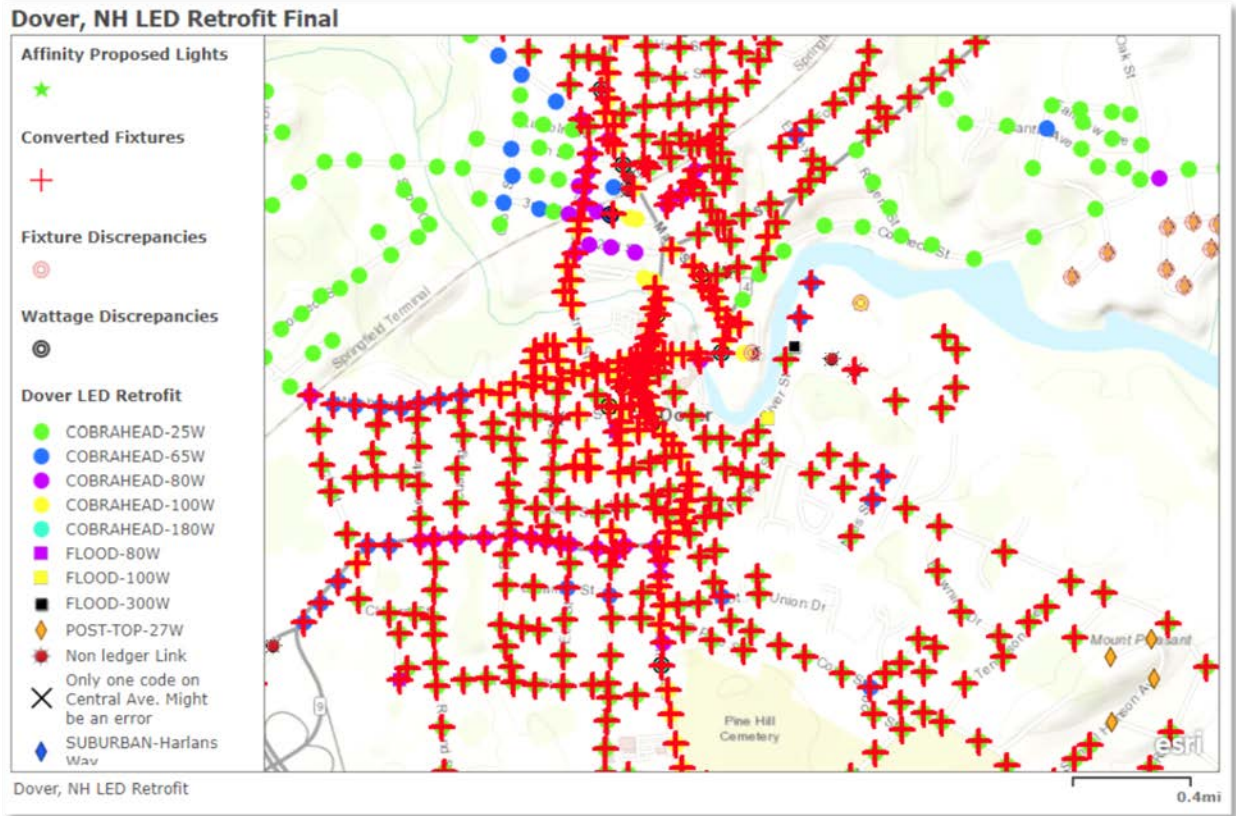


# Dover Energy Commission Annual Report



Dover's Smart Street Light LED Retrofit as of 11/22/2017

# **Dover Energy Commission**

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# Mission Statement

The Dover Energy Commission shall advise the City through its boards and committees on ways to reduce energy use, develop alternative energy sources and increase economic security and energy independence. The goal of the Energy Commission is to promote and encourage energy conservation measures for Dover residents, businesses and municipal operations. The Commission will work with the City Council to review current energy efficiency practices and possible future actions. The Commission's work will be available to the Planning Board as a resource with respect to energy consideration in the next Master Plan Update.

# Executive Summary

This updated report contains data from the last three years describing municipal energy use and its cost, as well as some potential means to lower those costs.

Major efforts by the Commission over this past year focused on Energy Conservation, Alternate Energy sources and the benefits of Distributed Energy Generation and Energy Use Management.

The Commission worked on two initiatives to bid the installation of Solar Photo Voltaics (PV) on the new High School and the Transportation Center. We are actively considering other possibilities if these are successful.

In collaboration with the Seacoast Energy Hub, which is part of a state network of six regional energy groups, the City and the Commission were major participants in the first round of the "Energize 360" campaign, a community-led effort among local energy leaders to encourage residents to measure, reduce and use renewable energy.

The Commission also recommended to the Dover City Council a resolution supporting exploration of an important energy source, off-shore wind, which was adopted by the Council.

The Commission received input from concerned citizens and groups at many of its meetings during the year. These conversations provided valuable information about the concerns of our citizens and the possibilities for concerted action to improve our energy consumption footprint.

The Commission toured the manufacturing facility of Affinity LED Lighting in the Washington Street Mills, the supplier for the City's Light-Emitting Diode (LED) streetlight retrofit.



# City of Dover Energy Use

## Buildings, Facilities and Lighting

To understand energy usage and associated costs, the Energy Commission has analyzed energy use provided by municipal and school Finance departments. The Finance departments maintain spreadsheets that track data from monthly billing statements for usage and cost of the electricity, natural gas, propane, heating oil and diesel fuels that are used in city buildings and facilities. The School Department (SAU 11) and other Municipal Departments contract separately with energy providers, and these contracted rates may differ from each other.

Although each form of energy is billed differently — electricity in kilowatt-hours, natural gas in therms, liquid propane and heating oil in gallons — we can normalize their usage on a comparable basis by converting these units to a single measure. A common practice in the industry is to use British Thermal Units (BTU), a measure of the heat content of a fuel. For large quantities, we use MMBTU, or millions of BTU.

For this report, all data is reported on a July-to-June fiscal year basis. FY2016 runs from July 2015 through June 2016.

During FY2016, the energy source with the largest percentage of the total cost was electricity with 83%. Natural gas was the second largest with 12% of the total cost (Figure 1). However, when looked at from the perspective of units of energy use (Figure 2), natural gas and electrical use were nearly equal. This is explained in Figure 3, which depicts Dover's FY2016 cost per MMBTU for the various energy sources.

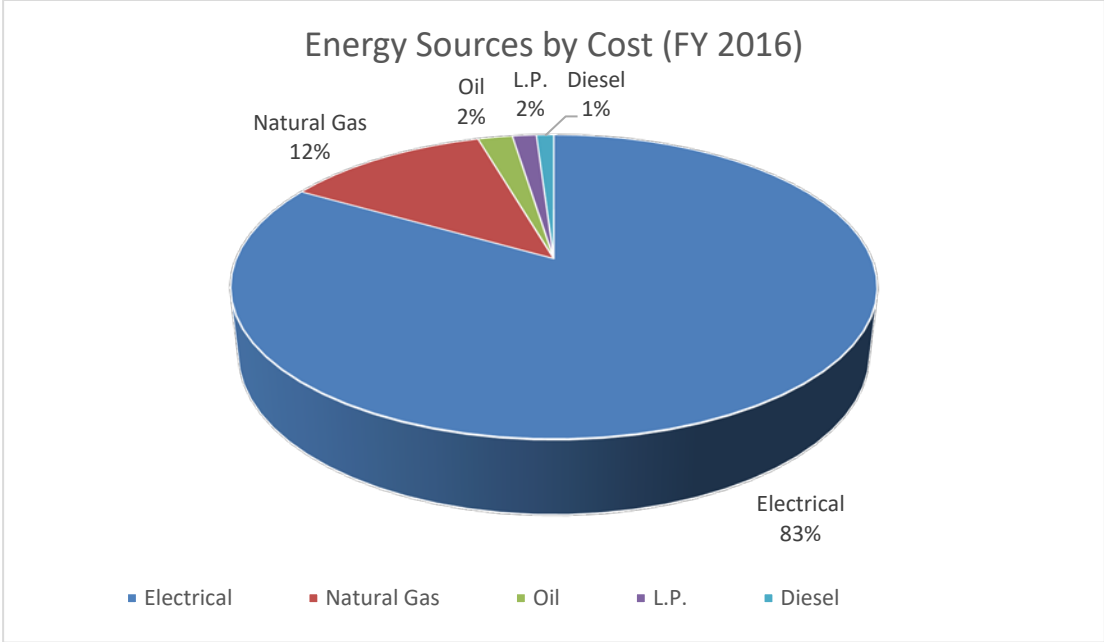


Figure 1 (based on Finance Department data)

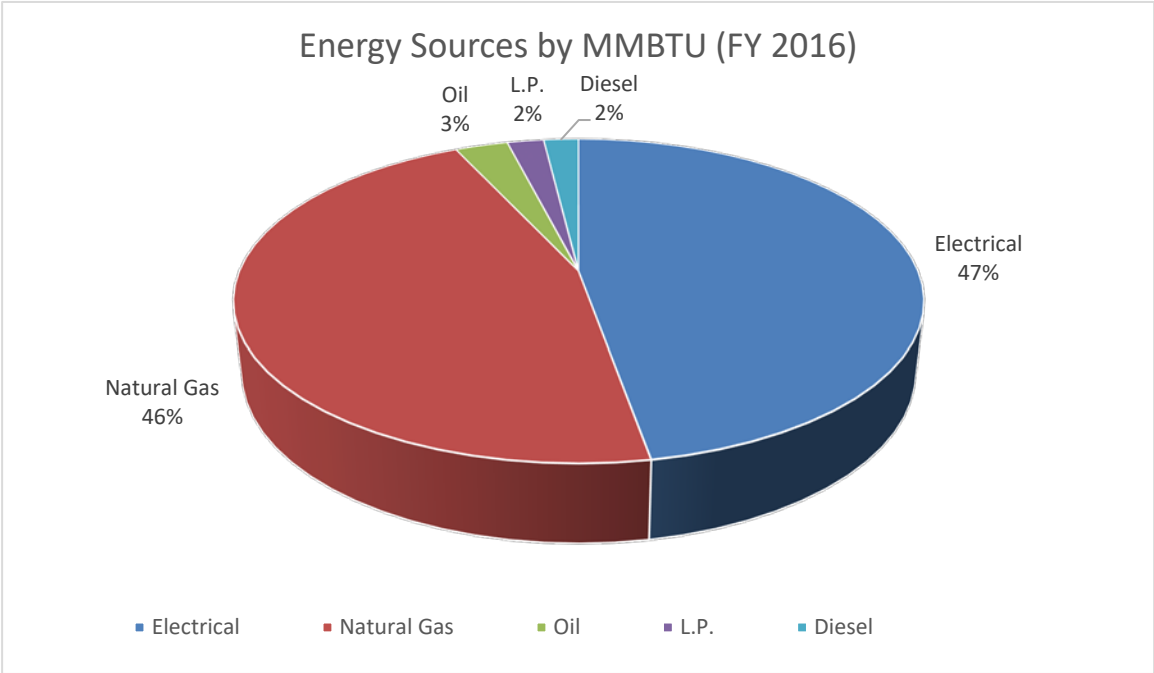
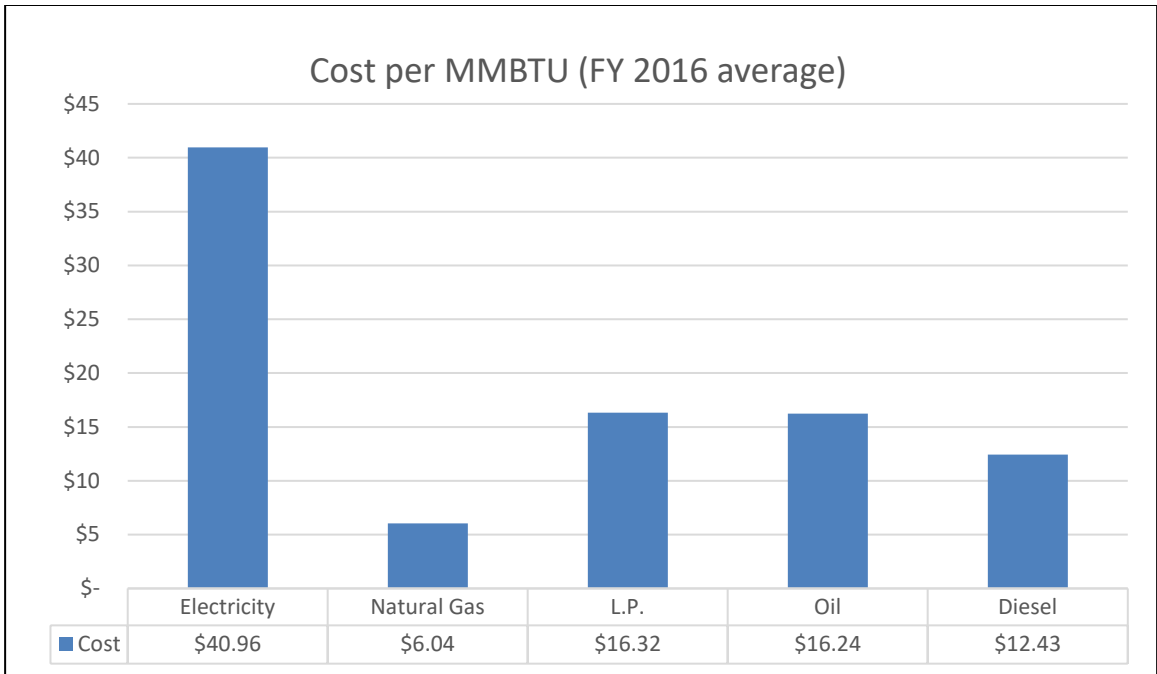


Figure 2 (based on Finance Department data)





*Figure 3 (based on Finance Department data)*

The breakdown of energy use by municipal facility is shown in the following tables for all energy sources.

Table 1 — FY2016 Electrical Power Building/Facility Detail

<b>Electric Power</b>	<b>kwh</b>	<b>Cost</b>	<b>MMBTU<sup>1</sup></b>
Water Treatment Plant/Pumping Stations	4,648,405	\$583,614	15,861
Street/School/Traffic Lights <sup>2</sup>	862,419	\$281,204	2,943
Dover High School	1,615,335	\$201,019	5,512
Dover Middle School	1,472,042	\$188,559	5,023
Ice Arena	1,407,856	\$172,369	4,804
McConnell Center	859,200	\$108,321	2,932
Woodman Park Elementary School	691,431	\$90,605	2,359
Garrison Elementary School	400,641	\$53,851	1,367
Horne Street Elementary School	329,692	\$50,651	1,125
General Government Buildings	375,524	\$49,237	1,281
Indoor Pool	330,785	\$41,606	1,129
Parking Lots	322,923	\$41,023	1,102
Facilities & Grounds	292,479	\$38,089	998
Fire Department	256,492	\$33,289	875
Library	100,560	\$14,275	343
Jenny Thompson Pool	63,270	\$9,846	216
Parks & Recreation	35,009	\$6,641	119
Cemeteries	11,817	\$2,874	40
Mast Road Recycling Center	2,298	\$584	8
<b>Grand Total</b>	<b>14,078,179</b>	<b>\$1,967,657</b>	<b>48,037</b>

<sup>1</sup> One kWh (kilowatt-hour) is equivalent to 0.0034124 MMBTU.

<sup>2</sup> Street lights are tariffed based on predicted use, based on number and type of lights, not on actual use.

Table 2 — FY2016 Natural Gas Building/Facility Breakdown

<b>Natural Gas</b>	<b>Therms</b>	<b>Cost</b>	<b>MMBTU<sup>3</sup></b>
Ice Arena	47,954	\$44,119	4,795
Indoor Pool	41,907	\$39,288	4,191
McConnell Center	36,667	\$38,245	3,667
Dover High School	84,765	\$29,572	8,477
271 Mast Road / DPW	14,019	\$16,685	1,402
Dover Middle School	54,494	\$14,664	5,449
Woodman Park	40,767	\$11,567	4,077
Garrison School	39,366	\$11,213	3,937
Career Technical Center	38,452	\$11,091	3,845
110 Portland Ave / Outdoor Pool	9,407	\$11,035	941
262 Sixth Street / NE Station	8,306	\$10,663	831
73 Locus Street / Library	8,117	\$10,305	812
46 Chestnut Street / Police Garage	9,644	\$9,569	964
Horne Street School	24,161	\$7,762	2,416
Lowell Ave. Water Bldg 2	3,974	\$4,513	397
9 Broadway / Central Fire Station	2,812	\$3,650	281
Dover Alternative School	5,793	\$1,875	579
Charles Street Pump Station	654	\$1,474	65
Back River Road / Veterans Building	691	\$1,458	69
46 Locust St (Jul15-Mar16)	717	\$1,354	72
Storage Building (Schools)	2,537	\$1,276	254
31 Sullivan Dr. Bldg Pump House Lot 1	446	\$1,216	45
Transportation Center	347	\$1,175	35
110 Portland Ave / Pool House	191	\$999	19
16 Lowell Ave	137	\$962	14
Mill Street	25	\$833	2
66 Mast Road Pump Station	unknown	\$809	NA
46 Locust St - City Hall (Apr16-Jun16)	157	\$354	16
South End Fire Station	12	\$325	1
<b>Grand Total</b>	<b>476,519</b>	<b>\$288,054</b>	<b>47,652</b>

<sup>3</sup> One therm is equivalent to 0.1 MMBTU.

Table 3 — FY2016 Propane Building/Facility Breakdown

<b>Propane</b>	<b>Gallons</b>	<b>Cost</b>	<b>MMBTU<sup>4</sup></b>
Griffin Well	6,011	\$8,956	549
South End Fire Station	4,705	\$7,011	430
French Cross Rd. Water Treatment Plant	2,410	\$3,591	220
Ice Arena/ Vehicle Fuel	2,368	\$3,528	216
Wastewater Treatment Facility	1,701	\$2,534	155
Recreation (River St)	1,004	\$1,495	92
Hughes Well	759	\$1,131	69
Smith Well	741	\$1,104	68
Watson Road (Sewer)	569	\$848	52
Calderwood Well	434	\$647	40
Crosby Road (Sewer)	403	\$601	37
Mt Pleasant/Henry Law/Back Rd (Pump Station)	289	\$431	26
Brickyard/Isaac Lucas Cir (Pump Station)	250	\$372	23
Ireland Well	247	\$369	23
Campbell Well	247	\$368	23
Islinglass River (Pump Station)	192	\$285	18
County Farm Road (Pump Station)	171	\$255	16
Pub Works/Recycle	162	\$241	15
Cummings Well	89	\$133	8
Leighton Way (Pump Station)	9	\$13	1
Boston Harbor Road (Pump Station)	7	\$10	1
<b>Grand Total</b>	<b>22,766</b>	<b>\$33,922</b>	<b>2,079</b>

<sup>4</sup> One gallon of liquid propane is equivalent to 0.091 MMBTU.

Table 4 — FY2016 #2 Heating Oil Building/Facility Breakdown

#2 Heating Oil	Gallons	Cost	MMBTU <sup>5</sup>
City Hall	10,909	\$24,545	1,511
484 Middle Road -Wastewater Treatment Facility	8,000	\$18,000	1,108
Pine Hill Chapel	1,312	\$2,951	182
Pine Hill Cemetery	1,044	\$2,348	145
Bellamy Park Administrative Building	394	\$887	55
<b>Grand Total</b>	<b>21,659</b>	<b>\$48,732</b>	<b>3,000</b>

Table 5 — FY2016 Diesel Fuel Building/Facility Breakdown

Diesel	Gallons	Cost	MMBTU <sup>6</sup>
Fleet Services / 277 Mast Road	12,017	\$19,825	1,651
Sewer / 60 River Street	653	\$1,644	90
Sewer / Varney Brook	808	\$1,336	111
Sewer / Piscataqua	227	\$634	31
Wastewater Treatment Facility / 484 Middle Road	393	\$619	54
PD Station & Garage / 46 Chestnut	317	\$556	43
<b>Grand Total</b>	<b>14,415</b>	<b>\$24,615</b>	<b>1,980</b>

Note: The above diesel accounts do not include fuel used for municipal vehicles.

<sup>5</sup> One gallon of #2 Heating Oil is equivalent to 0.1385 MMBTU.

<sup>6</sup> One gallon of Diesel Fuel is equivalent to 0.137381 MMBTU.

The mix of energy sources measured by cost over the previous three fiscal years has risen slightly, driven almost exclusively by electricity costs. Electricity has become an even larger share of the total (Figures 4 and 5.)

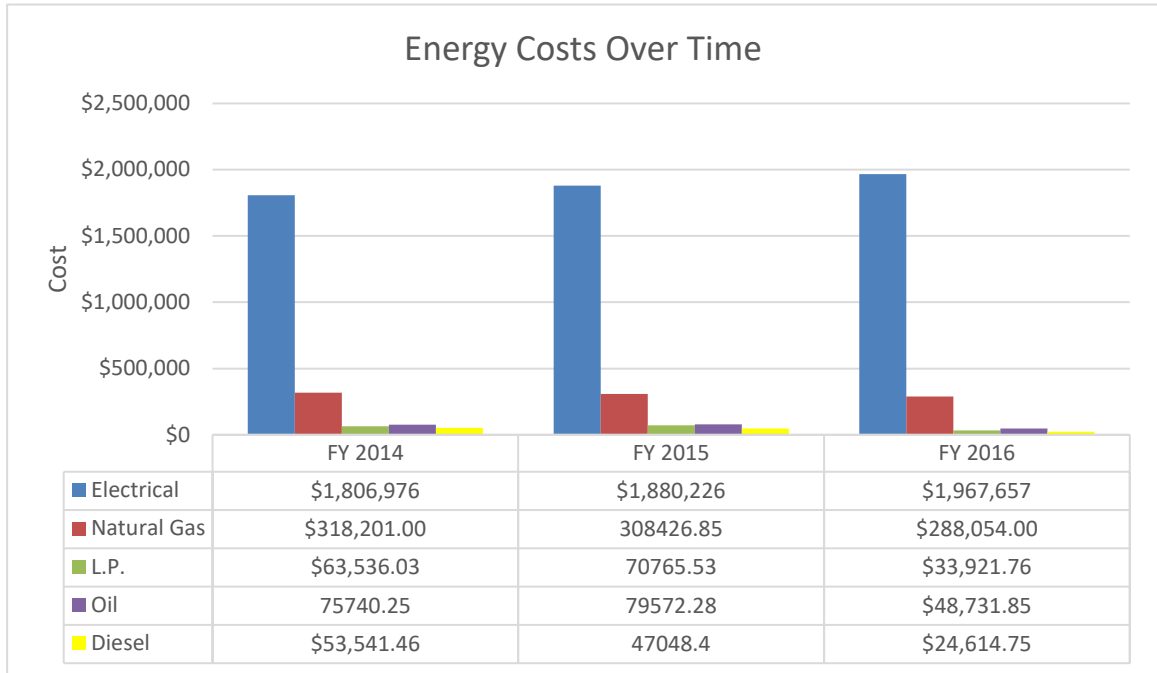


Figure 4 (based on Finance Department data)

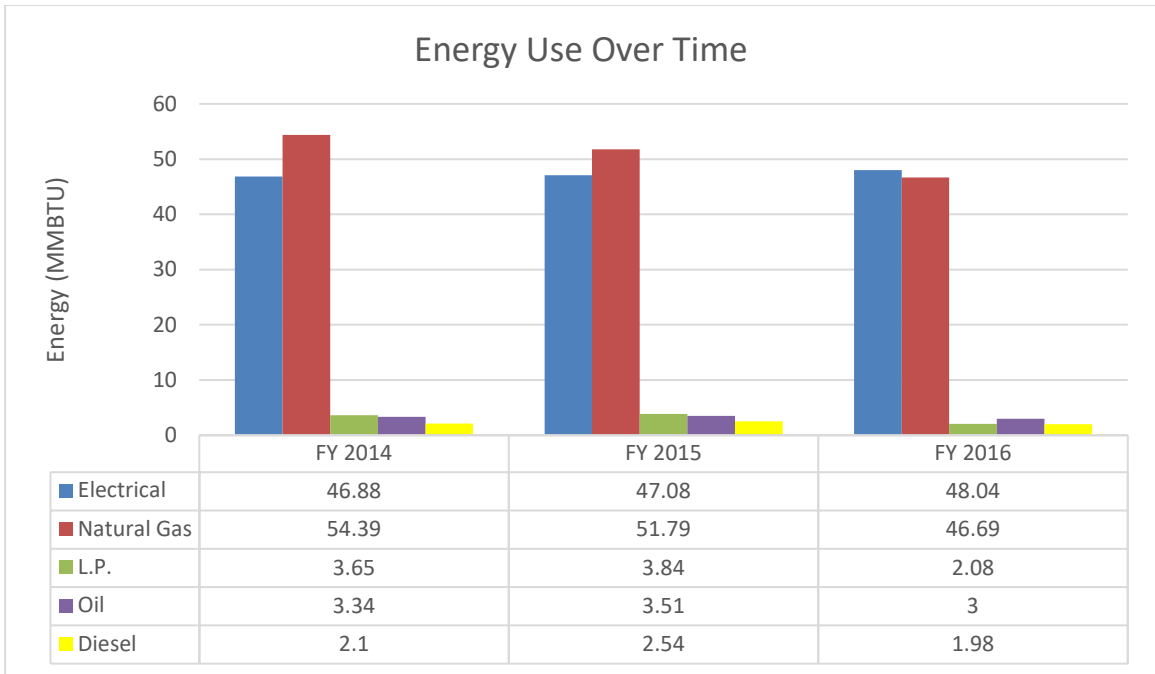


Figure 5 (based on Finance Department data)

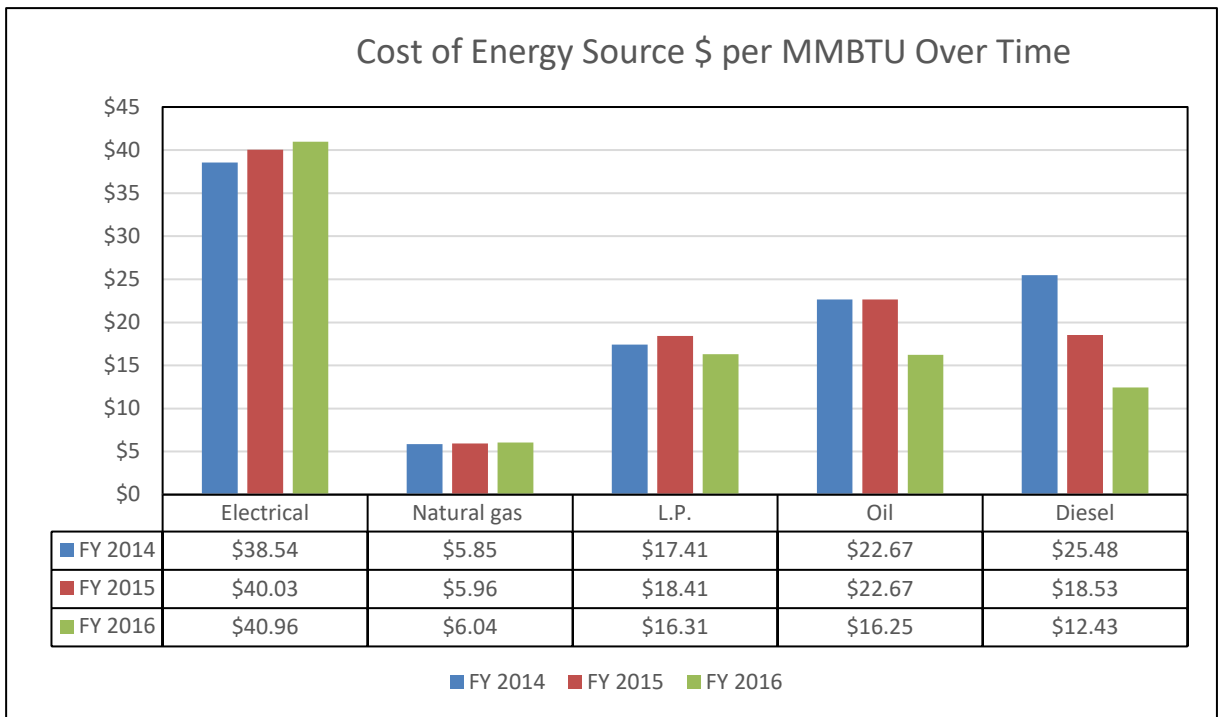
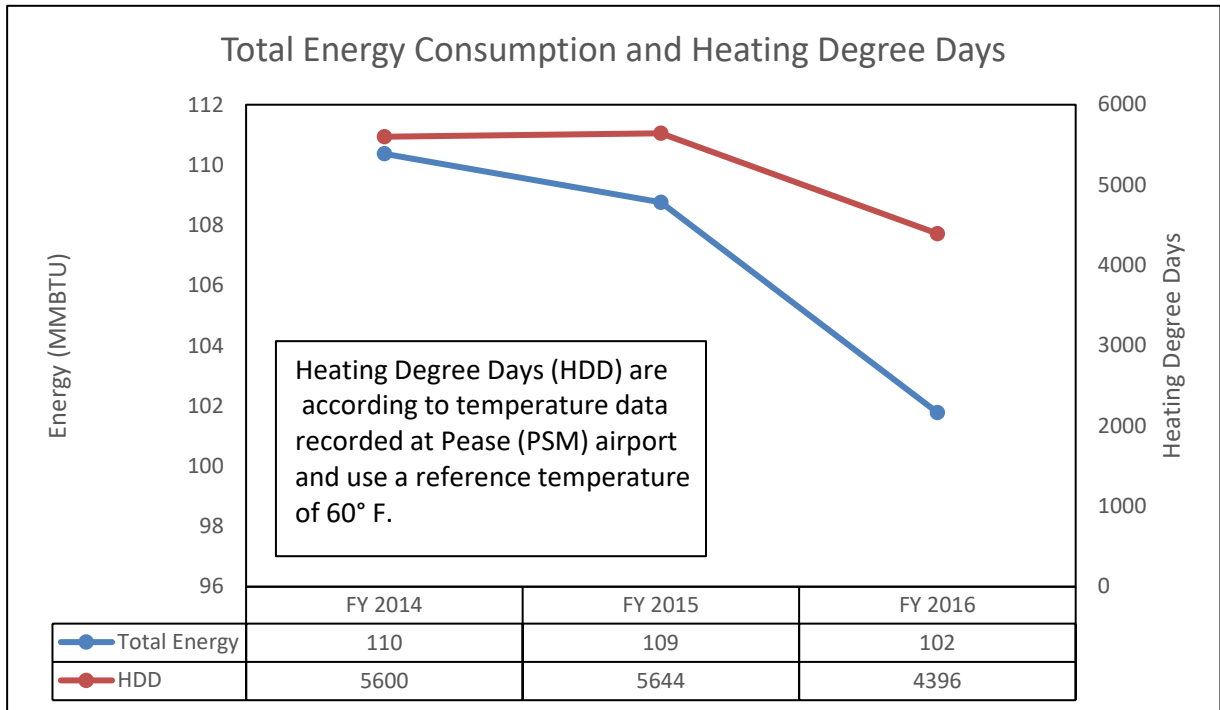


Figure 6 (based on Finance Department data)



*Figure 7 (based on Finance Department data)*

**Table 6 — Energy Cost and Usage Net Effect**

Energy Source	Usage Change	Unit Cost Change	Aggregate Cost Change
Electrical	2.5%	6.3%	8.9%
Natural Gas	-14.2%	3.3%	-9.5%
Liquid Propane	-43.0%	-6.3%	-46.6%
Heating Oil	-10.2%	-28.3%	-35.7%
Diesel	-5.7%	-51.2%	-54.0%
<b>Total</b>	<b>-7.8%</b>		<b>1.9%</b>

Table 6 summarizes Figures 6 and 7 and details how during the period from FY 2014 through FY 2016 Dover saw increased costs per unit of energy for electrical power, while fossil fuel sources mainly saw unit price decreases. In the same time period, Dover’s overall consumption of energy decreased 7.8%. As a contributing factor, the winters in the past two years have been milder. The net result is that aggregate energy costs, for buildings and facilities, increased 1.9% over this time period.



## Fleet Vehicles

Dover consumes energy via its fleet of vehicles used by the Community Services, Police, Fire and Recreation Departments. In FY 2017, total consumption was 100,133 gallons or \$178,538.86. The breakdown by month, department and fuel type are shown in the following two charts. Only the most recent fiscal year's data for fleet vehicle fuels was immediately available as of this writing.

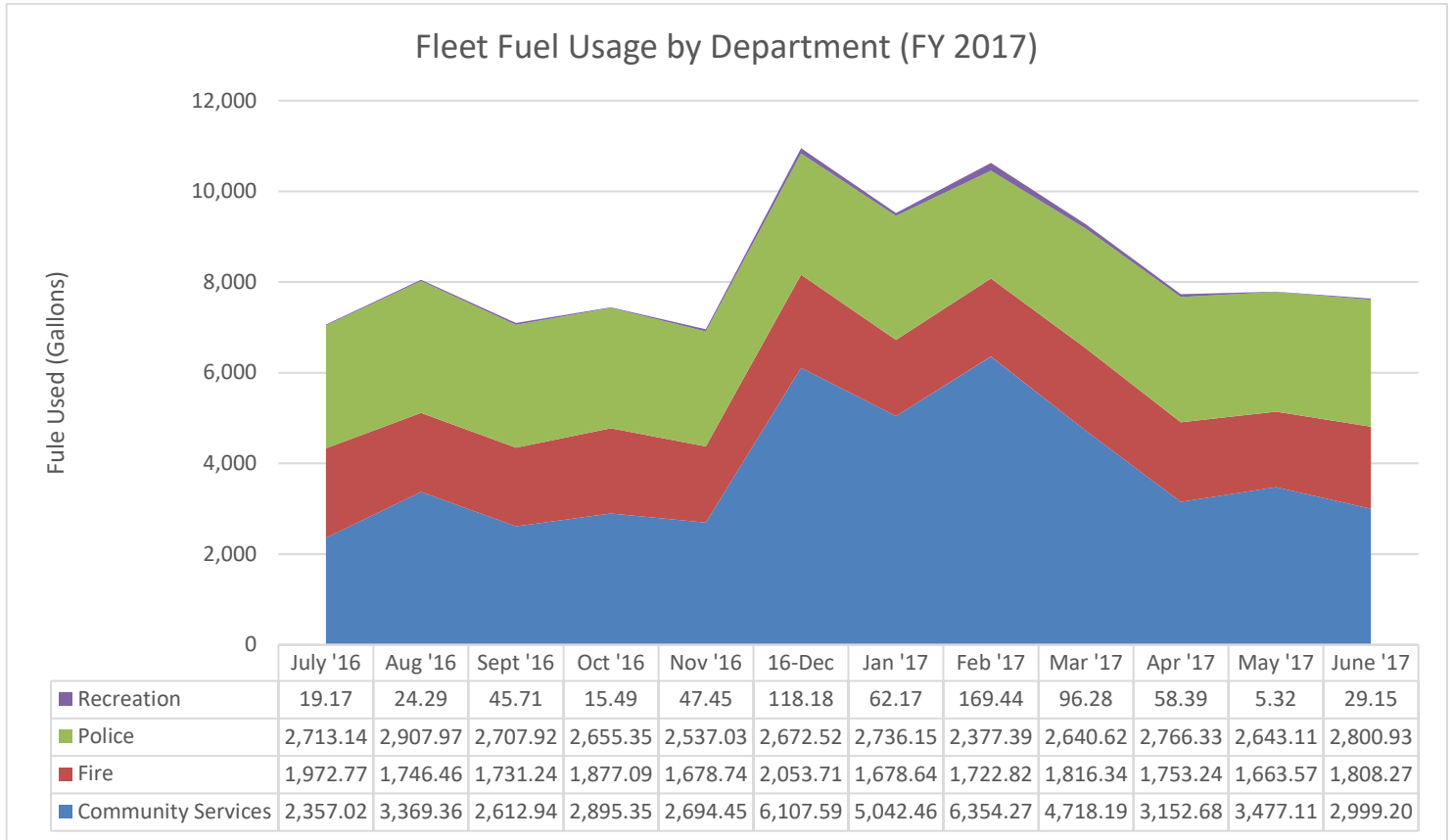


Figure 8 (based on Finance Department data)

### Fleet Fuel Cost by Department - FY2017

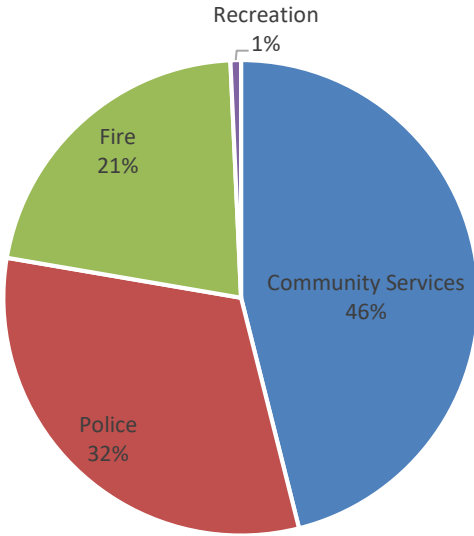


Figure 9 (based on Finance Department data)

### Fleet Fuel Gallons by Fuel Type - FY2017

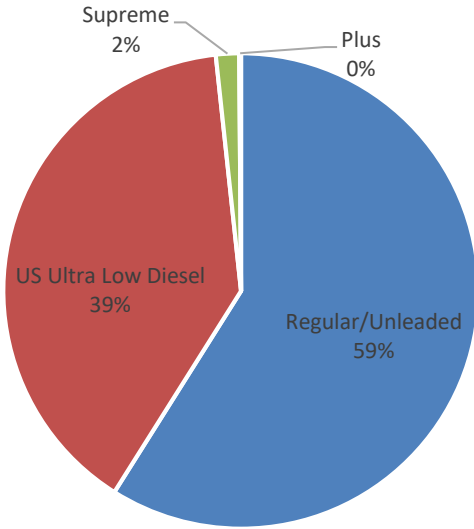


Figure 10 (based on Finance Department data)

# Initiatives

## Energy Star Portfolio Manager

The Environmental Protection Agency's (EPA) Energy Star Portfolio Manager (Portfolio Manager) is a free on-line application for the purpose of measuring, grading, tracking, benchmarking and comparing existing buildings. It also aids in the design of new buildings' usage of energy, water and waste, and can help calculate emissions. This versatile utility allows users to do as little as track energy costs or as much as building an enterprise-wide energy management system.

Portfolio Manager is aimed at commercial buildings, but a simplified version for residential use called the "Home Energy Yard Stick" is also available. The main differences between Portfolio Manager and commercially available applications is that Portfolio Manager is free to use and provides less granular details. Other limitations include very large facilities, maximum spreadsheet file size, and large quantities of data, as it is a cloud-based application.

Portfolio Manager allows users to track performance, generate reports, benchmark, share data, create graphs and calculate matrices. The application can grade buildings on a scale of 0-100 and compare data to those of national standards and sample buildings of most common types such as: office buildings, medical buildings, dormitories, retail centers and banks. It can also be used to register a building as Energy Star Certified.

Data entry is very flexible. It can be entered manually, imported through the use of a MS Excel template spreadsheet or by using the data collection wizard. Once data is entered it can be analyzed and manipulated to give greater visibility of how much energy is being used, what steps could help save energy, help justify energy efficient equipment and ultimately reduce emissions.

Training for Portfolio Manager is available through a variety of methods. The Portfolio Manager website includes how-to guides, web events, live question & answer sessions with previous sessions available for down load, and a library of knowledgebase topics.

You can visit the Portfolio Manager website at: <http://www.energystar.gov>

## Local & Regional Coordination

### Seacoast Energy Hub

Members of the Dover Energy Commission also represent Dover in the Seacoast Energy Hub. The group's aim is to leverage resources, ideas and best practices from member communities. The Seacoast Energy Hub is comprised of the communities of Dover, Durham, Exeter, Hampton, Lee, Hampton Falls, New Castle, Portsmouth, Rye and Stratham. It is one of six such organizations under the New Hampshire Local Energy Solutions Work Group (LES) <http://www.nhenergy.org/who-we-are.html>. The Regional Energy Hub Network is a pilot project of the LES Work Group to support and encourage regional collaboration around local energy work. Regional Energy Hubs provide coordination

and support at the regional level so local groups can focus on local work. Each hub has one or more coordinator who is typically a member of their municipal Energy Committee/Commission and is dedicated to connecting groups within the region, sharing successful strategies and models, organizing workshops and events, and providing local groups with important energy information and updates.

## Energize 360

A major Seacoast Energy Hub project that started in 2016 was the “Energize 360” campaign. Energize 360 aims to raise awareness of energy use among Seacoast residents about all aspects of their homes. These include efficiency/weatherization to reduce fossil fuel use, as well as converting from fossil fuel sources to renewable energy solutions such as solar PV and solar-powered water and space heating. The program also sets aside a fund to spread the benefits of efficiency and solar to under-represented or otherwise disadvantaged groups.

Through a competitive RFP process developed by the Hub, ReVision Energy and Yankee Thermal Imaging won the opportunity to be the providers for the program. This campaign represents a partnership between Seacoast Regional Energy Hub, Seacoast Area Renewable Energy Initiative (SEAREI), ReVision Energy, Yankee Thermal Imaging and was initially launched in the spring of 2017 in five Seacoast towns of Dover, Durham, Lee, Northwood and Portsmouth.

The total amount of annual CO<sub>2</sub> offset realized from Dover’s Energize 360 campaign, to include both weatherization and photo voltaic system installation, amounted to over 157,000 lbs. Specifically, for Yankee Thermal’s energy efficiency/weatherization campaign, there were 19 customer inquiries with 16 contracts of which seven customers were eligible for a 50% incentive, up to \$4,000, which for any of the qualified measures included lighting upgrades, water conservation measures, air sealing, and insulation. The resulting annual fuel savings for these Dover residents amounted to an annual CO<sub>2</sub> offset of 27,507 lbs. For ReVision Energy’s photo voltaic systems, there were 43 customer inquiries and 16 contracts with an annual production of clean electricity of 129,983 kWh and an annual CO<sub>2</sub> offset of 129,503 lbs.

## Net Metering

Net metering is a program initiated by the state legislature, implemented by electric utilities and overseen by the New Hampshire Public Utilities Commission (PUC). Any utility customer generating electricity from an on-site renewable energy source, such solar, wind, or hydro, in excess of that consumed on-site, can feed that power onto the electric grid and receive credit as set forth in the PUC tariff. Credit is “netted” over a 12-month billing cycle allowing seasonable surplus to be carried forward (e.g., solar energy is more plentiful during the summer and scarcer in the winter.)

Net metering provides benefits to both the net metered customer and ratepayers in general. Receiving compensation for sharing excess power to the grid helps a solar investor shorten their return on investment. Ratepayers benefit from net metering in many ways. As more power generation is distributed out across the electric grid through the implementation of various renewable projects, the burden for investment in additional large central power plants and transmission lines is reduced. This additional distributed capacity helps to trim peak energy demand on the grid.

Most electric power is purchased under the ISO (Independent System Operator) New England's managed markets where the day-ahead price is set by the highest cost producer. Keeping those high cost producers out of the queue during periods of high demand can substantially reduce rates. The power provided by net metered renewable sources is lower in harmful emissions compared to fossil fueled plants thereby helping to mitigate the negative impacts to climate and health.

Under the tariff introduced by the PUC that took effect in September of 2017, net metering customers fall into two categories--those with an installed rated capacity of less than 100 kW and those greater than 100 kW, but less than 1,000 kW. A typical home installation is usually under 10 kW. Smaller systems under 100 kW will be credited with 100% of the retail energy and transmission and 25% of the electric utilities distribution charge under the new tariff. Net metered installations installed prior to 9/1/2017 will be grandfathered to 2040 under their existing rate structure. Larger systems will continue to receive credit monthly at the default energy rate and will continue to be responsible for cost incurred tying into the grid.

A major change in the new PUC tariff is the elimination of caps based on the total installed net metering in the state by utility. In 2016 the quantity on net metered installation exceeded most utilities cap allocation resulting in a near cessation of solar installations. The state cap was later doubled, only to be largely consumed by the time this new PUC ruling was made. The assumption is that the new tariff will be cost neutral to ratepayers, thus making a cap unnecessary. Full details of the PUC rules can be found in the New Hampshire Code of Administrative Rules, Chapter PUC 900 (<https://www.puc.nh.gov/Regulatory/Rules/PUC900.pdf>).

## **LED Light Retrofit**

In the fourth quarter of 2017, the City began retrofitting 1,781 streetlights with LED fixtures manufactured by Affinity LED Lighting, a small business located here in Dover. A grant from Eversource for \$100,000 helped fund the project. The projected savings on electricity is \$130,000/year. The installation also includes "smart controls" which will help monitor and control the lights, and potentially yield further savings in the future.

LED light retrofits have also been completed at the McConnell Center, Community Services building, and the recently renovated ground floor Customer Service Center at City Hall, with the remainder of the building to be completed in the near future.



# Appendix

## History of Energy Planning in Dover

Since the mid-1990s, Dover has implemented a variety of programs to reduce its energy use. These initiatives have decreased costs for heat and electricity for the municipality. An early step was to retain, in 1996, the Siemens Company, an energy consulting firm, through a performance contract. Evaluating the history of cooling and electrical needs in city and school buildings, Siemens identified opportunities for cogenerating heat and electricity by gas-fired motors; energy-efficient fixtures and occupancy sensors were installed and heating and cooling systems were reconfigured to increase efficiency in five school and eight city buildings. While some efforts were successful, those which were not were protected by the performance contract.

Dover introduced Light-Emitting Diodes (LED) technology for traffic lights and outdoor lighting and made energy-improving upgrades to the windows in the fire station, library, and city hall. Energy-efficient technologies were used in at the McConnell Center, Woodman Park School, Ice Rink and Pool. These technologies include energy-saving windows, lighting and high efficiency gas-fired boilers. A computer-driven energy management system was installed at Woodman Park School to monitor use of heating, cooling, and lighting, initially for the school, but ultimately for all city buildings. This system tracks patterns of energy use in buildings and makes adjustments accordingly.

The City has also participated in several grant and rebate programs through the utility companies, purchasing and installing high efficiency gas boilers through a grant from Northern Utilities.

In 2006 the City of Dover committed to the Sierra Club's "Cool Cities" for Climate Protection Campaign and the U.S. Mayors' Climate Change Agreement. As a result, the Dover Energy Advisory Committee (DEAC) was created to assist in: creating recommendations for energy conservation policy and procedures; to develop energy efficiency and renewable energy projects; to reduce greenhouse gas emissions; and to work to insulate the City from fluctuations in future energy costs. In March 2008 DEAC published Dover's first "Energy Action Plan" which included a detailed report of the City's energy use, energy costs and greenhouse gas emissions and recommendations.

In addition, the City has joined the EPA's Energy Star Challenge, a national campaign to improve energy efficiency by 10% or more in buildings across the United States.

The City entered into an Energy Savings Performance Contract with Johnson Controls in 2009, with a set of Facility Improvement Measures to 14 municipal buildings and facilities for a 10-year guaranteed total cost avoidance of \$3,623,746.<sup>7</sup>

In 2011 the City established the Dover Energy Commission per RSA Chapter 38-D<sup>8</sup>, subsuming the mission of the DEAC.

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<sup>7</sup> See Johnson Controls 2016 Report, [www.dover.nh.gov/Assets/government/city-operations/2document/planning/community-development/energy-improvements/Dover%20Y4%20Annual%20Report%201-7-16.pdf](http://www.dover.nh.gov/Assets/government/city-operations/2document/planning/community-development/energy-improvements/Dover%20Y4%20Annual%20Report%201-7-16.pdf)

<sup>8</sup> <http://www.gencourt.state.nh.us/rsa/html/iii/38-d/38-d-mrg.htm>

In 2016 the Commission investigated the feasibility of Dover adopting C-PACE (**Property Assessed Clean Energy**) rules that would enable financing tools that connect private financing for energy efficiency and renewable energy projects to privately-owned commercial buildings through a municipal tax assessment on the building, tying repayment to the building, not the owner/borrower. The investigation ended after the statewide administrator of the program, the Concord-based Jordan Institute, dissolved after their funding ended.