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!

TABLE OF CONTENTS

MIDDLETOWN ENERGY PLAN

INTRODUCTION AND OVERVIEW

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

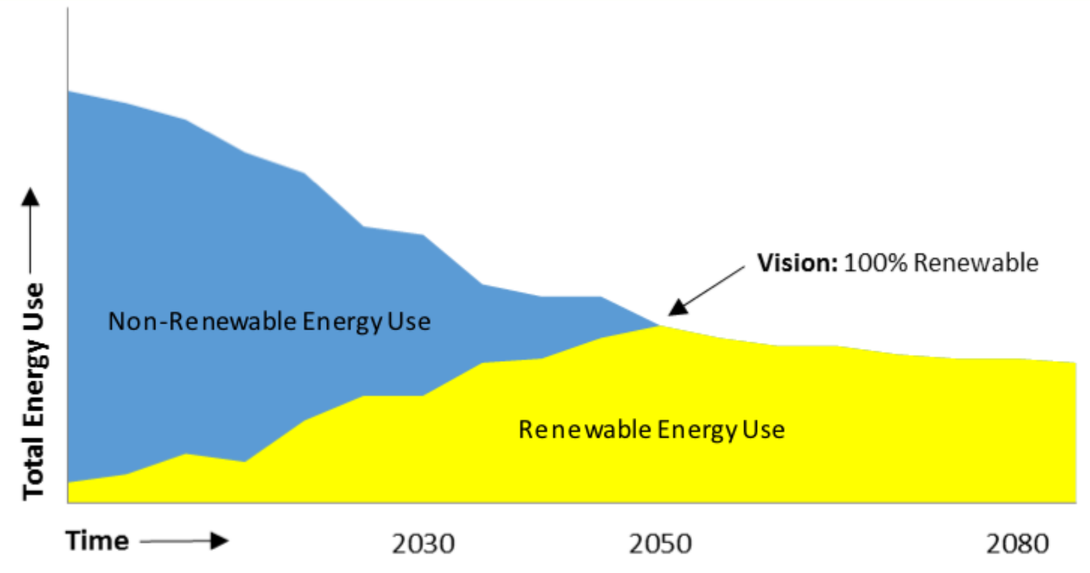
SECTION I:

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%

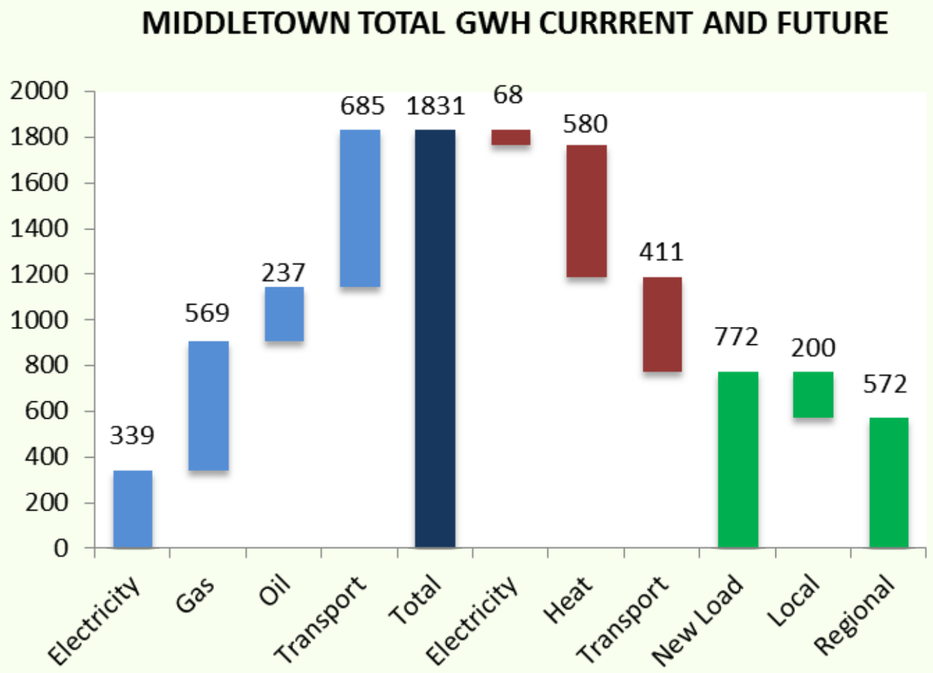
*2017 data was erroneous; this table assumes no change from 2017 to 2018

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

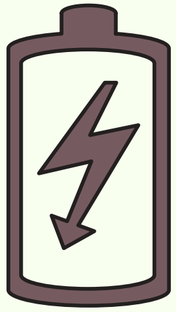
The above discussion applies to both the Municipal sector and the Residential/Business sectors, both of which are discussed below in their respective sections. These sections will address the application of the City's vision of an energy future, and how to achieve it through goal-setting, policy, energy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

SECTION II

MUNICIPAL APPROACH

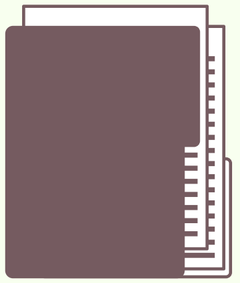
SECTION II:
MUNICIPAL APPROACH

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

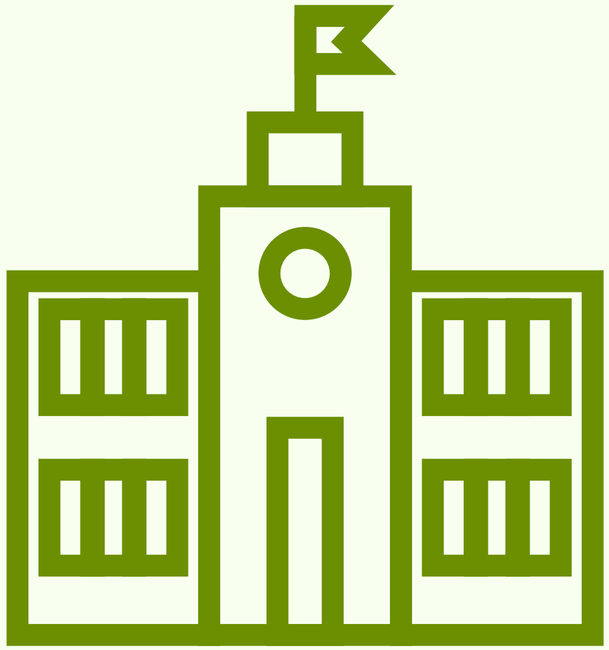
The generation portion of the City's electric costs includes transmission costs – the space on the large transmission system that brings electricity into the local distribution system. The transmission costs are administered through a characteristic unique to each customer called its "captag." The captag 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

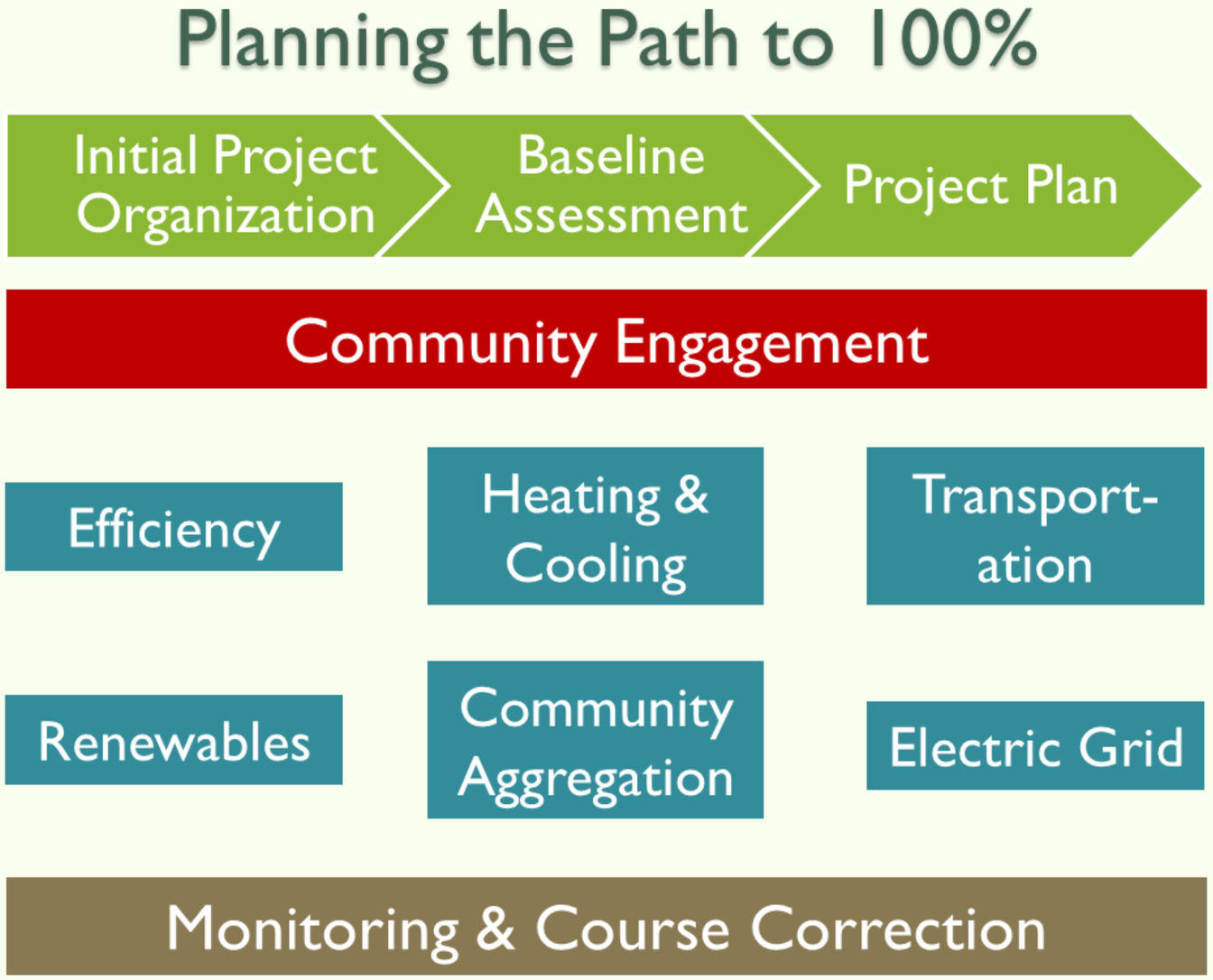
SECTION III:
RESIDENTIAL AND BUSINESS SECTOR APPROACH

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

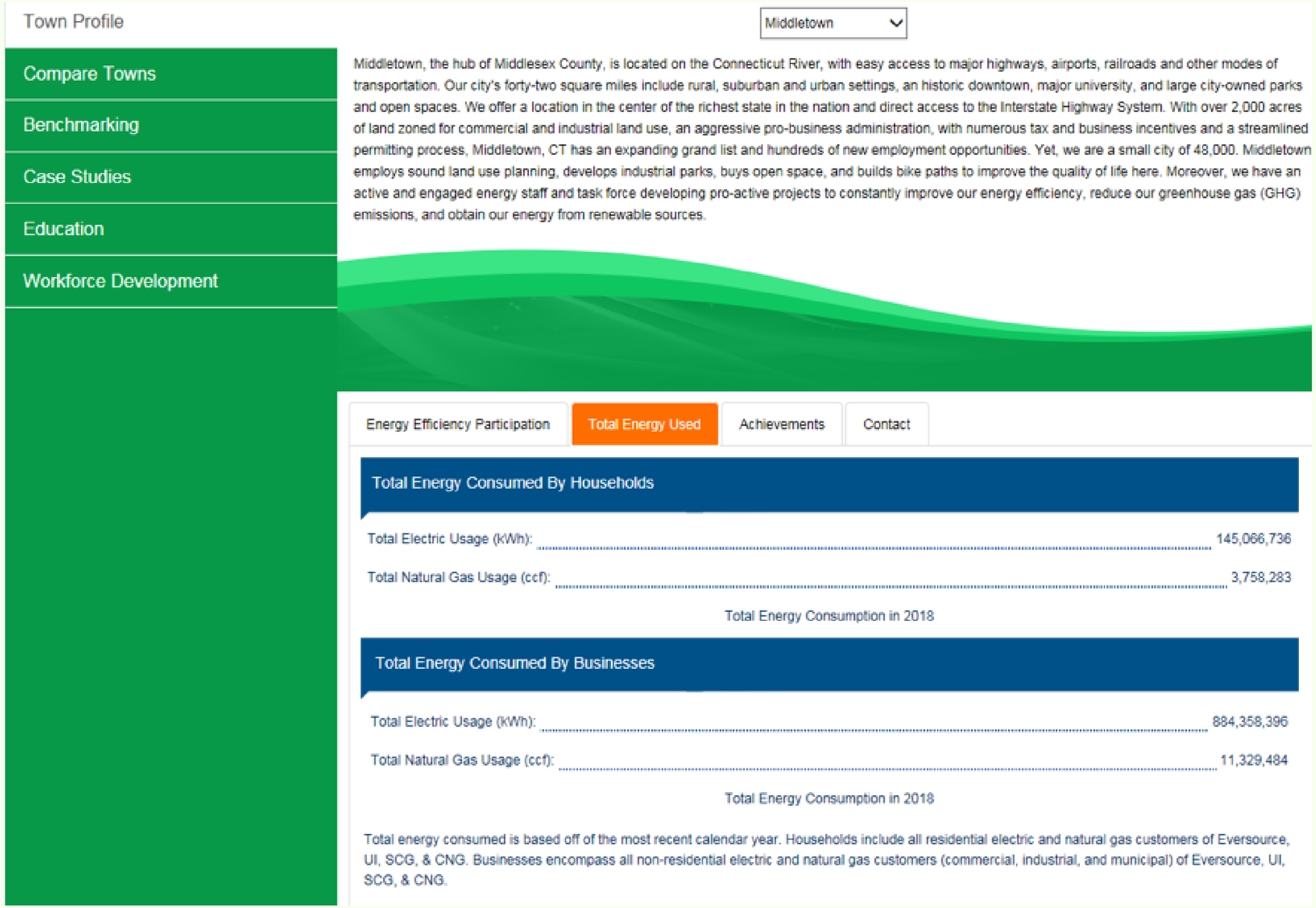


Figure 3.
Clean Communities Screen Shot

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