts.

Energy tracking for municipal buildings is accomplished through:

- utility billing and website
- Eversource customer engagement platform
- Energy Star website and benchmarking

ENERGY REDUCTION GOALS AND ACTIONS

As of 2018, the City consumed about 36,000 MWh of equivalent energy – meaning this value included electrical, process and heating ventilation and air-conditioning (HVAC) energy. The amount of electrical energy used by the City is about half of the 36,000 MWh total.

While the City's total energy requirement has remained flat since 2011, the contribution from renewable energy had declined to 115 MHw equivalent prior to the installation of a 400 kilowatt (kW) fuel cell that the High School.

The High School is the largest energy consumer in the city. With its installation, all of the electrical energy needs to the building are provided by the fuel cell. This occurs as a result of the 24-hour per day operation of the fuel cell in which much of the electricity needed in the building during the day is produced during the night time hours and 'stored' on the electric grid. The stored energy is retrieved each day.

Although the fuel provides a modest financial benefit as a result of its classification as a renewable energy source, the need to retrieve energy during the day results in costly demand charges. However, the total contribution by the fuel cell of some 3,000,000 kWh per year accounts for 19% renewable energy contribution toward the 18,000 total electrical use by the City.

PEAK DEMAND REDUCTION GOALS AND ACTIONS

Demand, and efforts to impact demand, are organized under two general initiatives:

- CAPTAG MANAGEMENT
- DEMAND RESPONSE

CAPTAG MANAGEMENT

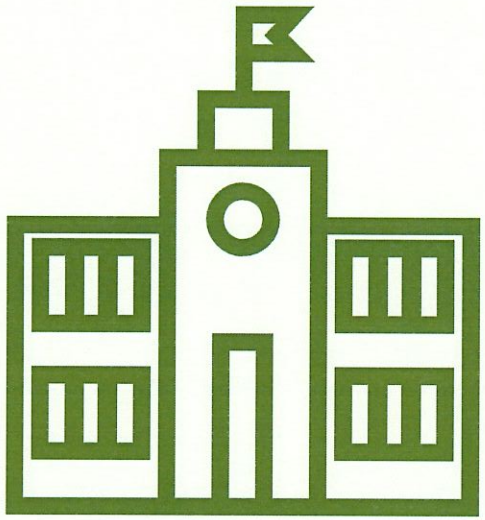
The generation portion of the City's electric costs includes transmission costs – the space on the large transmission system that brings electricity into the local distribution system. The transmission costs are administered through a characteristic unique to each customer called its "captag." The captag is an representation of the aggregate, or combined, demand of all electric accounts for any given customer. It is determined on the peak day for the regional electric system serving the customer.

Captag management involves monitoring the system for its peak day and attempting to reduce demand on that day. Any reductions are reflected as a lower captag with an associated reduced cost for all electricity purchased.

While the process is straightforward if successful reducing electric load, it is not so straightforward predicting the peak day. Peak days that occur early in the summer season may be exceeded later in the summer. So there may be multiple days in which curtailment or load reduction is attempted. In addition to the potential to reduce energy costs, another advantage of managing captag includes raising awareness about electric demand its cost.

DEMAND RESPONSE

Tracking the largest users through interval meters, the City of Middletown Board of Education participates in a demand response program with C-Power Energy Management for some larger schools:



Bielfield Elementary

Lawrence Elementary

Wesley Elementary

Keigwin Middle
(to be repurposed within two years)

Woodrow Wilson Middle
(to be replaced within two years)

Middletown High

DEMAND RESPONSE

(continued)

Each of the schools listed has an interval meter that can provide detailed demand information. Currently, Eversource is developing the ability to provide this information via its Customer Engagement Platform. Through the C-Power program, the above schools are audited twice per year to develop a measurement of the facilities ability to curtail load if requested. This capacity to curtail generates modes income for the City and Board of Education.

Additional revenue potential exists if ISO New England, the regional electrical system operator, requests an emergency curtailment through C-Power.

The above demand management is reactive in nature, meaning it only responds to requests for curtailment. In the future, as real-time metering becomes more available, the City will responds to measured demand proactively to try to maintain demand below predescribed levels.

CLEAN ENERGY GOALS

Master Plan Study for Schools

Master Plan Study for Municipal Buildings

100% Renewable Energy Program

MIDDLETOWN SCHOOLS' ENERGY AUDITING

As of August 2019, the City of Middletown has completed energy auditing of over 800,000 square feet comprising all of our schools. The energy auditing identified energy efficiency projects as well as deferred maintenance needs. The information will be compiled, screened, prioritized and bundled into projects based on urgency, cost, savings and other benefits under the 2019 Energy Efficiency program. The projects will be implemented in a phased manner.

A similar effort is beginning in late 2019 for all municipal buildings.

While this above described process will identify real energy savings potential, the comprehensive approach should result in reductions across the board of about 20%.

Additionally, in 2019, 150 computers were replaced, reducing demand by about 60 kW, and reducing usage by about 150,000 kWh.

MASTER PLAN STUDY FOR SCHOOLS

In order to evaluate the value and appropriateness of solar on schools, a master plan study is contemplated to evaluate the myriad intersectional considerations when applying solar. First and foremost, it is useful to consider that solar energy fits well with the diurnal operation of schools. This fundamental fit matches the energy production of the solar, increasing during the morning, peaking during the afternoon, and decreasing in the late afternoon – with the building's needs. During the cooling season, these needs tend to mirror the production closely. Heating needs, while less exaggerated, are greatest in the morning, relatively flat during occupied periods, and diminishing post-occupancy – yielding, still, a rather good fit between production and use.

The other considerations that need to be evaluated during the master study include:

- Condition of the roof
- Availability of ground-mount area in addition to roof mount
- Optimal sizing of the solar given the building needs
- Grid interconnection concerns
- Shading, solar production
- Cost versus benefits
- Long-term plan for the facility

Some schools will score better than others with regard to solar. The Master Plan offers the opportunity to strategic evaluate these factors.

MASTER PLAN STUDY FOR MUNICIPAL BUILDINGS

Similar to the school master plan solar study, a study is contemplated for the municipal buildings as well. All of the same criteria apply. Moreover, the combination of the School and Municipal master plan studies offers insight into the aggregate value of solar production that is potentially available to the City of Middletown in the context of the 100% Renewable Energy Program.

Renewable energy was generated by a 200 kW fuel cell in 2011, contributing 1,664 MWh, 9% of total electrical energy use. In 2015, this contribution briefly declined until a new 400 kW fuel cell was brought online in FY2017. FY2015 renewable contribution consisted of energy from a 21 kW photovoltaic (PV) system on the Police Station, and an 88 kW PV system on Moody School. The overall, current renewable energy contribution has increased by 107% over FY2011 levels and represents 19% of total city-wide electrical energy use. The increase is attributable to the systems described above and a recently installed 218 kW PV system installed at the Bacon Water Treatment Plant (Higby).

Renewable Energy System	Capacity (kW)	Annual Production (MWh)
Police Station PV	21	21
Moody School PV	88	113
High School Fuel Cell	400	3,035
Higby PV	218	280
Total	727	3,449

Table 2. Summary of Current Renewable Energy Systems

TRANSPORTATION SECTOR

The transportation sector provides additional opportunity for the City to analyze transportation use and the current means of meeting these needs. From that baseline, alternative, more efficient approaches can be identified. The alternatives would then be subject to cost/benefit analyses that would support a process of screening and prioritizing as discussed in previous sections.

One of the challenges of moving the City fleet and broader transportation sector toward greater efficiency is the need to break down the general consideration that unfettered transportation is a characteristic of an efficient work place. The City's first action with regard to its transportation sector is the willingness and ability to look closely at the miles driven, miles per vehicle, energy per mile and other metrics that can reveal efficiency characteristics of city work process.

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

Decreasing transportation-generated emissions in a community can have an immediate effect on local air quality in a way that other sustainability activities may not. 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 this goal.

TRANSPORTATION SECTOR

Improved

According to the National Association of Realtors (NAR), walkable/bikeable communities are prefered by homeowners (2017)

Preferred

Improve local air quality and noise levels

Available and Easy

Communities with available and easy to use public transportation access show resilience in property values even in times of volatility (NAR, 2013)

MICROGRIDS

All of us in Middletown rely on the electric grid to provide electricity to our homes, businesses and town facilities. Our current grid performs exceptionally well, but was built and designed before the advent of solar panels, allowing individual houses and businesses to generate their own electricity, and batteries, allowing them to store it. Moreover, it is vulnerable to blackouts during major storms and attacks. While the Middletown history of electric utility availability has been excellent over the recent past, the consideration of microgrid benefits is essential to strategically ensuring a resilient system as disruptive tendencies increase with time.

These tendencies, of course, include the condition of the grid itself, and the threat of. If we want to continue to encourage more renewable energy and greater resilience, we need to re-think the grid. A key building block of the future grid will be microgrids, consisting of smaller subsets of power sources, users, wires and controls. 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. An example of a microgrid could be a collection of key town facilities, a solar array, battery storage and a backup generator. In the future, the grid might consist of a series of interconnected microgrids.

BENEFITS OF MICROGRIDS

- **Enables more renewable energy** through integration of storage and smart controls. Electricity can flow in multiple directions.
- **Greater reliability,** allowing the microgrid or key facilities (e.g., emergency shelter) 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.

PROGRESS TO DATE

- On two occasions, Middletown explored the feasibility of creating microgrids:
  - One downtown
  - One built around the High School
- On both occasions, for different reasons, the projects did not proceed
  - Importantly, we learned about the barrier to participation in the state microgrid program in which significant engineering investment is required to submit an application
  - This information is useful for planning any future applications
  - We have potential future projects in store as we learn more about the cost/benefit relationship for microgrids

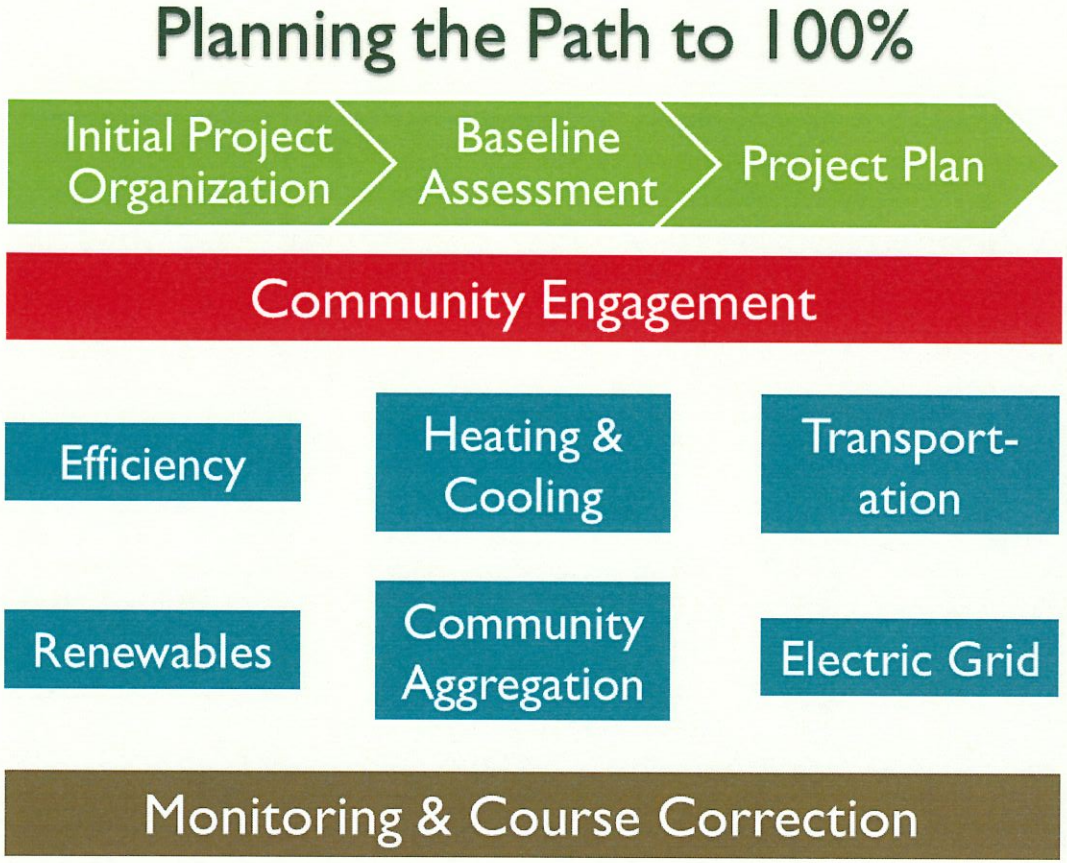
SECTION III:
RESIDENTIAL AND BUSINESS SECTOR APPROACH

Measure and track residential and business sector energy use on an ongoing basis

Evaluate current residential and business sector energy use and renewable energy generation potential

Set target for energy use reduction in the residential and business sectors

SECTION III : RESIDENTIAL AND BUSINESS SECTOR APPROACH



BENCHMARKING

The Middletown Energy Plan addresses the residential and business sectors through the vision of 100% Renewable Energy. The process for moving toward 100% Renewable involves initially estimating the total energy use by all sectors within the city boundaries. This information is largely available on the Eversource/Connecticut Clean Communities website. Below is a screen shot of the current total energy use for the City of Middletown.

This activity is known as benchmarking. It is a process of developing an understanding of energy use for two purposes:

1. To understand total current energy use for estimating and tracking reductions in usage.
2. To develop capacity estimates for serving the expected energy needs of the community.

OUTREACH TO LOW AND MODERATE INCOME RESIDENTS

CHEER Middletown

The CHEER Middletown program (Comfortable, Healthy, Energy Efficient, and Renewable) works with existing state programs, like Home Energy Solutions Income-Eligible energy audits and matches state and utility funding with internal CHEER funds to address health and safety issues alongside energy efficiency and renewable energy for low- and moderate-income Middletown homeowners and renters.

Renewable Energy

The City's Clean Energy Task Force and Energy Coordinator's Office are continually looking for opportunities to make renewable energy accessible to all. In 2019, the City led a Solar for All campaign with no money down and no credit check required solar leases to homeowners. The City continues to investigate options for making renewable energy available to renters, including the future possibility of shared solar.

BENCHMARKING

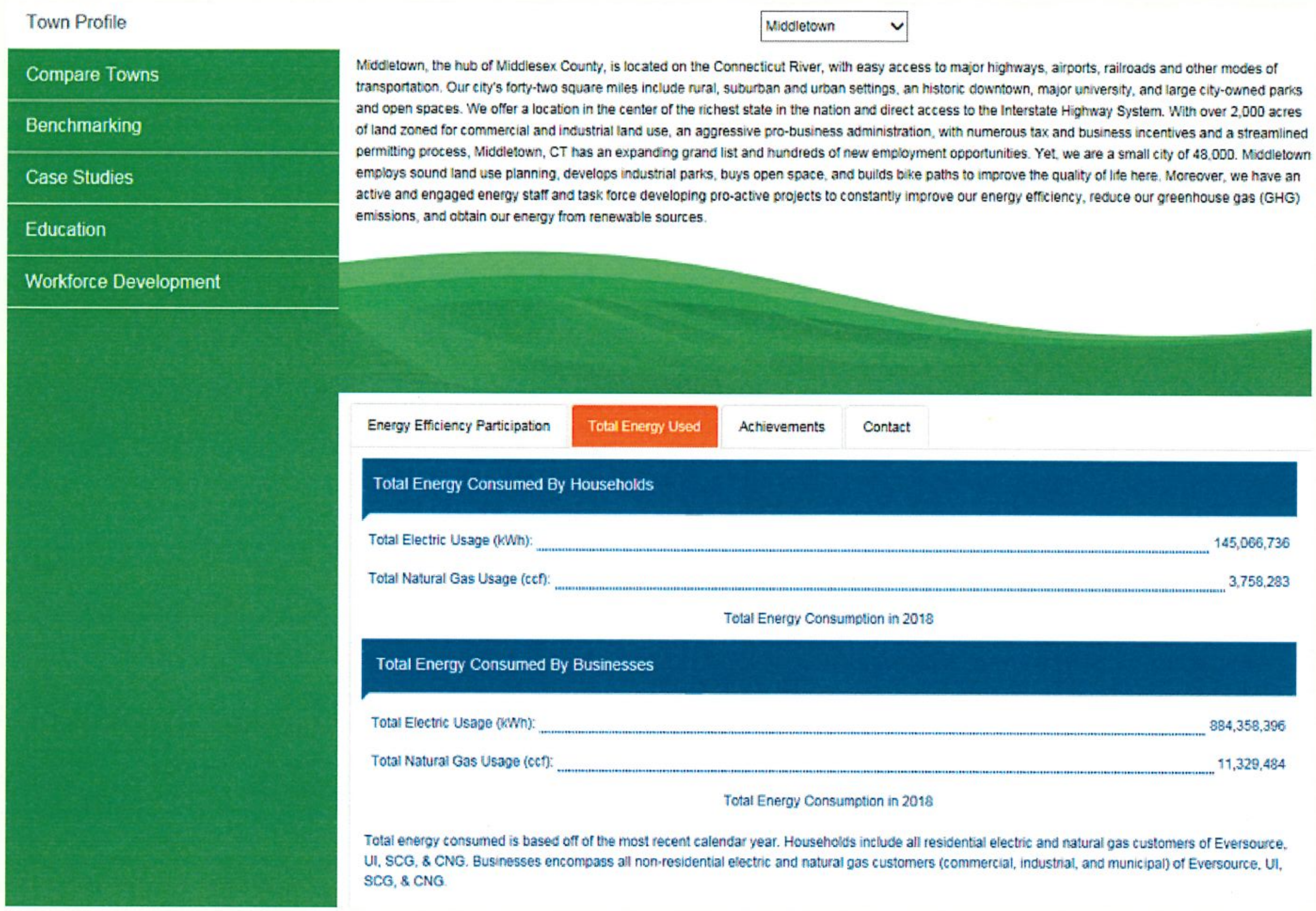


Figure 3.
Clean Communities Screen Shot

TABLE 3. ENERGY VALUES FOR MIDDLETOWN

2018 Residential and Commercial Aggregate Energy Usage by Town

Households include all residential electric and natural gas customers of Eversource, UI, SCG, & CNG. Businesses includes all non-residential electric and natural gas customers (commercial, industrial, and municipal) of Eversource, UI, SCG, & CNG.

Town Name	Residential Electric Usage (kWh)	Residential Natural Gas Usage (ccf)	Commercial Electric Usage (kWh)	Commercial Natural Gas Usage (ccf)
Middletown	145,066,736	3,758,283	884,358,396	11,329,484

As can be seen above, the Middletown commercial electrical usage is extremely high. While we have submitted inquiries to better understand this value, note that this is the largest value of any Connecticut town. The table below is available through the Clean Communities web-site and has been sorted to show the towns with the highest values of commercial electric usage.

TABLE 4: CT TOWNS WITH HIGHEST ELECTRICITY CONSUMPTION

Town Name	Residential Electric Usage (kWh)	Residential Natural Gas Usage (ccf)	Commercial Electric Usage (kWh)	Commercial Natural Gas Usage (ccf)
Middletown	145,066,736	3,758,283	884,358,396	11,329,484
Stamford	473,598,076	21,091,000	789,603,445	24,000,075
New Haven	307,410,861	33,895,699	731,293,767	30,965,794
Hartford	221,095,036	36,335,319	684,929,927	60,957,008
Bridgeport	331,826,021	38,156,266	419,756,709	34,384,329
Milford	176,970,426	12,929,181	412,756,166	8,348,635
Danbury	280,351,173	8,752,741	377,409,551	19,182,421
Waterbury	345,494,588	17,084,158	375,792,231	22,506,056

In correspondence with Eversource, we have identified a usage of 225 million kWh, Middletown's usage for calendar year 2017, as a more representative value for the town. We are in the process of trying to unravel the abnormally high value currently being reported by Eversource.

HEAT AND TRANSPORTATION ENERGY

The process of evaluating the total energy use of the city includes estimating fuel oil and propane use for heating and process, and estimating transportation energy. The process we have used to date involves information from the Tax Assessors office from which we are able to extrapolate the additional energy use. The table on the next page is a summary of the current calculations for total energy use.

TABLE 5: ENERGY, ENERGY EQUIVALENT AND GHG TOTALS

2017 Energy Consumption
Middletown

		Unit	Commercial	Residential	Total
Current Energy Used	Natural Gas	CCF	14,894,388	4,715,174	19,609,562
	Transport	Gallons	4,713,348	15,627,696	20,341,043
	Oil Heat	Gallons	454,569	5,378,868	5,833,437
	Electricity	KWh	196,807,199	142,578,842	339,386,041
Current Energy in Giga Watt Hours	Natural Gas	GWh	432	137	569
	Transport	GWh	159	527	685
	Oil Heat	GWh	19	219	237
	Electricity	GWh	197	143	339
	Total	GWh	806	1,025	1,831
Current Greenhouse Gas Emissions	Natural Gas	GHG - tons	87,207	27,607	114,814
	Transport	GHG - tons	44,541	147,682	192,223
	Oil Heat	GHG - tons	5,091	60,243	65,334
	Electricity	GHG - tons	57,487	41,647	99,135
	Total	GHG - tons	194,326	277,180	471,506

RESIDENTIAL AND BUSINESS SECTOR ENERGY USE TARGET REDUCTION

Over the next several years, the City of Middletown will further analyze non-municipal energy use as we develop our path to 100% renewable energy. To make this 100% renewable goal more accessible, we seek a minimum of 10% reduction in energy use in residential and commercial sectors. This goal will be revisited and revised as further action is taken.

TRANSPORTATION

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

Decreasing transportation-generated emissions in a community can have an immediate effect on local air quality in a way that other sustainability activities may not. 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 this goal

BENEFITS

- **Improve** 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 access show **resilience** in property values even in times of volatility (NAR, 2013)

PREPARING FOR 100% RENEWABLES: AFTER THE BENCHMARKING

The following are suggested steps as a process for moving the City toward 100% renewable energy:

STEP 1: ASSESS EFFICIENCY PROSPECTS

Develop plan and adjust benchmarking

STEP 2: ASSESS ELECTRIFICATION PROSPECTS

Identify sites in the community & prioritize (e.g. based on use factors, distribution, grid and user proximity)

STEP 3: IDENTIFY GENERATING SITES NEAR THE COMMUNITY & POTENTIAL FOR COLLABORATIVE PROJECTS WITH SURROUNDING COMMUNITIES

Engage with utility: reality-check local and regional generating capacity

PREPARING FOR 100% RENEWABLES: AFTER THE BENCHMARKING

STEP 4: ITERATIVE REVIEW:

Steps 1 – 3, evaluate, repeat

- **Quantitative contribution of each item to 100%** - How close are we? What are limiting factors and strategies for dealing with these factors?
- **Qualitative assessment** – Which of these have greatest socio-political support? Who are needed partners and how do we invite them on board?
- **Fit with the community's culture, values, awareness** – esp. efficiency and electrification
  - How to go at these for success?
  - How much/how fast?
  - Where to begin to build success and support?

PREPARING FOR 100% RENEWABLES:
AFTER THE BENCHMARKING

STEP 5: SCREEN, SORT, PRIORITIZE POTENTIAL PROJECTS

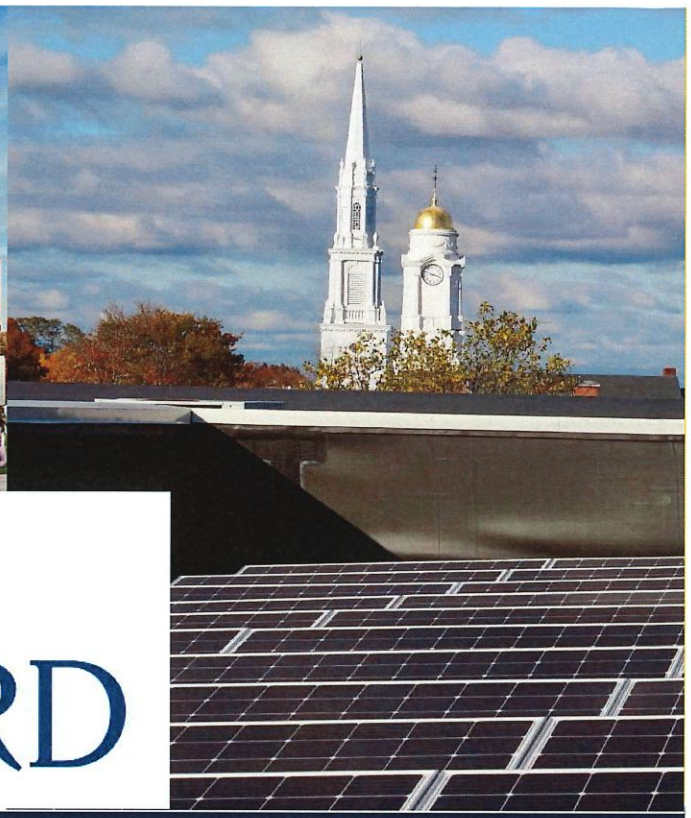
- **Time:** short – medium – long term
- **Investment levels:** easy – moderate – challenging to execute (consider people-power, time investment, levels of uncertainty)
- **Cost:** low – moderate – high
- **Cost-effectiveness:** high – moderate – low (financial, political, social capital, leverage, etc.)
- **Ease of funding/financing:** easy – moderate – difficult
- **Risk:** low – moderate – high
- **Impact on 100% shift:** low – moderate – high impact
- Other criteria that matter to the community

APPENDICES

Appendix 1. 2018 Energy Coordinator Letter to Clean Energy Task Force

Appendix 2. Energy Action Plan

Appendix 3. 2010 Middletown Energy Plan



WEST HARTFORD

1854

Energy Plan

West Hartford Clean Energy Commission | 2020

DRAFT – June 16, 2020


We aspire for our entire community
to use 100% clean, renewable energy
by 2050.
DRAFT – June 16, 2020

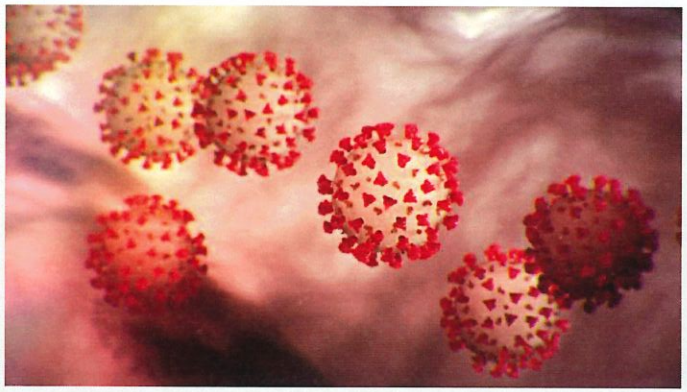
a Note on COVID-19 and Racism

This Energy Plan was largely written before the COVID-19 outbreak and George Floyd's murder. However, we felt it necessary to acknowledge that these events have changed the way we look at the world, even in the context of this plan.

We must forward on energy in a meaningful, inclusive way. This includes seeking out multiple perspectives, acknowledging and calling out both individual and systemic inequity and injustice, and committing to work actively to dismantle barriers and transform our institutions, polices, practices, and actions so that they work for everyone.

Disruption affords us an opportunity: to recover and rebuild, not "back to normal" but "back to better," to choose a different path , a different energy path – a cleaner, greener, sustainable, and just path.

Include something to this effect?



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Introduction

Energy is essential. It is the lifeblood of West Hartford. It heats and cools our buildings, runs our lights and appliances, and allows us to travel to work and play. Yet, most of our energy still comes from the burning of fossil fuels, which is the biggest contributor to green house gas emissions and climate change.

Our use of energy comes with an intrinsic responsibility to consume and produce it sustainably. Recognizing and acting on this responsibility today is necessary to ensure that West Hartford continues to thrive and prosper. It protects our future and our children's future. It also offers opportunities to shape what that future looks like.

As a local community, we have the power to affect change. The West Hartford Clean Energy Commission has prepared this 2020 Energy Plan to build on the work of its 2009 Energy Plan and to guide the town toward greater energy efficiency and sustainability.

Implementing this plan will yield many benefits to our residents and businesses:

- **Economic and financial**: By saving energy, we will save money: money that can be spent other basic needs, or maybe right here in town to support our local ecomony. It may also create new jobs.
- **Environmental, health, comfort**: By saving energy and reducing fossil fuel use, we will lower emissions, improve air quality, and improve health, especially for vunerable popultations like children and seniors. By making our homes and businesses more energy efficient, they will also be more comfortable.
- **Equity and inlcusion:** By focusing on inclusive solutions to save energy and provide assistance, we will make a difference in the lives of all our residents, including marginalized or at-risk communties and those who currently bear the largest energy burdens.
- **Security and resiliency**: By reducing overall energy needs, modernizing our grid and increasing local generation, we will make our energy supply more secure and be in a better position to weather storms, outages and other natural or man-made disasters..

Mayor Cantor and Council Members Sweeney and Kerrigan activate Town Hall's solar array, October 2019.

The State of Connecticut is committed to reducing its greenhouse gas emissions 45% from 2001 levels by 2030. Governor Lamont's Executive Order No. 3 commits Connecticut to 100% carbon neutral electricity by 2040. This Energy Plan aims to achieve similar goals for West Hartford: **We aspire for our entire community to use 100% clean, renewable energy by 2050.**

While it will be difficult to achieve this vision, it is both achievable – even with today's technology – and realistic – as other cities and states have set similar goals and timelines. There is general consensus that "business as usual" is not an option. Recently, more voices – for youth and climate justice – have joined in demanding action.

By fostering a culture of conservation throughout our community and by making the right choices, West Hartford can address energy and climate change challenges in a meaningful way. Over the last decade, the town has lead by example. With the adoption of this plan, we will move our community forward into a efficient, clean, inclusive, and sustainable future.

West Hartford Clean Energy Commission, June 2020

West Hartford's Energy by Numbers

With about 64,000 residents, West Hartford is the 9th largest town in Connecticut; we also rank 9th in energy use.

The West Hartford Clean Energy Commission compiled data from local utilities and the town's grand list to estimate total community energy use. This use includes: Residential (homes and apartments), Commercial (businesses, including industry and municipal operations), and Transportation (vehicles registered in West Hartford, including municipal and school buses). Details on these estimates can found in Appendix 1.

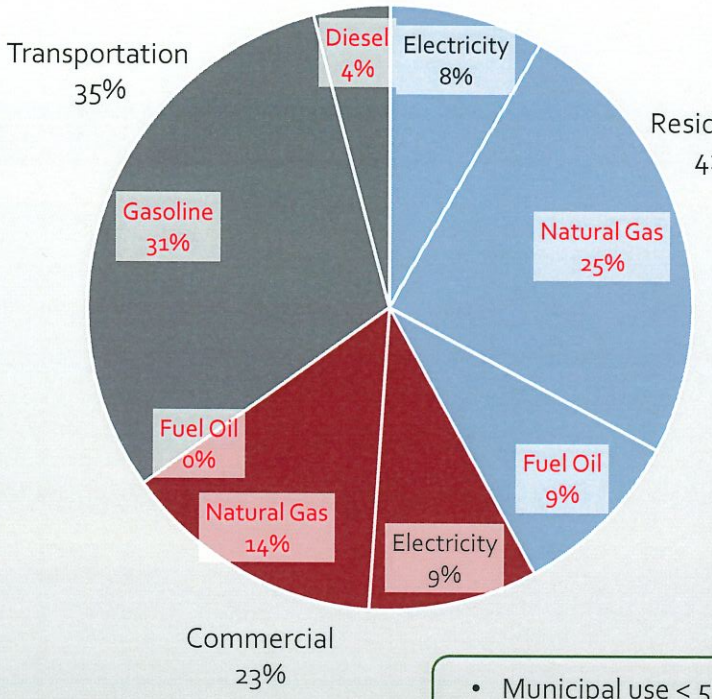
We estimate that in 2019, West Hartford: I still think MMBTU

- Spent $168.5 million on energy, or $2,663 per person.
- Consumed the energy equivalent of 2,181 Gigawatt-hours, or 34,000 Kilowatt hours per person.
- Generated 556,727 tons of greenhouse gases (GHG), or 9 tons per person.

As shown in the pie-chart, two-thirds of West Hartford's energy use is Residential and Commercial, primarily building use, while one-third is Transportation. **Municipal operations account for less than 5% of the total.**

Direct fossil fuel use (red on the pie chart), which is the largest contributor to green house gas emissions and climate change, **accounts for over 80% of West Hartford's total energy use.** Residential and Commercial buildings rely on natural gas and fuel oil for heating. While our Transportation is almost exclusively comprised of vehicles that run on gasoline or diesel. Electricity represents 17% of total energy use.

2019 Total Energy Use = 2,181 GWh



- Municipal use < 5%
- Direct fossil fuel use > 80%

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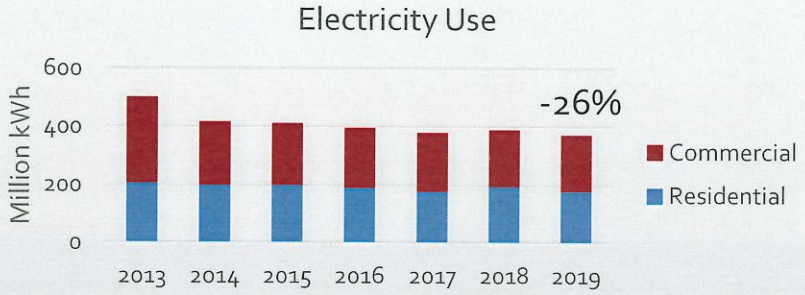
West Hartford's Energy Trends

I feel this section needs to directly address progress on the 2 BIG metrics: 1. Reducing, Produce

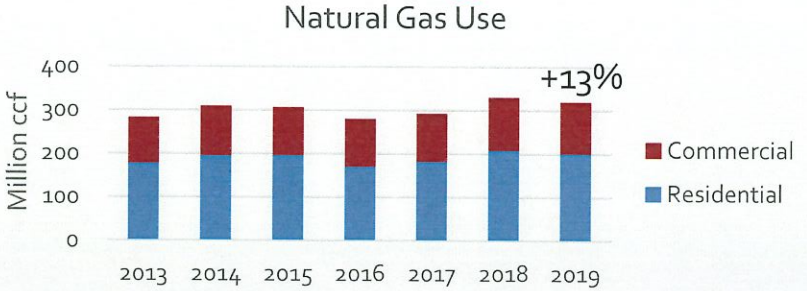
West Hartford has not experienced any major growth or decline recently as a town that would significantly impact energy use. **West Hartford's total energy use is up/down XX% from 2017,** the first time the Clean Energy Commission compiled these numbers

Year	Total Energy Use (GWh	% Change
2013		
2017	2,181 GWh	
2019	2,080 GWh	-4%

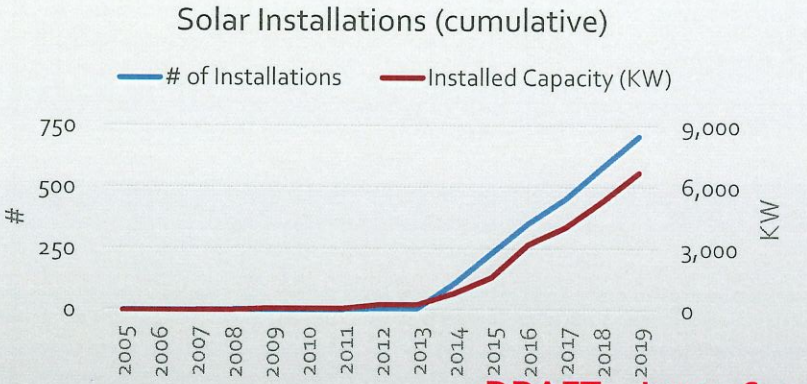
As reported by local utilities, West Hartford's electricity use has declined 26% since 2103 to 369 Million kWh in 2019. Energy efficiency and solar energy, generated and consumed on site, or behind the meter, are likely reasons for this drop. The Commercial sector has seen a bigger drop than Residential.



On the other hand, gas use, has increased 13% since 2013 to 31.7 Million ccf in 2019. Conversions to natural gas are likely one of the drivers behind this increase. Town assessor data indicates an increase of XXX homes heated by natural gas from 2017 (XXXX) to 2019 (xxx). Weather can also impact the annual use of natural gas for heating.



Another notable trend is the rise of solar photovoltaic (PV) installations in the last decade. There are about 700 solar installations in town with total capacity of about 6.7 MW (or 8 Million kWh annually). About 650 West Hartford homes have gone solar. Twelve municipal buildings, including 7 schools, also have solar. Since 2014, West Hartford has been adding just over 100 installations (or 1 MW of capacity) a year. Make just residential



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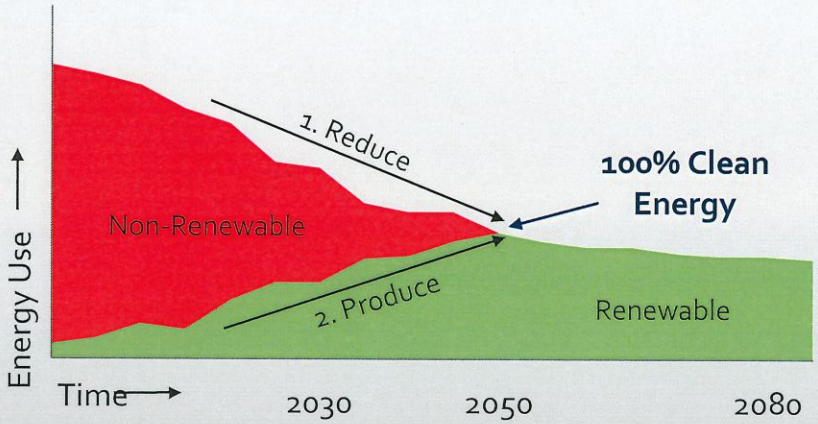
100% Clean Energy by 2050

West Hartford aspires to use 100% clean energy by 2050. The path to 100% clean energy comprises two complementary actions as illustrated in the chart below:

1. Reduce: We must reduce our overall energy consumption dramatically.
2. Produce: We must increase the amount of that energy that is produce by clean, renewable sources.

The goal is to reach a point – 100% Clean Energy – where our new efficient level of consumption is supplied entirely by clean, renewable sources.

Minimizing energy use must be a priority. We estimate that **in order to reach 100% clean energy, West Hartford will need to reduce energy consumption by about 50-60% in roughly 30 years.** This may seem like an impossible task, but, mathematically it represents only a 2.5-3% drop in total energy use per year. Over a five year period, it is a drop of 14%.



Some reductions will be achieved through behavior change or adoption of simple energy efficiency measures like home weatherization or installing LED lights. But, significant reductions will depend on the adoption of new, more transformative technologies to move us away from direct fossil fuel use for building heating and cooling and transportation. For example, electric vehicles have significantly better fuel economy than conventional vehicles and zero tailpipe emissions. Electric heat pumps can deliver efficiency levels of 300% (3 units of heat or every 1 unit of energy) compared to 98% for a condensing natural gas or oil furnace. As we move away from direct fossil fuel use and strategically electrify certain end-uses, we expect the amount of **electricity** we use to increase. It will require policy and planning to ensure reliable infrastructure and capacity is available to support these changes (e.g., EV chargers, a modernized electric grid).

Likewise, our transition to clean energy will not happen overnight. It will involve a range of simpler, short-term solutions, such as the replacement of fossil fuels with greener alternatives, like bio-fuels or fuel-cells, and long-term solutions like the development of storage and a modern "smart" electric grid, powered by distributed local and regional renewable generation like solar, off-shore wind, or other emerging technologies.

The path to 100% clean energy by 2050 will be an evolving journey, but one we must make. Some key elements of this Energy Plan are:

1. Reduce energy use by improving the efficiency of our buildings – public and private.
2. Transition heating and cooling in buildings to more efficient technologies that will enable the use of clean energy
3. Promote alternative mobility (e.g., bike, walk, public transport) and the transition to electric vehicles, including planning for sufficient charging infrastructure.
4. Promote the responsible development of renewable energy in town, including residential rooftop solar, community shared solar, commercial solar and solar carports Geo thermal, solar thermal?
5. Explore and advocate for other clean, renewable energy options both locally and regionally, such as solar, bio-fuels, wind, and a cleaner grid, including collaboration with utilities to modernize our electric grid to enable higher levels of renewables.
6. Ensure that our solutions are inclusive and equitable, serving and protecting the interests of all our residents.

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Approach

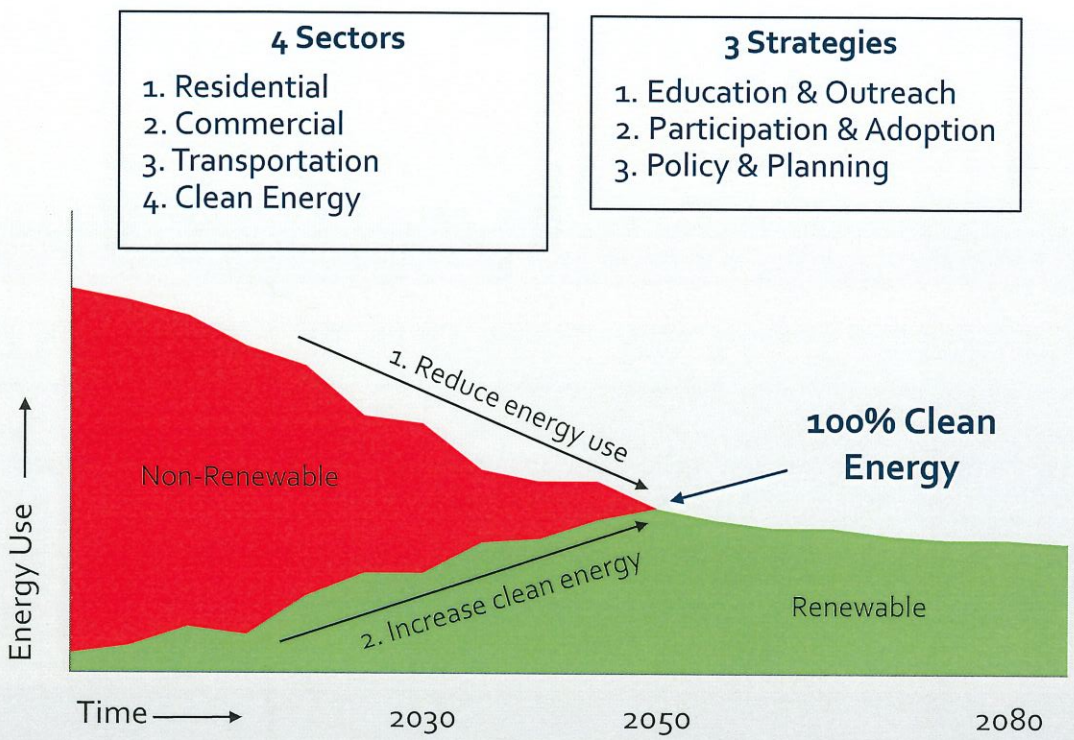
Energy efficiency is sometimes referred to as the "first fuel" because it offers the possibility of reducing energy consumption before turning to the more complex, often more expensive question of energy generation.

To drive down energy use in the **Residential, Commercial,** and **Transportation** sectors, our approach centers on three strategies that are within our power to accomplish:

1. Provide **education** and **outreach** to engage and encourage the community to make responsible energy choices
2. Facilitate and support **participation** in energy programs and services and the **adoption** of new technology and capital improvements
3. Develop and support **policy** and **planning** to ensure an sustainable clean energy future and the infrastructure to support it.

These same three strategies will help facilitate the transition to **Clean Energy**.

We have also selected a handful of indicators for each sector While not comprehensive by any means, these metrics are readily available and we believe will provide insight into our progress towards 100% clean energy by 2050.



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Residential

About 1/3 of our community's energy use is Residential. Some members of our community have trouble paying their monthly utility bills. In 2019, the town's Social Services department processed XXX applications for Energy Assistance.

Many West Hartford homes were built in the 1950-60s and have ample opportunities to improve efficiency. Efficiency can have an immediate impact by reducing energy bills and delivering savings year after year to increase household disposable income or pay off an investment. Many improvements have additional benefits of making a home more comfortable or increasing property value.

A wide range of programs and incentives exist for residents – both home-owners and renters – to make their homes more efficient or purchase energy-efficient equipment and appliances. Additional assistance is available for residents who meet certain income eligibility criteria.

Typically 50% of a household's annual energy use is for heating and cooling. In West Hartford, most homes heat with fossil fuel – natural gas (66%) or fuel oil (31%). A typical residential furnace is about 80-85% efficient; new high-performance one can reach 95-98% efficient. However, an electric air-source heat pump can deliver efficiencies of over 300% – by recovering hot/cold air – allowing homeowners to lower their energy costs, and at the same time, reduce direct fossil fuel use and 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. Heat pumps are capable of both heating and cooling, using the same technology as a refrigerators or air conditioners. Heat pumps can be used alongside existing heating systems to address specific needs and lower cost. They can also be a convenient way to add air conditioning to older homes.

By educating and incentivizing residents to reduce energy needs through common sense efficiency measures, towns can help mitigate the need to increase generation of electricity and expansion of natural gas lines.

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Residential Progress & Goals

Progress-to-Date

- 20% of households participate in EnergizeCT efficiency programs
- LED lightbulb swaps held at libraries and Elmwood CC
- Occasional community presentations and WH-CPTV programming
- Energy Assistance case officer located on-site at town hall

Approach

1. Education & Outreach. Increase energy efficiency awareness via multi-touch, multi-channel messaging. Use website, social media, email, tax inserts, video, events, networking, etc. Consider using multiple languages. Work with partners like Social Services, Housing Authority of WH, WHPS, houses of worship, EnergizeCT, Efficiency for All, utilities, contractors, etc.

2. Participation & Adoption. Promote Home Energy Solutions and other energy programs. Host giveaways or sign-up events. Educate about options/technology like LEDs, EnergyStar appliances or electric heat pumps. Showcase positive examples and stories. Target specific groups such as low-to-income residents, oil-heated homes, new home owners, etc. Identify identify and address barriers (e.g., landlord permission, language, financing)

3. Policy & Planning. Investigate use of municipal building, tax codes to accelerate efficiency. Work towards zero-energy new construction policy. Support and advocate for applicable legislation, including increased funding and wise use of Connecticut Energy Efficiency Funds.

"We are very happy with our decision to install an electric heat pump. We did not have air conditioning before. Our house is more comfortable now, in both the summer and winter. And, while our electric bill has gone up, our natural gas/oil bill is virtually zero. Max?

Benefits

- Lower energy bills
- More comfortable, healthy living environments
- Reduced need for energy generation
- Greater security
- Greater resiliency during extreme weather
- Lower CO_2 and greenhouse gas emissions
- Local job creation

2022 Goals

- 30% of residents participate in EnergizeCT energy efficiency programs
- 10% of residents receive rebates for performing energy retrofits.
- Drop in # of shut-offs/energy assistance applications
- At least 6% drop in residential energy use, including a shift from oil and natural gas to electricity
- X% homes using heat pumps

Long-Term Goals

- 100% of residents participate in programs
- 50% of residents receive rebates
- 0 utility shut-offs
- 50% drop in residential energy use

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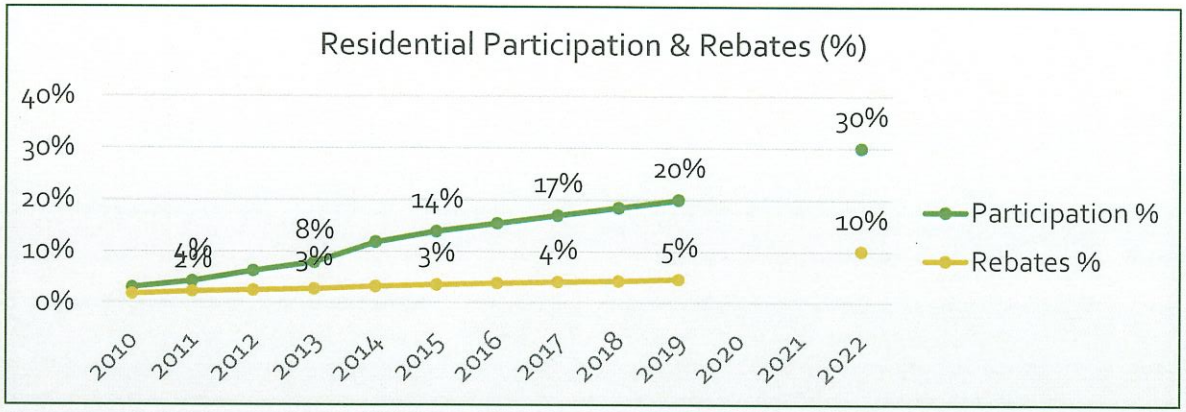
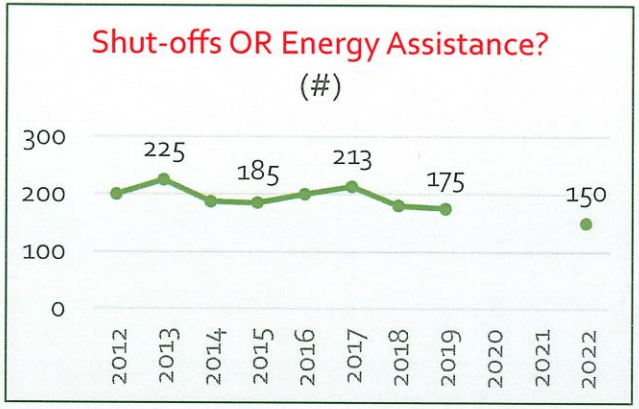
Residential Indicators





1. **Residential Participation** is the % of West Hartford's households that have participated in EnergizeCT energy efficiency programs like Homes Energy Solutions, Home Energy Solutions-Income Eligible and Residential New Construction. Source: EnergizeCT.

2. **Residential Rebates** is the % of West Hartford's households that have received an energy rebate for installing an qualifying project or equipment. This % is lower than Residential Participation, meaning that not all households that participate in an initial home assessment do follow-on energy efficiency projects. Source: EnergizeCT.

3. **Utilty Shut Offs / Energy Assistance** Source: Town of West Hartford, Social Services. Need input #s – made up

Commercial

28% of West Hartford's energy use is Commercial This sector includes retail shopping and services, offices, schools, health care, food establishments, lodging , and others. Any industrial or manufacturing is also counted in Commercial.

The Commercial sector differs from Residential. There are fewer – often larger – properties and fewer owners, including corporations, management companies and the town itself. Building energy systems may be centralized and have high, peak demand at certain times of the day. Space heating is typically natural gas, and represents about 25% of building use. Leases or other contractual arrangements can make it complicated to align the energy and capital improvement interests of owners and tenants.

Like Residential, there are a wide range of energy incentive and financing programs available to commercial property owners to make measures such as lighting, building controls and HVAC upgrades more achievable and profitable. Programs are available for existing buildings and new construction, as well as for regular businesses, non-profits, institutional, and municipal customers. Some projects – like LED lighting – can reduce energy use by over 50% - and pay for themselves quickly, yielding a high return on investment. These shorter-payback measures can be "packaged" with more expensive capital items for more comprehensive energy upgrades.

The town has tried to lead by example, using utility programs to implement over $5 Million of energy efficiency projects across the portfolio of municipal properties in the last 4 years. These projects, including LED interior, exterior, and street lights and building control system upgrades have helped reduce municipal electricity use by 25% and total energy use by 16.5% from 2015-2019.

New commercial development and construction is also an area where the town can .... In 2016, Charter Oak International Academy was rebuilt to LEED Gold green building standards with a geo-thermall/ electric heat pump system for heating and colling nd solar. This schools is the district's top energy perforamce with an energy use idex, or energy use per sf in the the low 30's kBtis/sf.

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Commercial Progress & Goals

Progress To Date

- 28% of businesses participate in EnergizeCT efficiency programs
- 2 C-PACE projects
- Over $5 Million of energy efficiency projects implemented in municipal buildings with savings over $1 Million annually.
- 15% reduction in total municipal energy use since 2013
- Direct mail efforts in partnership with vendors and CT Green Bank

Approach

1. Outreach & Engagement. Increase awareness of programs and benefits. Share results. Use word of mouth and B2B network. Work with partners like Chamber of Commerce, Community Development, neighborhood business associations, CT Green Bank, design professionals, contractors, utilities, etc.

2. Participation & Adoption. Promote Small Business Energy Advantage, C-PACE, LEED, Energy Star, and other commercial energy efficiency or certification programs . Encourage the formation of green teams in buildings and tracking of energy use.. Meet with individual property owners and companies. Identify and address barriers (e.g., financing, privacy). Have local businesses and town share their success stories, projects, and experience.

3. Policy & Planning. Investigate use of municipal building, tax codes, procurement, standards and recognition programs to accelerate efficiency. Work towards zero-energy new construction policy. Advocate for increased funding and wise use of Connecticut Energy Efficiency Funds. Support applicable legislation (e.g., High Performance Building Standards).

"Aiken Elementary School's annual electric use (kWh) has dropped X% since installing LEDs. There is also a noticeable drop in demand. (KW). We are savings about $2000 a month. Our classrooms have brighter, more consistent light, and maintenance cost have virtually disappeared. Results are similar in other buildings. It's a win-win. – Catherine Diviney, Energy Specialist , West Hartford.

Benefits

- Lower energy bills
- More comfortable, healthy working, educational environment
- Reduced need for energy generation
- Greater security and resiliency during extreme weather
- Lower CO_2 and greenhouse gas emissions
- Local job creation
- Enhanced public image

2022 Goals

- 40% business participation in EnergizeCT programs
- 25% reduction in municipal energy use
- At least 6% drop in commercial energy use
- 2 new C-PACE projects

Long-Term Goals

- 100% business participation in EnergizeCT programs
- Multiple C-PACE projects
- 50% drop in commercial energy use, including municipal

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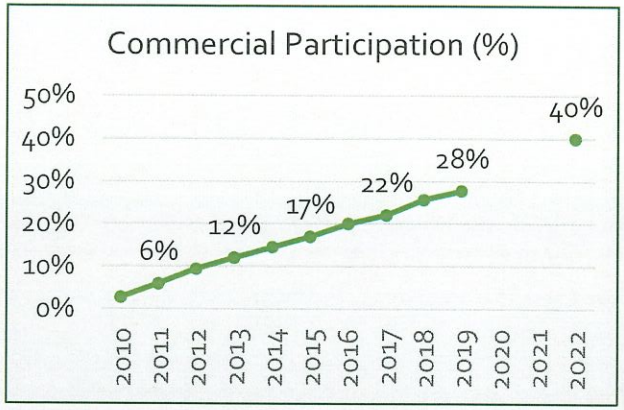
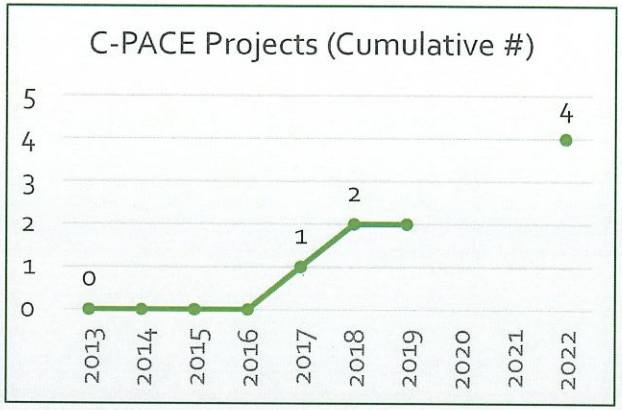
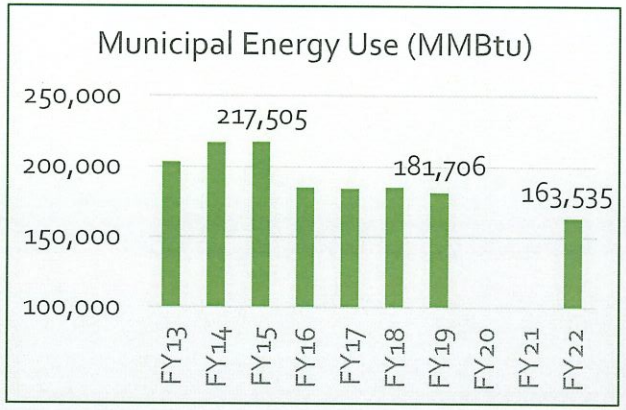
Commercial Indicators



1. **Commercial Participation** is the % of West Hartford's businesses (including municipal) that have participated in any energy efficiency programs. Source: EnergizeCT.



2. **C-PACE Projects** is the cumulative number of C-PACE projects reported by the CT Green Bank. C-PACE (Commercial Property Assessed Clean Energy) is a financing program available to businesses and non-profits to finance energy efficiency and clean energy projects to be repaid through a voluntary benefit assessment placed on their property by the municipality. Source: CT Green Bank



3. **Municipal Energy Use** is the annual energy use of all municipal operations, including town and school buildings, parks & pools, parking lots, and street & traffic lighting. All fuel types (e.g., electricity, natural gas and fuel oil) are converted to a common unit MMBtu. Source: Town of West Hartford, Plant & Facilities Services.

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Transportation

West Hartford's Transportation sector accounts for about 1/3 of our community's energy use. It relies almost entirely on fossil fuels. According to the US EPA, in the last 2 decades, the emissions coming from transportation has grown more than any other greenhouse gas source and is now the largest source of greenhouse gas emissions in the United States.

Decreasing transportation-generated emissions in a community can have an immediate positive effects in ways that other sustainable energy efforts may not.

By designing systems around people, not cars, and encouraging alternative mobility (e.g., walking, biking, public transport), we can improve access, traffic congestion, safety and equity. By supporting non-fossil fuel based transportation (e.g., electric vehicles), we can improve air quality, noise pollution, save money, and transform this sector for the long-term. Policy and planning and infrastructure (e.g., walkways, bike lanes, EV chargers, etc.) are key pieces to support this transformation.

The State of CT's newly released *EV Roadmap* (April 2020) also sites the widespread deployment of electric vehicles in the state as "a key tool in the state's effort to improve air quality for residents while also addressing the climate crisis." Recent satellite data pre and post-COVIDhas shown the massive impact that stay safe stay hmme and the reduction of combustion of fossil fuel / transportation has had on pollution emissions.,.

It is widely believed that by 2022, electric vehicle will cost the same as conventional ones. In addition, studies show that the total cost of ownership, including fuel and maintenance costs is lower.

Currently, the town owns only 2 hybrid cars and no EVs. The town should look to be a leader in cleaning up this sector. The limited range, daily travel patterns of some town vehicles – municipal parking, building inspectors, school buses – ar e ideally suited to EVs. Advocating for electric school buses is a particular issue cornered citizens can get behind to protect the heath and well-being of our children, let alone the planet, from toxic air pollution.

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Transportation Progress & Goals

Progress-to-Date

- Electric Vehicle Day in 2016 and w/ Kingswood Oxford School in 2018
- 8 registered public EV changers; 4 municipal-owned.
- 2% of registered vehicles are EV
- Active Complete Streets program
- Mutli-town RFP for ride-share (scooter) program

Approach

1. Outreach & Engagement. Increase awareness via multi-touch, multi-channel messaging. Use website, social media, email, tax inserts, videos, events, networking, etc. Provide information on benefits (e.g., health, cost of ownership). Consider using multiple languages. Work with partners like Pedestrian Bicycle Commission, Greater Hartford Transport District, WHPS, car dealerships, etc.

2. Participation & Adoption. Promote programs and financial incentives (e.g., CHEAPR, federal tax credits). Leverage grant funds (e.g., VW, DERA) or collective buying opportunities. Host EV demo days and Q&A with owners. Target specific groups like commuters, employers, people looking to replace vehicle, WHPS Board of Ed. Identify and address barriers (e.g., technology, fear, cost of ownership, charging infrastructure)

3. Policy & Planning. Investigate use of work place policies or municipal code to support sustainable mobility options and accelerate adoption of EVs (e.g., bus pass, work-from-home). Support Ped Bike Commission and alternative mobility strategies. Identify infrastructure needs for EVs and non-vehicle transportation (e.g., EV chargers, bike lanes). Incorporate emissions reductions into municipal RFPs and policy (e.g., anti-idling, bio-diesel, electric school buses).

"I was hesitant to buy an electric car because I was scared I would run out of battery and get stranded somewhere. I am so happy, I did! My Bolt is quieter, cleaner, costs less and is more fun to drive. Given the choice, I don't know why anyone would buy a conventional vehicle again." Bernie or Matt,

Benefits

- Lower CO_2 and greenhouse gas emissions
- Improved air quality and health (e.g., asthma)
- Less noise, traffic congestion
- Better fuel economy and financial savings
- Reduced risk of fuel-related environmental spills, leaks
- Increased energy security, reduced dependence on foreign oil
- Walk/bike friendly communities are preferred and can increase property value.

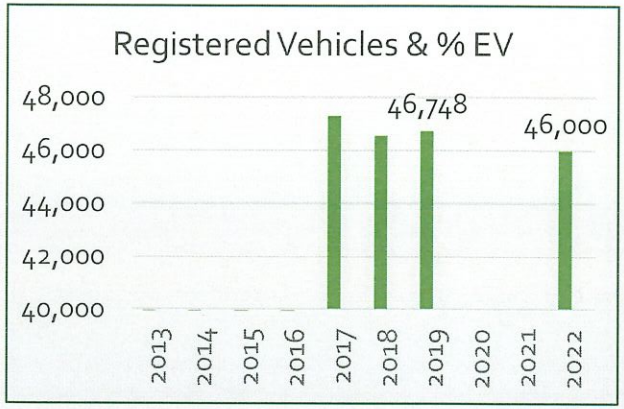
2022 Goals

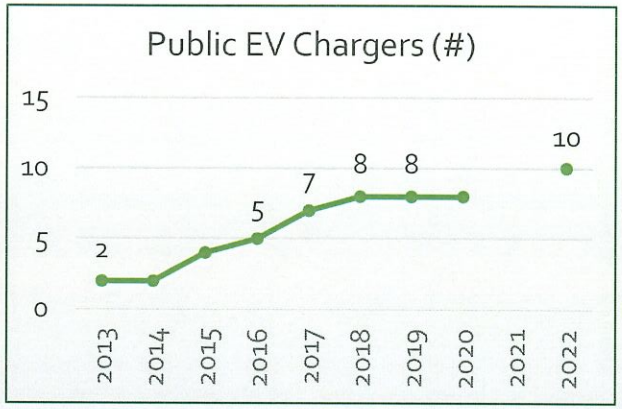
- EV strategy in municipal vehicle fleet plan
- 1 more municipal EV charger
- EV requirements incorporated into school bus RFP (contract expires Aug 2023).
- 10% of registered vehicles are EV; at least 1 municipal EV
- Review/revise municipal policies regarding commuting and work-from-home
- Community ride share program implemented

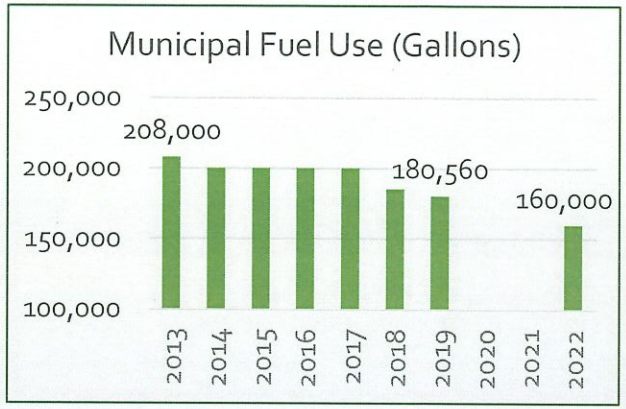
Long-Term Goals

- Fewer vehicles, fewer vehicle miles travelled, less traffic, more people bike/walk
- 100% of vehicles EV or powered by clean renewable energy; including municipal fleet and school busses

Transportation Indicators







1. **Registered Vehicles is the number of vehicles listed on the town's Grand List**, including municipal-owned vehicles. % EV is the portion of those vehicles that are designated with fuel type "electric.".Source: Town of West Hartford, Assessor. (need data)

2. **Public EV Chargers** is the total number of public electric vehicle charging stations that are listed on the US DOE's Alternative Fuel Data Center website, This includes municipal-owned chargers. Details on charger type, fees, and accessibility are available on the website. Source: US DOE, ADFC.

3. **Municipal Fuel Use** is the fuel (gas and diesel) used in municipal fleet, including all municipal and public safety vehicles, that is purchased via gas procurement card. This is the primary method that the town uses to purchase fuel for vehicles. This does not include fuel for school buses, which are under third-party contract. Source: Town of West Hartford, Public Works. (need data), school bus rpt?

1. **# of Registered vehicles**
2. **% of registered vehiles EV**
3. **Gallons of fuel (school buses)**
4. **Municpal gallons - vehicles**

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Clean Energy

People sometimes confuse renewable energy with saving energy. But, renewable or clean energy simply refers to the source of the energy, or how it is generated.

West Hartford has been a US EPA Green Power Partner since 2014. In FY20, 100% of West Hartford's municipal electricity use (about 16 Millions kWh) was renewable. About 650 West Hartford homes have gone solar and 12 municipal or school buildings. In 2016, Charter Oak International Academy was rebuilt to LEED Gold green building standards with geo-thermal and solar. The town also participates in a solar Virtual Net Metering agreement. As the price continues to decline, solar may be an affordable option for many. More households and businesses are looking at solar to stabilize or reduce energy coats and go green. Google's Project Sunroof estimates that West Hartford could support 205 MW of solar, producing 228 Million kWh annually. Other options like shared solar or green power purchases may be available as alternatives to on-site generation.

While the focus is certainly on solar, we cannot forget other technologies and solutions at the local and regional levels: geo-thermal, solar hot water, bio-fuels, and fuel cells, as well as off-shore wind and renewable energy credit (REC) purchases or utility renewable portfolio standards (RPS) to support a cleaner grid.

We also need to re-think the electric grid if we want to encourage more renewables and greater resilience. A key building block of the future will be microgrids, consisting of smaller subsets of distributed power sources and storage, users, wires and controls. Microgrids are capable of operating while connected to the wider grid, or they can "island" to operate separately in the event of an outage. An example of a microgrid could be several key town facilities, a solar array, battery storage and a backup generator. In the future, the grid might consist of a series of interconnected microgrids.

The clean energy industry has evolved and will continue to evolve. Changes in technology, pricing, market conditions, even political and public support will all contribute to where we settle eventually. West Hartford should look for ways to accelerate the use of clean energy in ways that support and enhance local economic, development and equity goals.

Clean Energy Progress & Goals

Progress To Date

- Solarize West Hartford campaign in 2013; Solar for All campaign in 2018
- 718 West Harford homes have solar
- 12 schools and town buildings have solar
- Renewable Energy Credit (REC) purchase in Fy19 = 20% of municipal electricity use

Approach

1. Outreach & Engagement. Increase awareness via multi-touch, multi-channel messaging. Use website, social media, email, tax inserts, videos, events, networking, etc. Consider using multiple languages. Work with partners like CT Green Bank, Clean Water Action, Posigen, contractors, neighborhood groups.

2. Participation & Adoption. Promote residential solar, and C-PACE programs. Educate about financing options and technology. Showcase positive examples and stories, both residents and businesses. Target specific groups such as properties with good exposure, EV-owners, etc. Identify and address barriers (e.g., income perceptions, safety, zoning)

3. Policy & Planning. Investigate use of municipal building, tax codes to accelerate adoption of clean energy. Analyze brownfield sites in town and potential for microgrids. Work towards zero-energy new construction policy. Support state renewable policies like off-shore wind and community shared solar and efforts to modernize the local and regional grid.

Benefits

- Improved air quality and public health due to decrease in pollution from burning fossil fuels.
- Lower CO_2 and greenhouse gas emissions
- Savings or stability on energy bills
- Improved energy independence
- Greater resiliency during power outages
- Creates jobs and economic growth
- Positive community image

2022 Goals

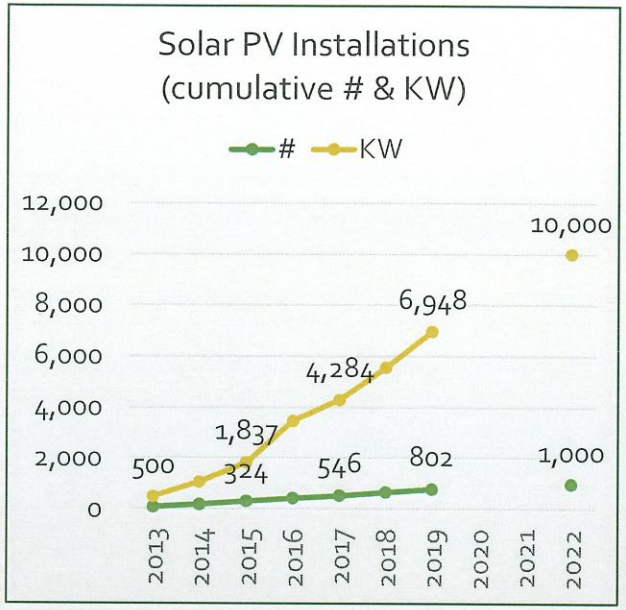
- 1,000 West Harford homes have solar, including low-to-moderate income
- 100% municipal electricity supplied by clean, renewable sources
- Investigate possible microgrid in town
- Asses remaining municipals sites for solar rooftop or carports.

Long-Term Goals

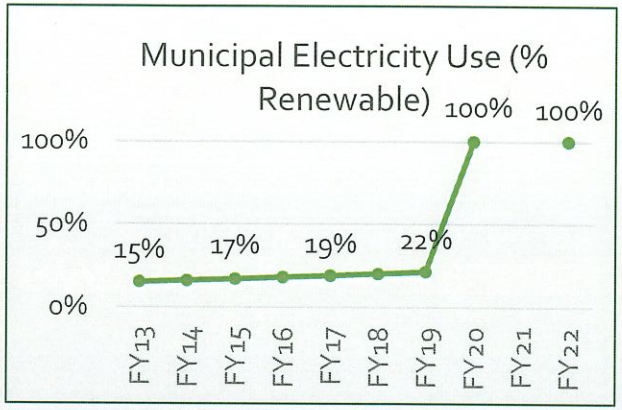
- 100% of West Hartford's energy supplied by clean, renewable sources
- Multiple microgrids in town

"I have had zero problems with my solar panels since they were installed in 2012. I can track how much energy they are producing via a weblink. My electricity bill is now half of what is was. The cost of installing the panels will be paid back in X years. We LOVE that we are able to do something good for the planet." Bernie or Matt,

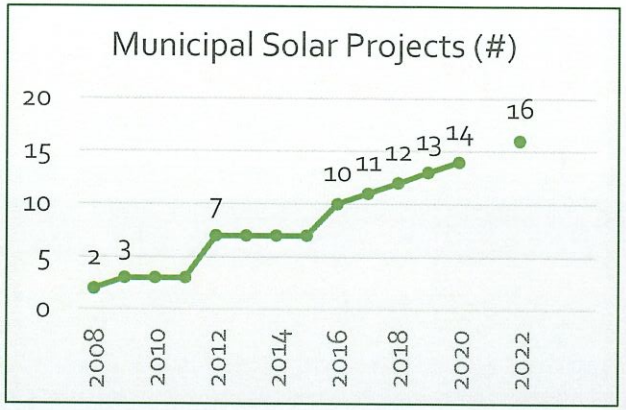
Clean Energy Indicators



1. **Solar PV Installations** is the cumulative number of solar photovoltaic installations and their production capacity (KW AC or DC?) based on utility interconnection agreements – both residential and commercial – reported since 2014. Source: EnergizeCT. (Data prior to 2014 has been estimated and requested from Eversource.) need to confirm data.



2. **Municipal Electricity Use (% Renewable)** is the % of total municipal electricity use that is supplied by clean, renewable sources. Please note: The town does not own the renewable energy credits (RECs) on many of its solar projects; therefore those projects cannot be claimed in this %. The town makes a separate annual Green-e certified REC purchase, which supports this official claim. Source: Town of West Hartford, Plant & Facilities Services.



3. **Municipal Solar Projects** is the number of total projects on-site (installed on municipal properties and schools) and off-site (virtual net metering). Most of these projects are under Power Purchased Agreements and the town does not own the renewable energy credits. As of 2020, these 15 projects total 4.1 MW and produce about 5 Million kWh annually. A list of projects is included in Appendix 2. Source: Town of West Hartford, Plant & Facilities Services.

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Next Steps – Energy Action Plan

2020-2021

1. Adopt resolution to support 100% clean energy and new Energy Plan
2. Give regular updates to Town Council, Public Works & Facilities subcommittee
3. Develop effective network or means of reaching community on energy issues, re-think connection with Sustainable West Hartford.
4. Invite youth/high school representatives on join Clean Energy Commission.
5. Conduct Heat pump education campaign
6. Work with Social Services, to design and implement an energy outreach campaign focused on equity (e.g., low-to-moderate income (LMI) residents)
7. Conduct outreach for the RF100 campaign – goal of 2021 adoption
8. Explore desire to create broader Sustainability Plan, Climate Action Plan, greenhouse gas inventory, (including Transportation and Waste/Materials Magement) with Town Council, and other appropriateCommissions.
9. Secure request from Town Council for a greenhouse gas inventory or Climate Action Plan?
10. Hold or partner on an electric vehicle event.
11. Support focus on energy efficiency and clean energy industry and jobs as part of economic stimulus and growth
12. Recruit group to implement Electric School Bus Toolkit (WHPS transportation RFP 2022)

Municipal-specific

1. Revamp town's clean energy website.
2. Disseminate quarterly communication on building performance
3. Work with Recycling Coordinator, quarterly meetings with schools
4. Review schedule of upcoming municipal capital improvement projects in conjunction with energy data
5. Analyze interval energy use of town buildings; develop plan to reduce peak demand
6. Update municipal fleet plans to include strategy for electrification and/or emissions reductions (e.g., bio-diesel).
7. Additional municipal solar or virtual net metering projects
8. Achieve Sustainable CT silver certification

Next

1. Join Sierra Club's Ready for 100 campaign.
2. Investigate potential for a microgrid in town
3. Consider implementing Community Choice Aggregation
4. Work with town staff and zoning and planning commissions to promote solar, heat pumps and EV-readiness in new construction.
5. Conduct Energy Star appliance or product campaign.
6. Explore how efficiency and clean energy adoption could be accelerated through municipal policy, building and/or tax codes
7. Pass municipal resolution or adopt policy zero-energy new construction be net zero.
8. Inventory brownfields for alternate use
9. Conduct residential Home Energy Audit (HES) audit campaign.
10. Restart Small Business Energy Advantage (SBEA)
11. Promote C-PACE financing of commercial projects
12. Top-ten sustainable things campaign.
13. Conduct solar campaign, including community discussion of responsible and sustainable solar development in town and options available for all.
14. Promote alternative mobility options to reduce vehicle mile travelled,
15. Collaborate with other commissions to complete a Greenhouse Gas Inventory

Municipal-specific

1. Retrofit a town building – at least in part - with a heat pump and monitor results for future installations. (King Phiilip and COIA are heat pump.)
2. Reinstate WHPS Energy Challenge or explore additional ways to reduce municipal energy use – e.g., treasure hunts, night audits, town vs. town energy competition, project fund
3. Develop a Sustainable Purchasing Policy
4. Expand GIS and anti-addling policies to reduce mile travelled and fuel use in municipal fleet
5. Complete assessment of EV charging infrastructure and needs

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Appendix 1

2017 West Hartford Energy Benchmark

	Unit	Commercial	Residential	Total
Natural Gas	**CCF**	**10,575,622**	**18,466,160**	**29,041,782**
Transport	**Gallons**	**2,656,947**	**19,928,564**	**22,585,511**
Oil Heat	**Gallons**	**0**	**4,955,922**	**4,955,922**
Electricity	**KWh**	**196,807,199**	**179,238,436**	**376,045,635**
Natural Gas	**GWh**	**307**	**536**	**842**
Transport	**GWh**	**90**	**672**	**761**
Oil Heat	**GWh**	**0**	**202**	**202**
Electricity	**GWh**	**197**	**179**	**376**
Total	**GWh**	**593**	**1,588**	**2,181**
Natural Gas	**GHG - tons**	**61,920**	**108,119**	**170,040**
Transport	**GHG - tons**	**26,038**	**195,300**	**221,338**
Oil Heat	**GHG - tons**	**-**	**55,506**	**55,506**
Electricity	**GHG - tons**	**57,487**	**52,356**	**109,843**
Total	**GHG - tons**	**145,446**	**411,281**	**556,727**

Notes

Natural gas and electricity data provided by Energize CT. Municipal data is provided by Dept of Plant & Facilties Services. Oil is estimated using data from the West Hartford 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:

- $1.25 per CCF natural gas
- $2.80 per gallon heating fuel
- $3.00 per gallon propane
- $2.80 per gallon gasoline
- $0.18 per KWh electricity

Prepared by: Bernard Peletier, WH Clean Energy Commission and PACE.

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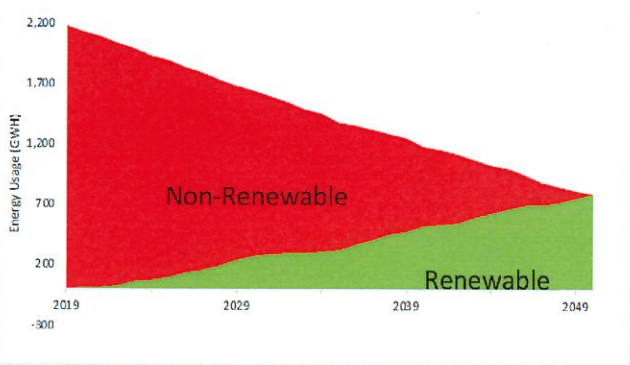
Include Waterfall chart?

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

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

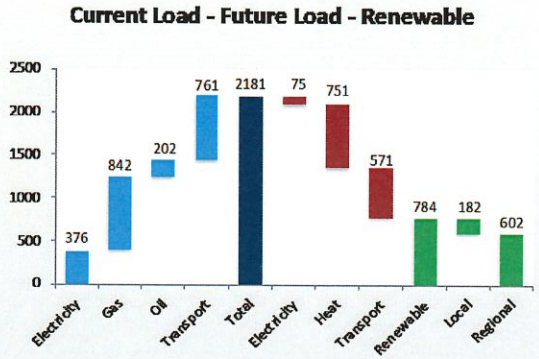
These complementary actions are visible in the declining overall consumption and increasing renewables in the chart below.



The key elements of this energy plan are:

1. Reduce our energy usage by improving the efficiency of our buildings, both public and private.
2. Transition heating and cooling to high-efficiency heat pumps.
3. Promote the responsible development of renewable energy in town, including residential rooftop solar, community shared solar, commercial solar and solar carports. For remaining energy needs, pursue regional solutions and advocate for a cleaner grid.
4. Promote public transportation and the transition to electric vehicles through various measures, including planning for sufficient charging opportunities.
5. In collaboration with Eversource, modernize the local electric grid to enable higher levels of renewable energy

The chart below is another way of visualizing West Hartford'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, West Hartford aims to reduce energy consumption by over half in roughly thirty 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.

West Hartford's 2050 energy target can be achieved through modest annual reductions of 3.4% per year. **Based on our initial analysis, we are selecting a 3.5% annual reduction target for all town sectors: residents, businesses and municipality. Over a five-year period, the targeted reduction is therefore 17.5%.** As our analysis of the town's energy usage develops, we may differentiate this target by sector and year. Together with the Dept. of Public Works, the Clean Energy Task Force will monitor town energy usage using existing data and update this analysis annually.

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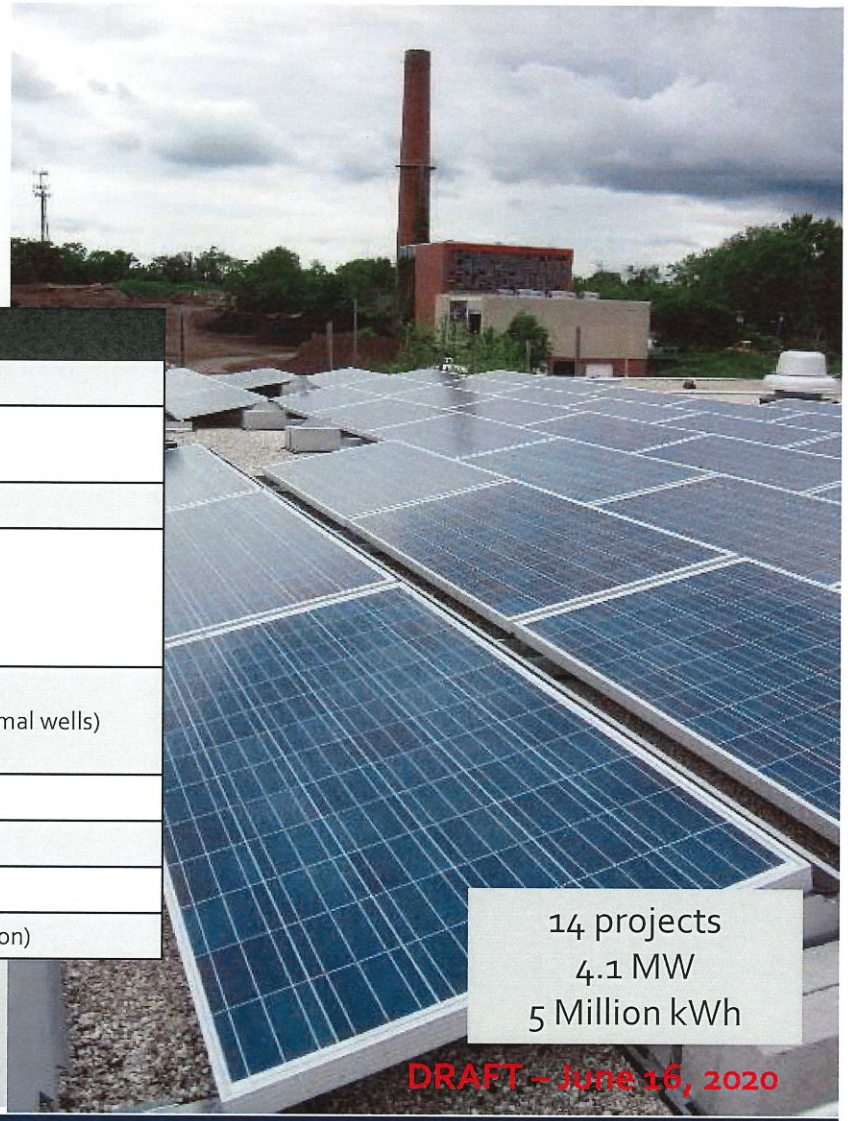
Appendix 2

Town of West Hartford Solar Projects

Year	Site	Size (KW DC)
2006	Town Hall	3 KW (removed)
2008	Hall HS Conard HS	3 KW 3 KW
2009	Bristow MS	95 KW
2012	Department of Public Works Bishops Corner Library Wolcott ES Conard Green Energy Lab	102 KW 58 KW 11 KW demonstration
2016	Westmoor Park Charter Oak International Academy Conard HS	5 KW 100 KW (also 64 geothermal wells) 357 KW
2017	Aiken ES	238 KW
2018	Off-Site (Thompson, CT) – Virtual Net Metering	2,400 KW
2019	Town Hall	129 KW
2020	King Philip MS	515 KW (under construction)



14 projects
4.1 MW
5 Million kWh

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Page 2 – NOAH.
Page 3 – CDC.
Page 4 – Ronnie Newtown/WeHa.
Page 9 – Energy; Realtor.com
Page 12 –
Page 15 –
Page 18 –

Resources

Residential

- www.EnergizeCT.com (Your Home)
- www.CTGreenBank.com

Commercial

- https://www.energizect.com/your-business (Your Business)
- www.CTGreenBank.com
- www.C-PACE.com
- www.

Transportation

- EVConnecticut (CT DEEP)
- Electric School Bus Toolkit (Live Green)
- https://portal.ct.gov/DEEP/Air/Air

Clean Energy / Renewables

- www.GoSolarCT.com
- www.EnergizeCT.com (Residential Solar Investment Program)
- https://portal.ct.gov/DEEP/Energy/Energy (CT's Energy Agenda)

TOWN OF WINDSOR
First in Connecticut. First for its citizens.

Citizen Advisory Task Force on Clean and Sustainable Energy
VIRTUAL MEETING
September 16, 2020
Special Meeting

UNAPPROVED MINUTES

1. CALL TO ORDER

Town Manager Souza called the meeting to order at 7:00 p.m. Present were Committee Members; Neil Chaudhary, Jeffrey Dyreson, Barbara Peyton, George Slate, Pamela Stratton, Eric Weiner, and Elizabeth Yetman.

Staff: Peter Souza, Town Manager; Scott Colby, Assistant Town Manager

2. INTRODUCTIONS

The task force was introduced to one another and to staff.

3. PUBLIC COMMENT – None

4. OVERVIEW OF COMMITTEE'S RESPONSIBILITY AND CHARGE

Town Manager Souza reviewed the task forces charges, information pertaining to the Freedom of Information Act (FOIA), and logistics of the meetings.

Task force members asked questions regarding the logistics.

5. SELECTION OF CHAIRPERSON, VICE-CHAIRPERSON, & SECRETARY

Town Manager Souza reviewed the roles and responsibilities for each position.

The task force unanimously decided that they needed more time to decide on this item.

MOVED by Mr. Slate and seconded by Mrs. Stratton to table this item until the next meeting.

Motion Passed 7-0-0

6. DISCUSS POSSIBLE FUTURE AGENDA TOPICS AND SET NEXT MEETING DATE

Town Manager Souza proposed some ideas of possible future agenda items. Each of the task force members also provided input as to what items they would also like to include on the next agendas.

Staff will work on coordinating with the task force members their availability to schedule the next two meetings and preparing the agenda.

7. ADJOURNMENT

MOVED by Mr. Slate and seconded by Mrs. Stratton to adjourn the meeting at 8:33 p.m.

Motion Passed 7-0-0

Respectfully Submitted,

Scott W. Colby Jr.
Assistant Town Manager