Town of Wareham, Massachusetts
Energy Reduction Plan

Prepared by the Southeastern Regional Planning and Economic Development District (SRPEDD) with support from the Town of Wareham

In Fulfillment of the
Massachusetts Green Communities Grant Program
Criterion #3

October 2018

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I. Purpose and Acknowledgements

A. Letter from the General Government Verifying Adoption of the Energy Reduction Plan

Town of Wareham
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Wareham, MA 02571
E-mail: selectmen@wareham.ma.us

Town Administrator
Derek D. Sullivan
Phone: 508.291.3100, ext. 3110
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BOARD OF SELECTMEN
Alan H. Slavin, Chairman
Patrick G. Tropeano, Clerk
Peter W. Teitelbaum, Esq.
Anthony R. Scarsciotti, Jr.
Mary Bruce

October 9, 2018

To Whom It May Concern:

Please be advised that on October 9, 2018, the Wareham Board of Selectmen met at a duly noticed and regularly scheduled meeting and voted to adopt the Energy Reduction Plan for Criterion 3 of the Green Communities Application for Designation. The Board of Selectmen was given copies of the plan for review prior to the meeting.

The Selectmen voted unanimously to adopt the plan. The minutes of that meeting include the vote.

Signed in agreement,

Alan H. Slavin, Chairman

Patrick G. Tropeano, Clerk

Peter W. Teitelbaum, Esq.

Anthony R. Scarsciotti, Jr.

Mary Bruce

B. Letter from the School District Verifying Adoption of the Energy Reduction Plan

Wareham Public Schools
Multi-Service Center
48 Marion Road
Wareham, MA 02571

Kimberly B. Shaver-Hood, Ed.D.
Superintendent of Schools

Phone: 508-291-3500
FAX: 508-291-3578
E-mail:
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October 24, 2018

MA Department of Energy Resources
Green Communities Division
100 Cambridge Street – Suite 1040
Boston, MA 02114

To Whom It May Concern:

Please be advised that the Wareham Public Schools hereby adopted the attached Fuel Efficiency Vehicle Policy for Criterion 4 of the Green Communities program.

Please be advised that the Wareham Public Schools hereby adopted the attached Energy Reduction Plan for Criterion 3 of the Green Communities program.

Thank you.

Sincerely,

Dr. Kimberly B. Shaver-Hood

Dr. Kimberly B. Shaver-Hood
Superintendent of Schools

C. List of Contributors

The collaborative efforts of the offices of Wareham Town Administrator Derek Sullivan, Town Planner Kenneth Buckland and MA Department of Energy Resources Green Community Regional Coordinator Seth Pickering were all vital in the production this Plan.

Much of the information in this Plan was derived from energy audits performed by RISE Engineering, led by Frank C. Davey. Additional technical assistance was provided by the Southeastern Regional Planning and Economic Development District (SRPEDD), the author of this Plan.

II. Executive Summary

A. Narrative Summary of the Town

The Town of Wareham is located in southeastern Massachusetts in southern Plymouth County. Known as "The Gateway to Cape Cod", Wareham is located 55 miles south of Boston and 45 miles east of Providence, Rhode Island. The town has an approximate area of 46.3 square miles and is bordered by Carver and Plymouth on the north; Bourne on the east; Marion on the southwest; Rochester on the west; and Middleborough on the northwest. According to the 2010 U.S. Census, Wareham had a population of 21,822, having experienced a 7.3% increase in population since 2000.

Wareham was first settled by white settlers in the late 1670s at the conclusion of King Phillip's War. Originally part of the towns of Plymouth and Rochester, Wareham incorporated as its own community in 1739. Originally an agricultural and fishing community, it's economy expanded into iron-related manufacturing and a variety of maritime industries in the 19th century. The early 20th century saw two new industries emerge in Wareham – summer tourism and cranberry growing, which have had lasting impacts on the town, as approximately one-third of the town's housing units are seasonal and cranberry growers control over 30% of Wareham's land.

Since 1950, Wareham's population has almost tripled and has transformed from a seasonal community to a more traditional suburban community, whose economic base has shifted to the service industries. Wareham is accessible to the larger southeastern Massachusetts region via Interstates 195 and 495 as well as via Routes 6, 25, and 28.

B. Summary of Municipal Energy Uses

- Total Number of Municipal Buildings: 16
- Total Number of Municipal Vehicles: 144
- Total Number of Street Lights: 1,700
- Total Number of Traffic Lights: 0
- Water & Sewer: 1 wastewater treatment plant and 45 wastewater pumping stations

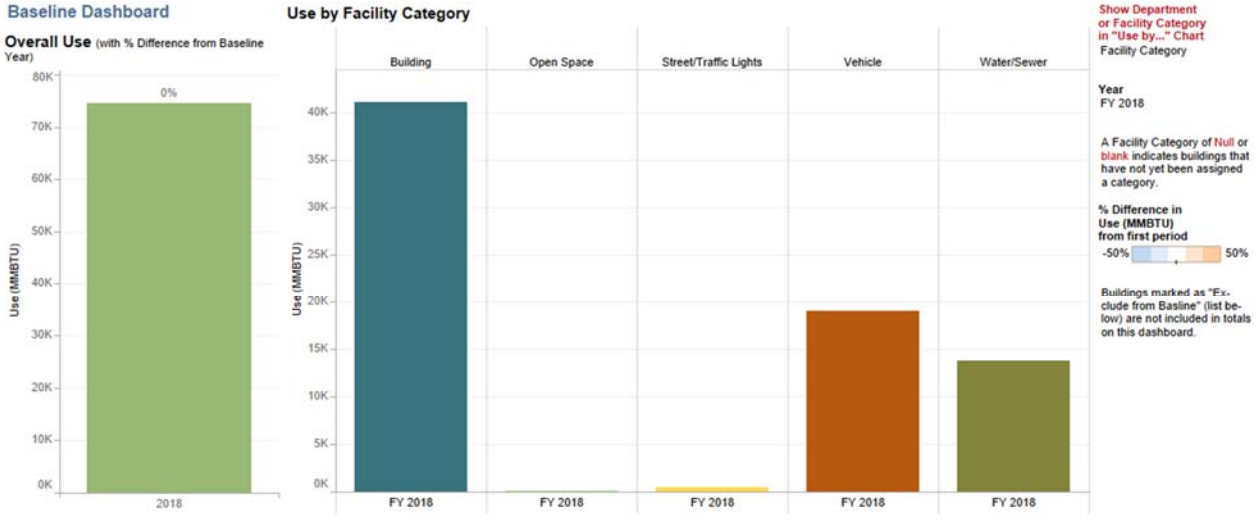
Table 1: Municipal Energy Use Summary

	Number	Ownership
Buildings	**16**	
Oil Heat	0	
Natural Gas Heat	15	Municipality
Electricity	1	Municipality
Vehicles	**144**	
Non-Exempt	15	Municipality
Exempt	129	Municipality
Street Lights	1,700	Municipality
Traffic Lights	0	
Water & Sewer	**46**	
Drinking Water Treatment Plant	0	
Drinking Water Pumping Station	0	
Wastewater Treatment Plant	1	Municipality
Wastewater Pumping Station	45	Municipality

C. Summary of Energy Use Baseline and Plans for Reductions

This Energy Reduction Plan commits Wareham to reduce energy use in municipal facilities by at least 20% compared to Fiscal Year 2018 over five years. In the baseline year, the town used 74,447 MMBTUs of energy, which means the town must reduce its usage by at least 14,890 MMBTUs over the following five-year period.

Figure 1: Municipal Energy Use Baseline Dashboard from MEI (FY 2018)



Drill down by Facility Category (showing Use (MMBTU))
Hover over Facility Category and Subcategory and click the plus or minus signs to expand and collapse the table.

Facility Category	FY 2018
Building	41,055
Open Space	108
Street/Traffic Ligh..	492
Vehicle	19,038
Water/Sewer	13,754

Drill down by Department (showing Use (MMBTU))
Hover over Department, Complex, etc. and click the plus or minus signs to expand and collapse the table.

Department	FY 2018
Null	34
EMS	323
Harbormaster	50
Library	1,537
Municipal Maintenance	14,473
Police	5,718
School Department	38,542
Sewer/Pumping	13,754
Street/Traffic Lights	14

Wareham has identified energy savings measures in each facility category to reduce energy use 20% based on the total baseline usage, as illustrated in Table 2.

Table 2: Summary of Municipal Energy Use and Reductions

Facility Category	MMBTU Used in Baseline Year	% of Total MMBTU Baseline Energy Consumption	Projected Planned MMBTU Savings	Savings as % of Total MMBTU Baseline Energy Consumption
Buildings	41,055	55.1%	13,276	17.8%
Vehicles	19,038	25.6%	0	0.0%
Street/Traffic Lights	492	0.7%	0	0.0%
Water/Sewer/Pumping	13,754	18.5%	672	0.9%
Open Space	108	0.1%	0	0.0%
Total	**74,447**	**100%**	**13,948**	**18.7%**

III. Energy Use Baseline Inventory

A. Identification of the Inventory Tool Used: The Town of Wareham used the Department of Energy Resources (DOER) MassEnergyInsight (MEI) web-based energy inventory and analysis tool.

B. Identification of the Baseline Year: Fiscal Year (FY) 2018 will serve as the baseline year. FY 2018 ran from July 1, 2017 to June 30, 2018. This will give the Town until June 30, 2023 (FY 2019 – FY 2023) to reach its 20% energy reduction goal.

C. Municipal Energy Consumption for the Baseline Year (FY 2018): In the baseline year, the town used 74,447 MMBTUs of energy. The Appendix presents energy use for each municipal facility in MMBTUs and native units.

- Buildings: Wareham's 16 buildings consume 41,055 MMBTUs, approximately 55.1% of Wareham's total municipal energy use. The buildings with the largest energy use are the Wareham Middle School (10,478 MMBTUs) and Wareham High School (9,268 MMBTUs), as shown in Figure 2.

- Street/Traffic Lights: There are 1,700 streetlights and 0 traffic lights in Wareham. These lights consume 492 MMBTUs, 0.7% of the Town's energy use.

- Vehicles: Wareham's 144 municipal vehicles use 25.6% of the baseline total, or 19,038 MMBTUs.

- Water/Sewer Facilities: The Town of Wareham is serviced for wastewater by the town's Sewer Department. Sewer facilities consume 13,754 MMBTUs, or 18.5% of the town's energy use.

Table 3A: Municipal Energy Consumption for FY2018, Native Fuel Units

ERP Guidance Table 3a - Municipal Energy Consumption for 2018 (Native Fuel Units)

		2018			
		Electric (kWh)	Gas (therms)	Gasoline (gallons)	Diesel (gallons)
Building	Boys & Girls Club/Donov..	36,160	18,101		
	East Wareham ES	22,063	3,749		
	John William Decas ES	282,459	45,207		
	Minot Forest IS	244,049	42,877		
	Wareham MS	873,624	74,973		
	Wareham SHS	1,093,989	55,349		
	West Wareham School	5,393			
	Work Shed	6,569			
	Onset Pier Interior	6,696			
	Onset Pier Exterior	1,456			
	Main	140,640	9,309		
	Spinney	5,170	1,090		
	Main	112,687	5,168		
	Train Station	476			
	Main	20,654	2,527		
	Town Hall	173,520	16,511		
	Multi-Service Center	90,320	16,379		
	Spillane Football Field	1,821			
	Maintenance Building	19,753			
	Tremont Nail	25,600	4,891		
	Onset Restrooms	711			
	Kennedy Lane	26,396			
	Main Building	81,600			
	Garage	9,091			
	Substation - Onset	1,322			
	Everett School	72	0		
	Onset Bath House	246			
	West Wareham School	8,464	1,788		
	Recycling	2,759			
	Community Development	7,219			
	Total	**3,300,979**	**297,919**		

Open Space	Onset Gazebo	192			
	Onset Band Stand	159			
	Center Cemetery	0			
	Town Green	1,114			
	Charge Pond	3,855			
	Onset Pier	11,097			
	Tennis Courts	6,183			
	Tempest Knob	1,233			
	Lopes Field	3,089			
	Mill Street Dam	1,040			
	Police Memorial	1,561			
	Dudley L. Brown Square - On..	204			
	Charlotte Furnace Road	1,804			
	Total	**31,531**			
Street/Traffic Lights	Lighthouses - Cran Hwy	52			
	Lights	4,059			
	Traffic Signal	50			
	Traffic Light	95			
	Onset Ave	301			
	Roby Street	344			
	Kennedy Lane	3,792			
	Shore Avenue	485			
	Off Tihonet	2,064			
	Circle Drive	1,233			
	Main Street Lights	24,402			
	Riverside Drive	241			
	Onset Ave - Period Street Lig..	107,003			
	Total	**144,121**			
Vehicle	Police Department Vehicles			38,558	
	School Department Vehicles			9,407	49,229
	MMD & Town Vehicles			16,253	30,450
	Total			**64,218**	**79,679**
Water/Sewer	Wareham Wastewater Pollutio..	2,342,544	26,631		
	Pumping Stations	857,032	1,736		
	Total	**3,199,576**	**28,367**		
Grand Total		**6,676,207**	**326,286**	**64,218**	**79,679**

Table 3A: Municipal Energy Consumption for FY2018, MMBTU

ERP Guidance Table 3b - Municipal Energy Consumption for 2018 (MMBTU)

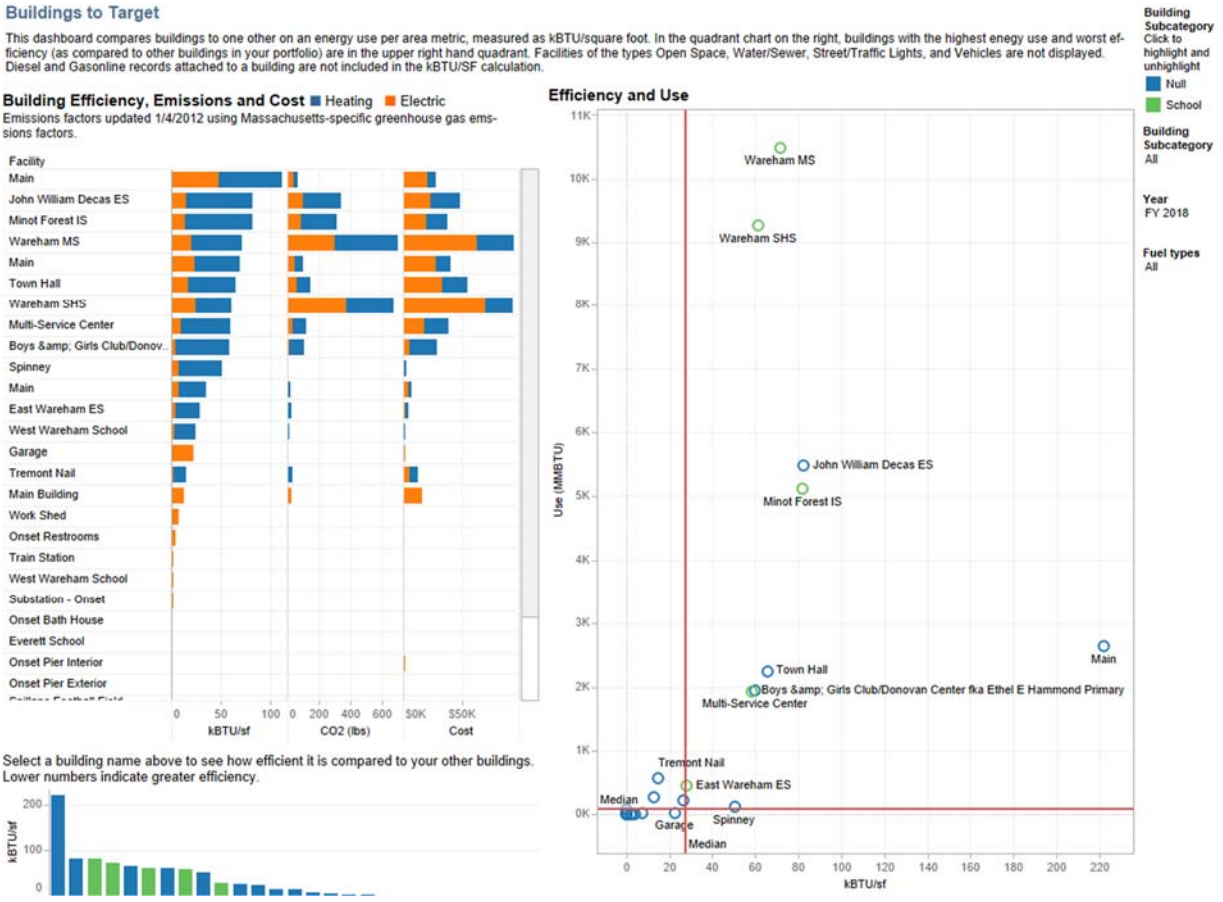
Please make sure that any data submitted to DOER contains complete Data!

		2018				
		Diesel	Electric	Gas	Gasoline	Total
Building	Boys & Girls Club/Donov..		123	1,810		**1,933**
	East Wareham ES		75	375		**450**
	John William Decas ES		964	4,521		**5,484**
	Minot Forest IS		833	4,288		**5,120**
	Wareham MS		2,981	7,497		**10,478**
	Wareham SHS		3,733	5,535		**9,268**
	West Wareham School		18			**18**
	Work Shed		22			**22**
	Onset Pier Interior		23			**23**
	Onset Pier Exterior		5			**5**
	Main		480	931		**1,411**
	Spinney		18	109		**127**
	Main		384	517		**901**
	Train Station		2			**2**
	Main		70	253		**323**
	Town Hall		592	1,651		**2,243**
	Multi-Service Center		308	1,638		**1,946**
	Spillane Football Field		6			**6**
	Maintenance Building		67			**67**
	Tremont Nail		87	489		**576**
	Onset Restrooms		2			**2**
	Kennedy Lane		90			**90**
	Main Building		278			**278**
	Garage		31			**31**
	Substation - Onset		5			**5**
	Everett School		0	0		**0**
	Onset Bath House		1			**1**
	West Wareham School		29	179		**208**
	Recycling		9			**9**
	Community Development		25			**25**
	Total		**11,263**	**29,792**		**41,055**

Open Space	Onset Gazebo		1			1
	Onset Band Stand		1			1
	Center Cemetery		0			0
	Town Green		4			4
	Charge Pond		13			13
	Onset Pier		38			38
	Tennis Courts		21			21
	Tempest Knob		4			4
	Lopes Field		11			11
	Mill Street Dam		4			4
	Police Memorial		5			5
	Dudley L. Brown Square - On..		1			1
	Charlotte Furnace Road		6			6
	Total		108			108
Street/Traffic Lights	Lighthouses - Cran Hwy		0			0
	Lights		14			14
	Traffic Signal		0			0
	Traffic Light		0			0
	Onset Ave		1			1
	Roby Street		1			1
	Kennedy Lane		13			13
	Shore Avenue		2			2
	Off Tihonet		7			7
	Circle Drive		4			4
	Main Street Lights		83			83
	Riverside Drive		1			1
	Onset Ave - Period Street Lig..		365			365
	Total		492			492
Vehicle	Police Department Vehicles				4,781	4,781
	School Department Vehicles	6,843			1,166	8,009
	MMD & Town Vehicles	4,233			2,015	6,248
	Total	11,075			7,963	19,038
Water/Sewer	Wareham Wastewater Pollutio..		7,993	2,663		10,656
	Pumping Stations		2,924	174		3,098
	Total		10,917	2,837		13,754
Grand Total		11,075	22,779	32,629	7,963	74,446

Figure 2: MEIs Buildings to Target Dashboard

In Figure 2 below, the points further to the right have a higher energy use per square foot (i.e. less energy efficient), while the points higher up use more total energy. The Wareham Middle School, for example, uses the most energy of any building in Wareham.



IV. Energy Reduction Plan

A. Narrative Summary

As shown below, the town has identified energy savings measures to reduce usage from FY 2018 by 13,948 MMBTUs or 18.7%.

- **Jon W. Decas Elementary School**

  Kitchen Hood Controls: Install controls to the kitchen hood to reduce the time the exhaust fan is running at full load.

  Door Weather-Stripping: Install weather stripping to six (6) exterior doors to reduce unwanted air flow.

  Refrigeration Controls and Replacement Evaporator Motors: Install evaporator fan controls and electronically commutated motors (EC motors) on the evaporator fans on the one (1) walk-in cooler and one (1) walk-in freezer that do not have refrigeration controllers.

  LED Lighting: Replace existing inefficient lighting (T8 and T12 fluorescent, CFLs, incandescent, and halogen bulbs on site) with high efficiency LED bulbs.

  Faucet Aerators: Install low flow aerators (1.5 GPM) to restrict the flow of water through faucets in all bathrooms and 90% of the classrooms that either have no aerators or aerators rated at 2.2 GPM.

  Programmable Thermostats: Replace manual thermostats with programmable thermostats in classrooms so setback temperatures may be controlled remotely for unoccupied, or nighttime durations.

- **Wareham High School**

  Kitchen Hood Controls: Install controls to the kitchen hoods in the kitchen and culinary room to reduce the time each exhaust fan is running at full load.

  Door Weather-Stripping: Install weather stripping to 13 exterior doors to reduce unwanted air flow.

  High Efficiency Condensing Boilers: Replace the six (6) existing Patterson-Kelley boilers rated at 85% efficiency with new high efficiency condensing boilers.

  High Efficiency Condensing Water Heater: Replace the one (1) standard 80% efficiency gas-fired water heater with a high efficiency water heater.

  Refrigeration Controllers: Install evaporator fan controls and electronically commutated motors (EC motors) on the evaporator fans on the one (1) walk-in cooler and one (1) walk-in freezer that do not have refrigeration controllers.

Variable Frequency Drives on Hydronic Pumps: Install variable frequency drives (VFDs) on the hydronic pumps to vary the energy consumed based on demand.

LED Lighting Upgrade: Replace the existing inefficient lighting with high efficiency LED bulbs.

Faucet Aerators: Install low flow aerators (1.5 GPM) to restrict the flow of water through faucets in locker rooms, bathrooms, teacher's lounges and hallways throughout the building that do not have aerators.

Programmable Thermostats: Replace manual thermostats with programmable thermostats in classrooms so setback temperatures may be controlled remotely for unoccupied, or nighttime durations.

High Efficiency RTUs: Install three (3) new high efficiency rooftop units to replace three (3) existing rooftop units that are operating at a sub-standard efficiency.

- **Wareham Middle School**

  Kitchen Hood Controls: Install controls on the two (2) kitchen hoods in the kitchen that do not have controls to reduce the time each exhaust fan is running at full load.

  Door Weather-Stripping: Install weather stripping to one (1) door to reduce unwanted air flow.

  High Efficiency Condensing Boilers: Replace the two (2) Smith Cast Iron hydronic boilers rated at 85% efficiency with new high efficiency condensing boilers.

  High Efficiency Water Heater – Kitchen: Replace the one (1) 85% standard efficiency water heater with a high efficiency water heater.

  Refrigeration Controls: Install evaporator fan controls and electronically commutated motors (EC motors) on the evaporator fans on the one (1) walk-in cooler and one (1) walk-in freezer that do not have refrigeration controllers.

  LED Lighting Upgrade: Replace the existing inefficient lighting with high efficiency LED bulbs.

  Faucet Aerators: Install low flow aerators (1.5 GPM) to restrict the flow of water through faucets in the science lab and classrooms throughout the building that either have no aerators or aerators rated at 2.2 GPM.

- **Town Hall**

  Heat Pump Water Heater: Replace the one (1) standard efficiency 10-gallon electric resistance water heater with a 10-gallon high efficiency heat pump water heater.

  Boiler Reset Controls: Install boiler controls for the existing boiler or newly installed hydronic boiler, which allow for scheduling and varying temperature set-points throughout the day.

Pipe/Valve/Tank Insulation: Install insulation on 185 linear feet of condensate return piping, five (5) 4”-6” gate valves, and one (1) 52” by 28” condensate tank with no insulation.

LED Lighting Controls: Add occupancy/motion controls.

Faucet Aerators: Install low-flow aerators (1.5 GPM) to restrict the flow of water through several faucets that have high-flow aerators rated 2.5 to 3.0 GPM.

Steam Trap Survey and Repairs: Contact the utility for a list of approved vendors to survey the approximately 90 to 120 steam traps in the building. National Grid will reimburse the town the cost of the steam trap survey and 50% of the cost of repairs under the Gas Efficiency Program.

- **Boys & Girls Club/Donovan Center**

  Door Weather-Stripping: Install weather stripping to two (2) doors to reduce unwanted air flow.

  High Efficiency Condensing Water Heater: Replace the standard efficiency water heater with a high efficiency water heater.

  Boiler Reset Controls: Install boiler controls on the existing boiler, which allow for scheduling and varying temperature set-points throughout the day.

  Pipe/Valve/Tank Insulation: Install insulation on 50 linear feet steam piping, 150 linear feet of condensate return piping, 20 linear feet of domestic hot water piping, one (1) condensate tank, one (1) 6” gate valve, one (1) 6” control valve, and two (2) 6” T valves that are not insulated, causing over and under-heating in the building.

  LED Lighting Upgrade: Replace the existing inefficient lighting with high efficiency LED bulbs.

  Faucet Aerators: Install low-flow aerators (1.5 GPM) to restrict the flow of water through faucets in the most classrooms and bathrooms that have high-flow aerators rated 2.0 GPM.

  Steam Trap Survey and Repairs: Contact the utility for a list of approved vendors to survey the approximately 50 to 80 steam traps in the building. National Grid will reimburse the town the cost of the steam trap survey and 50% of the cost of repairs under the Gas Efficiency Program.

- **Multi-Service Center**

  Kitchen Hood Controls: Install controls to the kitchen hood in the kitchen to reduce the time each exhaust fan is running at full load.

  Door Weather-Stripping: Install weather stripping to eight (8) doors to reduce unwanted air flow.

  High Efficiency Water Heater: Replace the standard efficiency water heater with a high efficiency water heater.

  Boiler Reset Controls: Install boiler controls for the existing boiler or newly installed hydronic boiler, which allow for scheduling and varying temperature set-points throughout the day.

Pipe/Valve/Tank Insulation: Install insulation on two (2) 3" control valves, one (1) 2.5' x 2.5' x 2.5' condensate tank, one (1) 8" gate valve, 5 linear feet of steam pipe, and 80 linear feet of condensate return piping that is uninsulated. Additionally, there is 4' of 3" steam pipe with existing insulation that has been compromised due to water exposure that needs to be replaced as well.

LED Lighting Controls: Add occupancy/motion controls.

Faucet Aerators: Install low-flow aerators (1.5 GPM) to restrict the flow of water through several faucets that have high-flow aerators rated 2.0 to 2.5 GPM.

Steam Trap Survey and Repairs: Contact the utility for a list of approved vendors to survey the approximately 60 to 80 steam traps in the building. National Grid will reimburse the town the cost of the steam trap survey and 50% of the cost of repairs under the Gas Efficiency Program.

- **Police Department**

Door Weather-Stripping: Install weather stripping to four (4) doors to reduce unwanted air flow.

High Efficiency Water Heater: Replace the standard efficiency water heater with a high efficiency water heater.

Pipe/Valve/Tank Insulation: Install insulation on 18 linear feet of steel pipe and 22 linear feet of copper pipe for heating output, 20 linear feet of steel piping for heating return, and 14 linear feet of copper piping for domestic hot water.

LED Lighting Controls: Add occupancy/motion controls.

Faucet Aerators: Install low flow aerators (1.5 GPM) to restrict the flow of water through faucets throughout the building that either have no aerators or aerators rated at 2.5 GPM.

Programmable Thermostats: Replace manual thermostats with programmable thermostats so setback temperatures may be controlled remotely for unoccupied, or nighttime durations.

- **Free Library**

Heat Pump Water Heater: Replace the two (2) standard efficiency electric resistance water heaters with two (2) high efficiency heat pump water heaters.

LED Lighting Controls: Add occupancy/motion controls.

Faucet Aerators: Install low-flow aerators (1.5 GPM) to restrict the flow of water through several faucets that have high-flow aerators rated 2.2 to 2.75 GPM.

Programmable Thermostats: Replace manual thermostats with programmable thermostats so setback temperatures may be controlled remotely for unoccupied, or nighttime durations.

- **Wastewater Treatment Facility**
  High Efficiency Condensing Boilers: Replace the three (3) standard efficiency hydronic boilers that hear the operations, dewatering, and filter blowing buildings with new high efficiency condensing boilers.

  VFDs on Hydronic Pumps: Install variable frequency drives (VFDs) on the hydronic pumps that circulate the hot water produced by the three (3) standard efficiency boilers in the three (3) buildings that currently have no controls.

  LED Lighting Upgrade: Replace the existing inefficient lighting with high efficiency LED bulbs.

- **Minot Forest Elementary School**
  At the end of the 2018-2019 school year, the Minot Forest Elementary School will close due to a combination of the school's structural problems and the community's budgetary constraints. The students who would have attended the Minot Forest Elementary School will instead attend the John W. Decas Elementary School.

B. Path to 20% Energy Use Reduction by the end of Fiscal Year 2023

1. Program Management Plan for Implementation, Monitoring, and Oversight

The Town Administrator's Office, in collaboration with the School Department, will be responsible both for oversight of the Energy Reduction Plan and for implementation of energy conservation measures within the Town. The Town Administrator's Office will be responsible for the annual reporting requirements to maintain designation and eligibility for annual competitive grant funding.

2. Summary of Energy Audit(s) or Other Sources for Projected Energy Savings

- Building audits were provided by RISE Engineering in 2018 and provide an energy savings of 8,829 MMBTUs or 11.9%. The RISE Engineering audits are included in the Appendix.
- The closing of the Minot Forest Elementary School at the end of the 2018-2019 school year will result in the savings of 5,120 MMBTUs or 6.9%. The students who would have attended the Minot Forest Elementary School will instead attend the John W. Decas Elementary School.
- Vehicle policy and maintenance targeting overall vehicle usage would result in the savings 1,146 MMBTUs or 1.5%. The supporting documentation for these policy and maintenance measures are available in the Appendix.

3. Energy Conservation Measures

Table 4 lists recommended energy conservation measures. References for each measure are included in the table and these references are included as appendices to the Energy Reduction Plan. Projected annual MMBTU savings for each category (buildings, vehicles, and street and traffic lights) are subtotaled to arrive at a municipal grand total.

Table 4: Energy Conservation Measures for Wareham Municipal Energy Use

Measure		Status	Energy Data						Financial Data						Reference	
			Projected Annual Energy Savings													
Category/Building	Energy Conservation Measure	Status (Completed Year or Planned Year)	Electricity Savings (kWh)	Natural Gas Savings (Therms)	Oil Savings (Gallons)	Gasoline Savings (Gallons)	Diesel Savings (Gallons)	Propane Savings (Gallons)	Projected Annual Cost Savings	Estimated Total Project Cost ($)	Green Communities Grant ($)	Estimated Utility Incentives ($)	Estimated Cost After Utility Incentives ($)	Estimated Payback After Incentives (Years)	Funding Source	Source for Energy Savings
John W. Decas Elementary School-B & C Wings	LED Lighting Upgrades & Controls	2019	42,505	0	-	-	-	-	$8,135	$89,349	-	$10,626	$78,723	7.8	-	RISE Engineering Audit, 2018
John W. Decas Elementary School-D & E Wings	LED Lighting Upgrades & Controls	2019	50,107	0	-	-	-	-	$9,590	$99,915	-	$12,527	$87,388	7.3	-	RISE Engineering Audit, 2018
John W. Decas Elementary School-A & Gym/Café Wings	LED Lighting Upgrades & Controls	2019	39,374	0	-	-	-	-	$7,536	$74,482	-	$9,843	$64,639	6.8	-	RISE Engineering Audit, 2018
John W. Decas Elementary School-Exterior LED LTG	LED Lighting Upgrades	2019	29,289	0	-	-	-	-	$5,606	$16,245	-	$7,322	$8,923	1.5	-	RISE Engineering Audit, 2018
John W. Decas Elementary School	Kitchen Hood Controls	2021	5,581	3,013	-	-	-	-	$4,111	$19,344	-	$4,520	$14,825	3.6	-	RISE Engineering Audit, 2018
John W. Decas Elementary School	Door Weather Stripping	2021	0	53	-	-	-	-	$54	$1,475	-	$0	$1,475	27.6	-	RISE Engineering Audit, 2018
John W. Decas Elementary School	Refrigeration Controllers	2021	3,757	0	-	-	-	-	$719	$10,526	-	$939	$9,587	13.3	-	RISE Engineering Audit, 2018
John W. Decas Elementary School	Faucet Aerators	2019	0	799	-	-	-	-	$807	$186	-	$186	$0	0.0	-	RISE Engineering Audit, 2018
John W. Decas Elementary School	Programmable Thermostats	2021	0	1,184	-	-	-	-	$1,196	$7,589	-	$925	$6,934	5.8	-	RISE Engineering Audit, 2018
John W. Decas Elementary School Totals			**170,613**	**5,049**	**-**	**-**	**-**	**-**	**$37,755**	**$319,381**	**-**	**$46,887**	**$272,493**	**6.1**	**-**	**RISE Engineering Audits, 2018**
Wareham High School-224-250 Wing	LED Lighting Upgrades & Controls	2019	59,525	0	-	-	-	-	$10,560	$91,185	-	$14,881	$76,304	5.8	-	RISE Engineering Audit, 2018
Wareham High School-209-221 Wing	LED Lighting Upgrades & Controls	2019	42,708	0	-	-	-	-	$7,576	$50,330	-	$10,677	$39,653	4.4	-	RISE Engineering Audit, 2018
Wareham High School-Café Wing	LED Lighting Upgrades & Controls	2019	58,612	0	-	-	-	-	$10,398	$98,240	-	$14,653	$83,587	6.1	-	RISE Engineering Audit, 2018
Wareham High School-Aud-Library Wing	LED Lighting Upgrades & Controls	2020	14,796	0	-	-	-	-	$2,625	$33,078	-	$3,699	$29,379	8.1	-	RISE Engineering Audit, 2018
Wareham High School-Gym Wing	LED Lighting Upgrades & Controls	2020	59,663	0	-	-	-	-	$10,584	$90,694	-	$14,916	$75,778	5.7	-	RISE Engineering Audit, 2018
Wareham High School-Exterior LED LTG	LED Lighting Upgrades	2020	88,200	0	-	-	-	-	$15,647	$38,371	-	$22,050	$16,321	1.0	-	RISE Engineering Audit, 2018
Wareham High School	Kitchen Hood Controls	2021	11,162	6,379	-	-	-	-	$8,423	$24,978	-	$9,569	$15,410	1.8	-	RISE Engineering Audit, 2018
Wareham High School	Door Weather Stripping	2021	0	195	-	-	-	-	$197	$2,242	-	$0	$2,242	11.4	-	RISE Engineering Audit, 2018
Wareham High School	High Efficiency Condensing Boiler	2022	0	7,995	-	-	-	-	$8,075	$342,200	-	$40,000	$302,200	23.1	-	RISE Engineering Audit, 2018
Wareham High School	High Efficiency Condensing Water Heater	2021	0	624	-	-	-	-	$630	$40,120	-	$1,600	$38,520	34.1	-	RISE Engineering Audit, 2018
Wareham High School	Refrigeration Controls	2021	3,757	0	-	-	-	-	$666	$10,526	-	$939	$9,587	14.4	-	RISE Engineering Audit, 2018

Wareham High School	VFD's on HW Circulation Pumps	2022	46,047	0	-	-	-	-	$8,169	$10,620	-	$3,600	$7,020	0.8	-	RISE Engineering Audit, 2018
Wareham High School	Faucet Aerators	2019	0	187	-	-	-	-	$189	$43	-	$43	$0	0.0	-	RISE Engineering Audit, 2018
Wareham High School	Programmable Thermostats	2021	0	3,200	-	-	-	-	$3,232	$21,240	-	$2,500	$18,740	5.8	-	RISE Engineering Audit, 2018
Wareham High School	High Efficiency RTUs	2023	26,129	0	-	-	-	-	$4,635	$278,480	-	$57,500	$220,980	19.8	-	RISE Engineering Audit, 2018
Wareham High School Totals			**410,599**	**18,580**		**-**	**-**	**-**	**$91,606**	**$1,132,347**	**-**	**$196,627**	**$935,720**	**8.1**	**-**	**RISE Engineering Audits, 2018**
Wareham Middle School-A & E Wings	LED Lighting Upgrades & Controls	2020	62,265	0	-	-	-	-	$10,566	$91,087	-	$15,566	$75,521	5.8	-	RISE Engineering Audit, 2018
Wareham Middle School-2nd Floor C Wing & Basement	LED Lighting Upgrades & Controls	2020	44,748	0	-	-	-	-	$7,594	$63,143	-	$11,187	$51,956	5.2	-	RISE Engineering Audit, 2018
Wareham Middle School-1st Floor-C & D Wings	LED Lighting Upgrades & Controls	2020	66,995	0	-	-	-	-	$11,369	$98,133	-	$16,749	$81,384	5.8	-	RISE Engineering Audit, 2018
Wareham Middle School-1st Floor-A & B Wings	LED Lighting Upgrades & Controls	2020	88,300	0	-	-	-	-	$14,985	$99,365	-	$22,075	$77,290	4.2	-	RISE Engineering Audit, 2018
Wareham Middle School-1st Floor E Wing	LED Lighting Upgrades & Controls	2021	43,233	0	-	-	-	-	$7,337	$55,424	-	$10,808	$44,616	4.9	-	RISE Engineering Audit, 2018
Wareham Middle School-Exterior LED LTG	LED Lighting Upgrades	2021	38,163	0	-	-	-	-	$6,476	$24,753	-	$9,541	$15,212	2.2	-	RISE Engineering Audit, 2018
Wareham Middle School	Kitchen Hood Controls	2021	6,581	3,488	-	-	-	-	$4,640	$19,344	-	$5,232	$14,112	3.0	-	RISE Engineering Audit, 2018
Wareham Middle School	Door Weather Stripping	2021	12	18	-	-	-	-	$20	$1,298	-	$0	$1,298	64.2	-	RISE Engineering Audit, 2018
Wareham Middle School	High Efficiency Condensing Boiler	2023	0	6,230	-	-	-	-	$6,292	$177,000	-	$20,000	$157,000	17.9	-	RISE Engineering Audit, 2018
Wareham Middle School	High Efficiency Condensing Water Heater	2021	0	1,310	-	-	-	-	$1,323	$40,120	-	$1,600	$38,520	26.1	-	RISE Engineering Audit, 2018
Wareham Middle School	Refrigeration Controllers	2021	6,643	0	-	-	-	-	$1,127	$21,051	-	$1,661	$19,390	17.2	-	RISE Engineering Audit, 2018
Wareham Middle School	Faucet Aerators	2019	0	187	-	-	-	-	$189	$28	-	$28	$0	0.0	-	RISE Engineering Audit, 2018
Wareham Middle School Totals			**356,940**	**11,233**	-	**-**	**-**	**-**	**$71,918**	**$690,746**	**-**	**$114,447**	**$576,299**	**6.6**	**-**	**RISE Engineering Audit, 2018**
Wareham Town Hall	LED Lighting Controls	2021	6,032	0	-	-	-	-	$1,229	$12,853	-	$1,508	$11,345	6.0	-	RISE Engineering Audit, 2018
Wareham Town Hall	Heat Pump Water Heater	2022	3,515	0	-	-	-	-	$716	$3,506	-	$879	$2,627	2.7	-	RISE Engineering Audit, 2018
Wareham Town Hall	Boiler Reset Controls	2022	0	456	-	-	-	-	$461	$472	-	$225	$247	0.5	-	RISE Engineering Audit, 2018
Wareham Town Hall	Pipe/Valve/Tank Insulation	2021	0	1,664	-	-	-	-	$1,681	$7,080	-	$2,496	$4,584	2.7	-	RISE Engineering Audit, 2018
Wareham Town Hall	Faucet Aerators	2019	388	0	-	-	-	-	$79	$16	-	$16	$0	0.0	-	RISE Engineering Audit, 2018
Wareham Town Hall	Steam Trap Survey and Repairs	2020	0	817	-	-	-	-	$825	$1,593	-	$1,593	$0	0.0	-	RISE Engineering Audit, 2018
Wareham Town Hall Totals			**9,935**	**2,937**	-	**-**	**-**	**-**	**$4,991**	**$25,520**	**-**	**$6,717**	**$18,803**	**3.2**	**-**	**RISE Engineering Audits, 2018**
Wareham Multi-Service Center	LED Lighting Controls	2021	5,411	0	-	-	-	-	$1,123	$14,746	-	$1,353	$13,393	7.1	-	RISE Engineering Audit, 2018

Wareham Multi-Service Center	Kitchen Hood Controls	2021	2,232	603	-	-	-	-	$1,072	$19,344	-	$0	$19,344	18.0	-	RISE Engineering Audit, 2018
Wareham Multi-Service Center	Door Weather Stripping	2021	0	92	-	-	-	-	$93	$1,770	-	$0	$1,770	19.0	-	RISE Engineering Audit, 2018
Wareham Multi-Service Center	High Efficiency Condensing Water Heater	2022	0	230	-	-	-	-	$232	$5,310	-	$1,600	$3,710	7.7	-	RISE Engineering Audit, 2018
Wareham Multi-Service Center	Boiler Reset Controls	2022	0	572	-	-	-	-	$578	$472	-	$225	$247	0.4	-	RISE Engineering Audit, 2018
Wareham Multi-Service Center	Pipe/Valve/Tank Insulation	2021	0	1,381	-	-	-	-	$1,395	$5,664	-	$2,072	$3,593	2.6	-	RISE Engineering Audit, 2018
Wareham Multi-Service Center	Faucet Aerators	2019	0	572	-	-	-	-	$578	$24	-	$24	$0	0.0	-	RISE Engineering Audit, 2018
Wareham Multi-Service Center	Steam Trap Survey and Repairs	2020	0	794	-	-	-	-	$802	$1,593	-	$1,593	$0	0.0	-	RISE Engineering Audit, 2018
Wareham Multi-Service Center Totals			**7,643**	**4,244**	-	**-**	**-**	**-**	**$5,873**	**$48,923**	**-**	**$6,866**	**$42,057**	**6.1**	**-**	**RISE Engineering Audit, 2018**
Wareham Free Library	LED Lighting Controls	2021	4,447	0	-	-	-	-	$892	$14,315	-	$1,112	$13,203	8.9	-	RISE Engineering Audit, 2018
Wareham Free Library	Heat Pump Water Heater	2022	3,954	0	-	-	-	-	$793	$3,506	-	$0	$3,506	3.4	-	RISE Engineering Audit, 2018
Wareham Free Library	Faucet Aerators	2019	679	0	-	-	-	-	$136	$28	-	$28	$0	0.0	-	RISE Engineering Audit, 2018
Wareham Free Library	Programmable Thermostats	2021	0	480	-	-	-	-	$485	$3,186	-	$375	$2,811	5.8	-	RISE Engineering Audit, 2018
Wareham Free Library Totals			**9,080**	**480**	-	**-**	**-**	**-**	**$2,305**	**$21,035**	**-**	**$1,515**	**$19,520**	**6.2**	**-**	**RISE Engineering Audit, 2018**
Wareham Police Department	LED Lighting Controls	2021	2,870	0	-	-	-	-	$580	$4,613	-	$717	$3,896	5.1	-	RISE Engineering Audit, 2018
Wareham Police Department	Door Weather Stripping	2021	43	57	-	-	-	-	$66	$1,156	-	$0	$1,156	17.4	-	RISE Engineering Audit, 2018
Wareham Police Department	High Efficiency Condensing Water Heater	2022	0	54	-	-	-	-	$55	$4,130	-	$1,600	$2,530	8.3	-	RISE Engineering Audit, 2018
Wareham Police Department	Pipe/Valve/Tank Insulation	2021	0	224	-	-	-	-	$226	$4,484	-	$0	$4,484	19.8	-	RISE Engineering Audit, 2018
Wareham Police Department	Faucet Aerators	2019	0	34	-	-	-	-	$34	$8	-	$8	$0	0.0	-	RISE Engineering Audit, 2018
Wareham Police Department	Programmable Thermostats	2021	0	320	-	-	-	-	$323	$2,124	-	$250	$1,874	5.8	-	RISE Engineering Audit, 2018
Wareham Police Department Totals			**2,913**	**689**	-	**-**	**-**	**-**	**$1,284**	**$16,515**	**-**	**$2,575**	**$13,940**	**8.1**	**-**	**RISE Engineering Audit, 2018**
Boys & Girls Club/Donovan Center	LED Lighting Upgrades & Controls	2021	3,045	0	-	-	-	-	$640	$11,026	-	$761	$10,265	7.3	-	RISE Engineering Audit, 2018
Boys & Girls Club/ Donovan Center	Door Weather Stripping	2021	0	46	-	-	-	-	$46	$2,478	-	$0	$2,478	53.3	-	RISE Engineering Audit, 2018
Boys & Girls Club/Donovan Center	High Efficiency Condensing Water Heater	2022	0	216	-	-	-	-	$218	$5,310	-	$1,600	$3,710	7.9	-	RISE Engineering Audit, 2018
Boys & Girls Club/Donovan Center	Boiler Reset Controls	2022	0	491	-	-	-	-	$496	$472	-	$225	$247	0.5	-	RISE Engineering Audit, 2018
Boys & Girls Club/Donovan Center	Pipe/Valve/Tank Insulation	2021	0	3,505	-	-	-	-	$3,540	$10,502	-	$5,258	$5,245	1.5	-	RISE Engineering Audit, 2018

Boys & Girls Club/Donovan Center	Faucet Aerators	2019	0	119	-	-	-	-	$120	$28	-	$28	$0	0.0	-	RISE Engineering Audit, 2018
Boys & Girls Club/Donovan Center	Steam Trap Survey and Repairs	2020	0	876	-	-	-	-	$885	$1,593	-	$1,593	$0	0.0	-	RISE Engineering Audit, 2018
Boys & Girls Club/Donovan Center Totals			**3,045**	**5,253**	-	**-**	**-**	**-**	**$5,946**	**$31,409**	**-**	**$9,464**	**$21,945**	**3.1**	**-**	**RISE Engineering Audit, 2018**
Wastewater Pollution Control Facility	LED Lighting Upgrades & Controls	2021	49,721	0	-	-	-	-	$8,438	$58,649	-	$12,430	$46,219	4.3	-	RISE Engineering Audit, 2018
Wastewater Pollution Control Facility	High Efficiency Condensing Boiler	2023	0	4,251	-	-	-	-	$4,294	$164,020	-	$22,500	$141,520	20.8	-	RISE Engineering Audit, 2018
Wastewater Pollution Control Facility	VFD's on HW Circulation Pumps	2022	22,782	0	-	-	-	-	$3,866	$34,220	-	$6,800	$27,420	6.7	-	RISE Engineering Audit, 2018
Wastewater Pollution Control Facility Totals			**72,503**	**4,251**	-	-	-	-	**$16,597**	**$256,889**	-	**$41,730**	**$215,159**	**9.9**	-	**RISE Engineering Audit, 2018**
Minot Forest Elementary School	Facility Closure	2019	244,049	42,877	-	-	-	-	N/A	N/A	-	N/A	N/A	N/A	-	Town of Wareham & Wareham Public Schools
Minot Forest Elementary School Totals			**244,049**	**42,877**	-	-	-	-	**N/A**	**N/A**	-	**N/A**	**N/A**	**N/A**	-	**Town of Wareham & Wareham Public Schools**
Totals			**1,287,320**	**95,593**	0	**0**	**0**	**0**	**$238,276**	**$2,542,764**	**-**	**$426,828**	**$2,115,936**	**-**	**-**	**-**
Total MMBTUs Saved			**4,389**	**9,559**	0	**0**	**0**	**0**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

C. Summary of Long-Term Energy Reduction Goals – Beyond 5 Years

1. Municipal Buildings (including schools)

To better strategize for the long-term maintenance and management of municipal buildings, Wareham will work with internal schools and town staff as well as outside consultants, when necessary, to assess and document the condition of major municipal buildings on an annual basis. In addition to exposing continuing opportunities for energy use reductions, this effort will provide the Town with a clear, long-term asset management strategy for the effective budgeting and maintenance of buildings.

2. Vehicles (including schools)

The Fuel-Efficient Vehicle policy will have become engrained within municipal purchasing practices after five years, and the Town will seek to explore even more efficient policies and tracking systems to enable more efficiency.

3. Perpetuating Energy Efficiency

Ongoing dialogue with Town and School staff can tap into the knowledge of the employees who use and maintain the buildings every day. It can empower building staff to develop a detailed repair and management schedule and collect data on problems and inefficiencies that may be missed by traditional third party audits. The use of a web-based application system like See Click Fix creates additional real-time opportunities for efficiencies in operation and maintenance.

The Town of Wareham will grow its capacity to retrofit and build more efficient facilities, purchase more efficient vehicles, and illuminate the Town through more efficient lighting throughout the 5-year period. These practices will become more engrained in the culture of the Town and will provide opportunities to instill the ethos into additional policies and programs for more dedicated long-term funding streams and strategies.

V: Appendices

- Building Energy Audits – RISE Engineering
- SRPEDD Vehicle Calculations
- MMBTU Conversion Chart

DECAS ELEMENTARY SCHOOL

Prepared for the Town of Wareham

Overview of Report

RISE Engineering conducted an energy efficiency assessment at the John William Decas School located at 760 Main St., Wareham, Massachusetts. The purpose of the audit was to identify energy conservation opportunities.

By: RISE Engineering

Contents

Executive Summary

The purpose of this review is to summarize the existing points of energy use, highlight any issues with regard to elevated energy consumption, and determine cost-effective measures that can be implemented by the customer. These measures will decrease the site's energy consumption and provide a favorable payback to the customer over the years. Incentives may be available from National Grid to help defer the cost of implementation. The table below summarizes the energy conservation measures (ECMs), their energy savings, estimated costs, estimated incentives, and payback.

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	therms	$	$	$	yrs.
1	Kitchen Hood Controls	5,581	3,013	$ 4,111.33	$ 19,343.74	$ 4,519.50	3.6
2	Door Weather-Stripping	0	53	$ 53.53	$ 1,475.00	$ -	27.6
3	Refrigeration Controllers	3,757	0	$ 719.09	$ 10,525.60	$ 939.25	13.3
4	LED Lighting Upgrade	161,275	0	$ 30,868.04	$ 279,991.00	$ 40,318.00	7.8
5	Faucet Aerators	0	799	$ 806.99	$ 185.79	$ 185.79	0.0
6	Programmable Thermostats	0	1,184	$ 1,195.84	$ 7,858.80	$ 925.00	5.8
	Totals	**170,613**	**5,049**	**$ 37,754.82**	**$ 319,379.93**	**$ 46,887.54**	**7.2**

Facility / Project Location
Decas Elementary School 760 Main Street Wareham, Massachusetts

RISE Engineering			
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Brendan Smith	Energy Engineer	RISE Engineering	(401) 230-7465 BSmith@RISEengineering.com
Site Contact			
Kenneth Buckland	Director of Planning and Community Development	Town of Wareham	(508) 291-3100 Ext 6501 kbuckland@wareham.ma.us

Facility Overview

Building Use

The building is used as an elementary school for the Town of Wareham, Massachusetts.

Operations Schedule

The building's hours of operation are 6:30 am-6:00 pm (Monday through Friday) from September to June with sporadic usage in the summer.

Equipment Usage

Qty.	Type	Fuel	Make	Model	Condition
3	Condensing Boilers	Natural Gas	Lochinvar Crest	FBN1751	Functioning
2	DHW heater	Natural Gas	Bradford White	EF100T199E3NA2	Functioning

Gross Floor Area

The total conditioned area of the building is approximately 68,028 square feet.

Analysis of Current Energy Usage

Space Heating

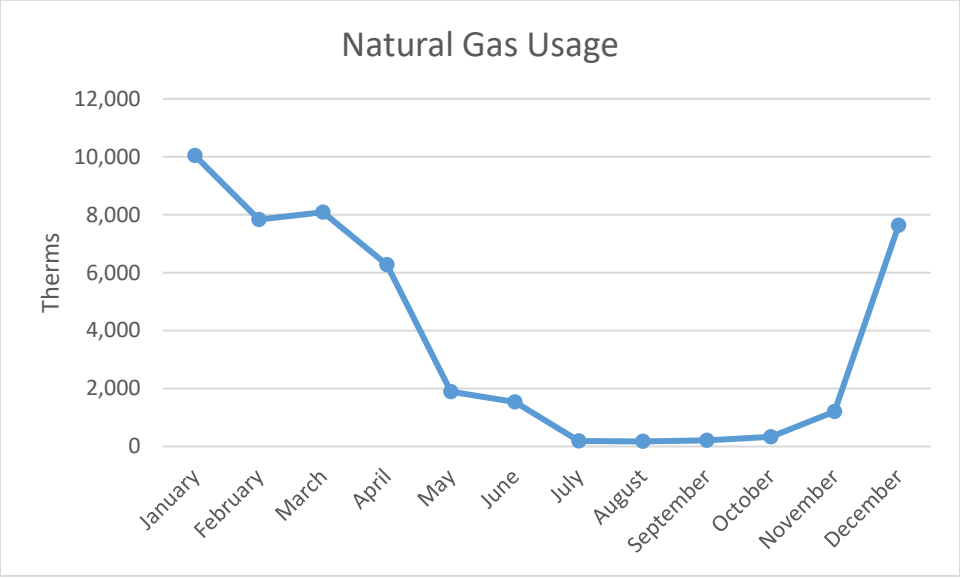
The building is heated with three (3) Lochinvar Crest condensing boilers that are equipped with variable frequency drives (VFDs). Larger spaces within the facility, such as the gym and cafeteria, are heated by hot water-fed air handlers. Classrooms in the main building are heated with unit ventilators, whereas the temporary classrooms are heated and cooled by eight (8) rooftop units (RTUs).

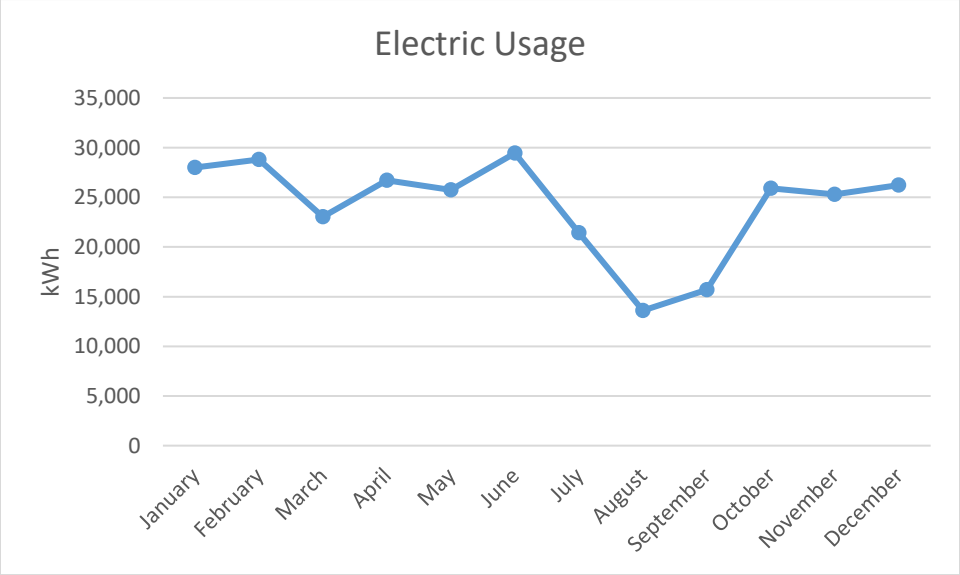
Domestic Hot Water

Domestic hot water is produced by two (2) standard efficiency natural gas-fired Bradford White water heaters.

Utility Introduction

Decas Elementary School currently has a natural gas energy intensity index of 0.67 therms/sqft. The following graphs show the natural gas and electric usages over the 12 most recent months of available data.





Proposed / Installed Energy Conservation Measures (ECM)

ECM 1: Kitchen Hood Controls

Kitchen hood controls monitor cooking activity, measure effluence, and automatically adjust the exhaust fan speed accordingly.

Existing Conditions

The kitchen has a 12' by 7.5' kitchen hood with no controls. When the fans are on, they run at full load.

Proposed Conservation Measure

Install controls to the kitchen hood to reduce the time the exhaust fan is running at full load.

Summary of Savings and Economic Results for Kitchen Hood Controls				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
5,581	$ 1,068.20	3,013	$ 3,043.13	$ 4,111.33
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 19,343.74	$ 4,519.50	$ 14,824.24	4.7	3.6

ECM 2: Door Weather-Stripping

Weather stripping seals spaces that may exist between doors and door frames to reduce air infiltration and exfiltration while doors are closed. This reduces the load on the heating and cooling systems and increases comfort within the conditioned space.

Existing Conditions

There are five (5) 2.5' by 7' exterior doors and one (1) 3' by 7' exterior door that have no weather stripping.

Proposed Conservation Measure

Install weather stripping to the doors described above to reduce unwanted air flow.

Summary of Savings and Economic Results for Door Weather-Stripping				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	53	$ 53.53	$ 53.53
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 1,475.00	$ -	$ 1,475.00	27.6	27.6

ECM 3: Refrigeration Controls and Replacement Evaporator Motors

Installation of evaporator fan controls and electronically commutated motors (EC motors) on the evaporator fans for the walk-in coolers and freezers. The controls will modulate the evaporator fans based on temperature control. Electronic controls allow less fluctuation in temperature and increase energy efficiency. EC motors offer increased efficiency of standard brush motors while offering additional controllability and reliability.

Existing Conditions

There is one (1) walk-in cooler and one (1) walk-in freezer existing at the site without refrigeration controllers installed.

Proposed Conditions

Installation of refrigeration controls on the walk-in cooler and freezer.

Summary of Savings and Economic Results for Refrigeration Controllers				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
3,757	$ 719.09	0	$ -	$ 719.09
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 10,525.60	$ 939.25	$ 9,586.35	14.6	13.3

ECM 4: LED Lighting

Standard bulbs emit light in all directions, therefore requiring the use of reflection to direct the light. LED bulbs utilize all light being produced by emitting in one direction initially. This results in up to a 90% increase in efficiency.

Existing Conditions

Existing T8 and T12 fluorescent, CFLs, incandescent, and halogen bulbs on site.

Proposed Conservation Measure

Replacement of existing inefficient lighting with high efficiency LED bulbs.

Summary of Savings and Economic Results for LED Lighting Upgrade				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
161,275	$ 30,868.04	0	$ -	$ 30,868.04
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 279,991.00	$ 40,318.00	$ 239,673.00	9.1	7.8

ECM 5: Faucet Aerators

Faucet aerators are small attachments to faucets that mix air into the stream of water to maintain pressure while reducing water flow. This reduces the amount of hot water needed. Low flow aerators are generally rated at 1.5 GPM or less.

Existing Conditions

The bathrooms and approximately 90% of the classrooms in the building have sinks with faucets. The majority of these faucets throughout the building have no aerators or aerators rated at 2.2 GPM.

Proposed Conservation Measure

Install low flow aerators (1.5 GPM) to restrict the flow of water through the faucets described above.

Summary of Savings and Economic Results for Faucet Aerators				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	799	$ 806.99	$ 806.99
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 185.79	$ 185.79	$ -	0.2	0.0

ECM 6: Programmable Thermostats

Heating and cooling set-points can be programmed for occupied and unoccupied times. Night set-back controls and scheduling are also featured.

Existing Conditions

There are outdated manual thermostats throughout the building and in the majority of classrooms.

Proposed Conservation Measure

Replace manual thermostats with programmable thermostats in classrooms so setback temperatures may be controlled remotely for unoccupied or nighttime durations.

Summary of Savings and Economic Results for Programmable Thermostats				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	1,184	$ 1,195.84	$ 1,195.84
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 7,858.80	$ 925.00	$ 6,933.80	6.6	5.8

Report Summary

Energy Action Plan

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	therms	$	$	$	yrs.
1	Kitchen Hood Controls	5,581	3,013	$ 4,111.33	$ 19,343.74	$ 4,519.50	3.6
2	Door Weather-Stripping	0	53	$ 53.53	$ 1,475.00	$ -	27.6
3	Refrigeration Controllers	3,757	0	$ 719.09	$ 10,525.60	$ 939.25	13.3
4	LED Lighting Upgrade	161,275	0	$ 30,868.04	$ 279,991.00	$ 40,318.00	7.8
5	Faucet Aerators	0	799	$ 806.99	$ 185.79	$ 185.79	0.0
6	Programmable Thermostats	0	1,184	$ 1,195.84	$ 7,858.80	$ 925.00	5.8
	Totals	**170,613**	**5,049**	**$ 37,754.82**	**$ 319,379.93**	**$ 46,887.54**	**7.2**

Next Steps

To pursue the recommendations outlined in this report, the customer should consult with qualified engineering design firms and mechanical contractors to conduct an in-depth design and cost analysis of proposed measures. Once specific proposals are selected through this process, the customer can apply to National Grid for financial incentives to help defray the cost of implementation.

If you have any questions with the material presented in this report please contact Frank Davey at FDavey@RISEengineering.com.

WAREHAM HIGH SCHOOL

Prepared for the Town of Wareham

Overview of Report

RISE Engineering conducted an energy efficiency assessment at Wareham High School located at 7 Viking Dr., Wareham, Massachusetts. The purpose of the audit was to identify energy conservation opportunities.

By: RISE Engineering

Contents

Executive Summary

The purpose of this review is to summarize the existing points of energy use, highlight any issues with regard to elevated energy consumption, and determine cost-effective measures that can be implemented by the customer. These measures will decrease the site's energy consumption and provide a favorable payback to the customer over the years. Incentives may be available from National Grid to help defer the cost of implementation. The table below summarizes the energy conservation measures (ECMs), their energy savings, estimated costs, estimated incentives, and payback.

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	therms	$	$	$	yrs.
1	Kitchen Hood Controls	11,162	6,379	$ 8,422.93	$ 24,978.24	$ 9,568.50	1.8
2	Door Weather-Stripping	0	195	$ 196.95	$ 2,242.00	$ -	11.4
3	High Efficiency Condensing Boiler	0	7,995	$ 8,074.95	$ 342,200.00	$ 40,000.00	37.4
4	High Efficiency Condensing Water Heater	0	624	$ 630.24	$ 40,120.00	$ 1,600.00	61.1
5	Refrigeration Controllers	3,757	0	$ 666.49	$ 10,525.60	$ 939.25	14.4
6	VFDs on Hot Water Circulation Pumps	46,047	0	$ 8,168.74	$ 10,620.00	$ 3,600.00	0.9
7	LED Lighting Upgrade	323,504	0	$ 57,389.61	$ 401,898.00	$ 80,876.00	5.6
8	Faucet Aerators	0	187	$ 188.87	$ 43.48	$ 43.48	0.0
9	Programmable Thermostats	0	3,200	$ 3,232.00	$ 21,240.00	$ 2,500.00	5.8
10	High Efficiency RTUs	26,129	0	$ 4,635.23	$ 278,480.00	$ 57,500.00	47.7
	Totals	**410,599**	**18,580**	**$ 91,606.01**	**$ 1,132,347.32**	**$ 196,627.23**	**10.2**

Facility / Project Location
Wareham High School 7 Viking Dr, Wareham, Massachusetts

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Site Contact			
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Facility Overview

Building Use

The building is used as a high school for the Town of Wareham, Massachusetts.

Operations Schedule

The building's hours of operation are 6:30 am-6:00 pm (Monday through Friday) from September to June with sporadic usage in the summer.

Equipment Usage

Qty.	Type	Fuel	Make	Model	Condition
6	Condensing Boilers	Natural Gas	Patterson-Kelley	N-1500	Functioning
3	Indirect Water Heaters	Natural Gas	Weil McLain	Plus 100/140/119	Functioning
1	Water Heater	Natural Gas	RUUD	Rheem	Functioning

Gross floor

The total heated area of the building is approximately 142,390 square feet.

Analysis of Current Energy Usage

Space Heating

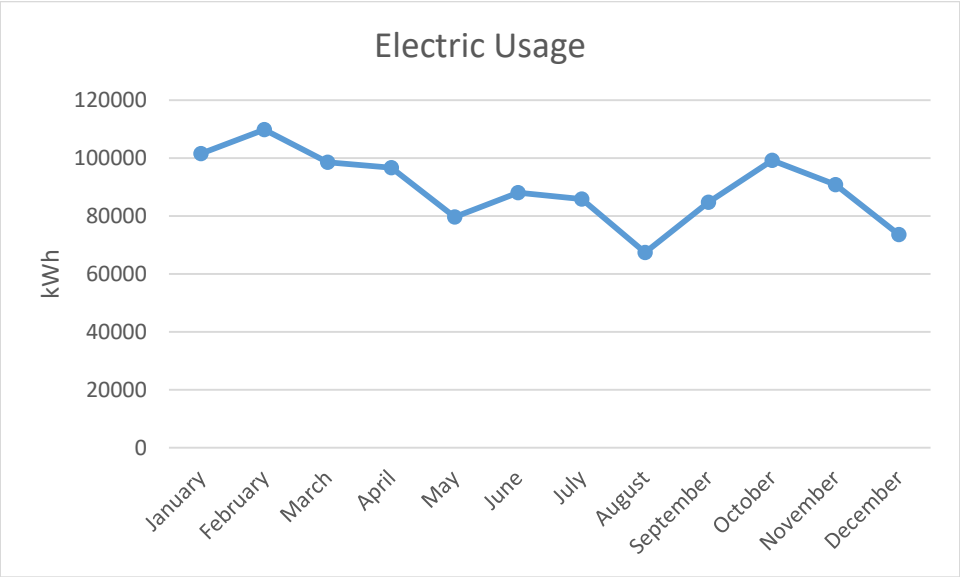
The building is heated by six (6) P-K hydronic standard efficiency boilers. Classrooms are heated by unit heaters, baseboards, air handlers, and RTU's. RTU's and window AC units are used to cool classrooms. The gym is heated by air handlers and the auditorium is serviced by an RTU packaged unit.

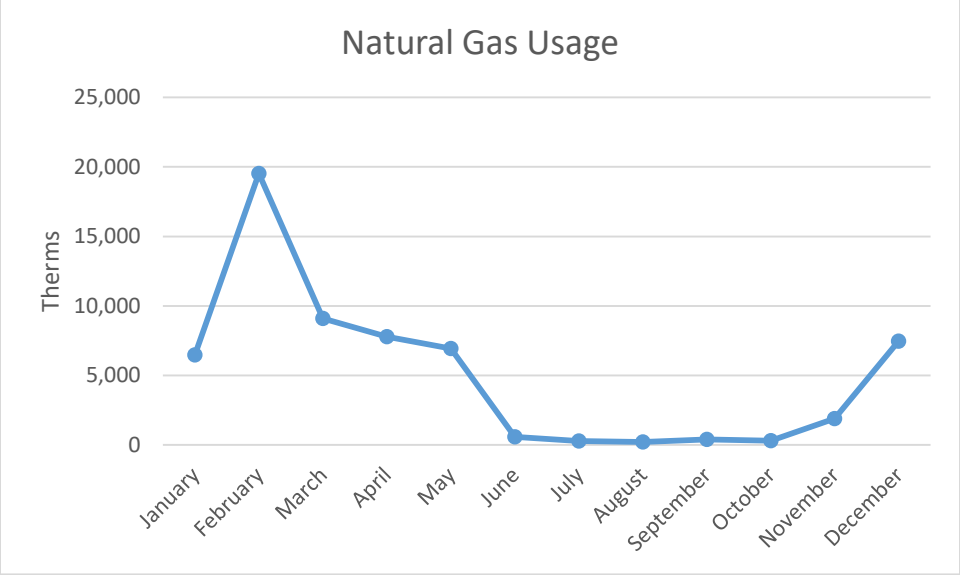
Domestic Hot Water

There are three (3) Weil McLain indirect water heaters used to produce domestic hot water for the building. The kitchen has a separate gas fired water heater storage tank.

Utility Introduction

The following graphs show the natural gas and electric usages over the 12 most recent months of available data.





Proposed / Installed Energy Conservation Measures (ECM)

ECM 1: Kitchen Hood Controls

Kitchen hood controls monitor cooking activity, measure effluence, and automatically adjust the exhaust fan speed accordingly.

Existing Conditions

The kitchen has a 14.5’ by 7.5’ kitchen hood and the culinary room has a 16’ by 4.5’ kitchen hood with no controls. When the fans are on, they run at full load.

Proposed Conservation Measure

Install controls to both kitchen hoods to reduce the time each exhaust fan is running at full load.

Summary of Savings and Economic Results for Kitchen Hood Controls				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
11,162	$ 1,980.14	6,379	$ 6,442.79	$ 8,422.93
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 24,978.24	$ 9,568.50	$ 15,409.74	3.0	1.8

ECM 2: Door Weather-Stripping

Weather stripping seals spaces that may exist between doors and door frames to reduce air infiltration and exfiltration while doors are closed. This reduces the load on the heating and cooling systems and increases comfort within the conditioned space.

Existing Conditions

There is one (1) 3’ by 7’ and twelve (12) 3.5’ by 7’ exterior doors have no weather stripping.

Proposed Conservation Measure

Install weather stripping in the doors described above to reduce unwanted air flow.

Summary of Savings and Economic Results for Door Weather-Stripping				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	195	$ 196.95	$ 196.95
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 2,242.00	$ -	$ 2,242.00	11.4	11.4

ECM 3: High Efficiency Condensing Boilers

High efficiency condensing boilers may include design improvements, sealed combustion, and using a second heat exchanger to condense flue gases in order to achieve increased efficiency.

Existing Conditions

Currently, there are six (6) Patterson-Kelley boilers rated at 85% efficiency.

Proposed Conservation Measure

Replace the boilers described above with new high efficiency condensing boilers.

Summary of Savings and Economic Results for High Efficiency Condensing Boiler				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	7,995	$ 8,074.95	$ 8,074.95
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 342,200.00	$ 40,000.00	$ 302,200.00	42.4	37.4

ECM 4: High Efficiency Condensing Water Heater

High efficiency water heaters implement sealed combustion and a secondary heat exchanger to achieve high thermal efficiencies. Sealed combustion allows the water to be heated from the center, rather than from the bottom, eliminating heat loss. The secondary heat exchanger is able to capture the heat typically lost from exhaust gases to further heat the water.

Existing Conditions

There is currently one (1) 80% efficiency gas-fired water heater that services the kitchen in the facility.

Proposed Conservation Measure

Replace the standard efficiency water heater described above with a high efficiency water heater.

Summary of Savings and Economic Results for High Efficiency Condensing Water Heater				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	624	$ 630.24	$ 630.24
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 40,120.00	$ 1,600.00	$ 38,520.00	63.7	61.1

ECM 5: Refrigeration Controllers

Installation of evaporator fan controls and electronically commutated motors (EC motors) on the evaporator fans for the walk-in coolers and freezers. The controls will modulate the evaporator fans based on temperature control. Electronic controls allow less fluctuation in temperature and increases energy

efficiency. EC motors offer increased efficiency of standard brush motors while offering additional controllability and reliability.

Existing Conditions

There is one (1) walk-in cooler and one (1) walk-in freezer existing at the site without refrigeration controllers installed.

Proposed Conditions

Installation of refrigeration controls on the walk-in cooler and freezer.

Summary of Savings and Economic Results for Refrigeration Controllers				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
3,757	$ 666.49	0	$ -	$ 666.49
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 10,525.60	$ 939.25	$ 9,586.35	15.8	14.4

ECM 6: Variable Frequency Drives on Hydronic Pumps

Variable frequency drives (VFDs) control the motor speed of pumps by varying the incoming frequency and voltage that power the motor. The power supplied to the pump is varied by the VFD to match the demand. This prevents excess consumption cause by direct on-line operation.

Existing Conditions

The existing hydronic pumps have no controls.

Proposed Conservation Measure

VFDs will be installed on the hydronic pumps to vary the energy consumed based on demand.

Summary of Savings and Economic Results for VFDs on Hot Water Circulation Pumps				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
46,047	$ 8,168.74	0	$ -	$ 8,168.74
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 10,620.00	$ 3,600.00	$ 7,020.00	1.3	0.9

ECM 7: LED Lighting Upgrade

Standard bulbs emit light in all directions, therefore requiring the use of reflection to direct the light. LED bulbs utilize all light being produced by emitting in one direction initially. This results in a 90% increase in efficiency.

Existing Conditions
Currently, there is no LED lighting in the building.

Proposed Conservation Measure
Replacement of existing inefficient lighting with high efficiency LED bulbs.

Summary of Savings and Economic Results for LED Lighting Upgrade				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
323,504	$ 57,389.61	0	$ -	$ 57,389.61
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 401,898.00	$ 80,876.00	$ 321,022.00	7.0	5.6

ECM 8: Faucet Aerators
Faucet aerators are small attachments to faucets that mix air into the stream of water to maintain pressure while reducing water flow. This reduces the amount of hot water needed. Low flow aerators are generally rated at 1.5 GPM or less.

Existing Conditions
There are faucets in locker rooms, bathrooms, teacher's lounges, and hallways throughout the building with no aerators.

Proposed Conservation Measure
Install low flow aerators (1.5 GPM) to restrict the high flow of water through the faucets described above.

Summary of Savings and Economic Results for Faucet Aerators				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	187	$ 188.87	$ 188.87
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 43.48	$ 43.48	$ -	0.2	0.0

ECM 9: Programmable Thermostats
Heating and cooling set-points can be programmed for occupied and unoccupied times. Night set-back controls and scheduling are also featured.

Existing Conditions
There are covered thermostats throughout the building with no controls.

Proposed Conservation Measure

Replace manual thermostats with programmable thermostats in classrooms so setback temperatures may be controlled remotely for unoccupied, or nighttime durations.

Summary of Savings and Economic Results for Programmable Thermostats				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	3,200	$ 3,232.00	$ 3,232.00
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 21,240.00	$ 2,500.00	$ 18,740.00	6.6	5.8

ECM 10: High Efficiency RTUs

Air conditioning is a major consumer of electricity. Systems that exceed baseline efficiencies can save a considerable energy and money.

Existing Conditions

There are currently three (3) standard efficiency rooftop units that heat (with a hot water coil) and cool. The units are in working condition but are operating at a sub-standard efficiency.

Proposed Conditions

Installation of three (3) new high efficiency rooftop units.

Summary of Savings and Economic Results for High Efficiency RTUs				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
26,129	$ 4,635.23	0	$ -	$ 4,635.23
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 278,480.00	$ 57,500.00	$ 220,980.00	60.1	47.7

Report Summary

Energy Action Plan

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	therms	$	$	$	yrs.
1	Kitchen Hood Controls	11,162	6,379	$ 8,422.93	$ 24,978.24	$ 9,568.50	1.8
2	Door Weather-Stripping	0	195	$ 196.95	$ 2,242.00	$ -	11.4
3	High Efficiency Condensing Boiler	0	7,995	$ 8,074.95	$ 342,200.00	$ 40,000.00	37.4
4	High Efficiency Condensing Water Heater	0	624	$ 630.24	$ 40,120.00	$ 1,600.00	61.1
5	Refrigeration Controllers	3,757	0	$ 666.49	$ 10,525.60	$ 939.25	14.4
6	VFDs on Hot Water Circulation Pumps	46,047	0	$ 8,168.74	$ 10,620.00	$ 3,600.00	0.9
7	LED Lighting Upgrade	323,504	0	$ 57,389.61	$ 401,898.00	$ 80,876.00	5.6
8	Faucet Aerators	0	187	$ 188.87	$ 43.48	$ 43.48	0.0
9	Programmable Thermostats	0	3,200	$ 3,232.00	$ 21,240.00	$ 2,500.00	5.8
10	High Efficiency RTUs	26,129	0	$ 4,635.23	$ 278,480.00	$ 57,500.00	47.7
	Totals	**410,599**	**18,580**	**$ 91,606.01**	**$ 1,132,347.32**	**$ 196,627.23**	**10.2**

Next Steps

To pursue the recommendations outlined in this report, the customer should consult with qualified engineering design firms and mechanical contractors to conduct an in-depth design and cost analysis of proposed measures. Once specific proposals are selected through this process, the customer can apply to National Grid for financial incentives to help defray the cost of implementation.

If you have any questions with the material presented in this report please contact Frank Davey at FDavey@riseengineering.com.

WAREHAM MIDDLE SCHOOL

Prepared for the Town of Wareham

Overview of Report

RISE Engineering conducted an energy efficiency assessment at Wareham Middle School located at 4 Viking Dr., Wareham, Massachusetts. The purpose of the audit was to identify energy conservation opportunities.

By: RISE Engineering

Contents

Executive Summary

The purpose of this review is to summarize the existing points of energy use, highlight any issues with regard to elevated energy consumption, and determine cost-effective measures that can be implemented by the customer. These measures will decrease the site's energy consumption and provide a favorable payback to the customer over the years. Incentives may be available from National Grid to help defer the cost of implementation. The table below summarizes the energy conservation measures (ECMs), their energy savings, estimated costs, estimated incentives, and payback.

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	therms	$	$	$	yrs.
1	Kitchen Hood Controls	6,581	3,488	$ 4,639.68	$ 19,343.74	$ 5,232.00	3.0
2	Door Weather-Stripping	12	18	$ 20.22	$ 1,298.00	$ -	64.2
3	High Efficiency Condensing Boiler	0	6,230	$ 6,292.30	$ 177,000.00	$ 20,000.00	25.0
4	High Efficiency Condensing Water Heater	0	1,310	$ 1,323.10	$ 40,120.00	$ 1,600.00	29.1
5	Refrigeration Controllers	6,643	0	$ 1,127.32	$ 21,051.20	$ 1,660.75	17.2
6	LED Lighting Upgrade	343,704	0	$ 58,326.57	$ 431,905.00	$ 85,926.00	5.9
7	Faucet Aerators	0	187	$ 188.87	$ 27.67	$ 27.67	0.0
	Totals	**356,940**	**11,233**	**$ 71,918.05**	**$ 690,745.61**	**$ 114,446.42**	**8.0**

Facility / Project Location
Wareham Middle School 4 Viking Dr., Wareham, Massachusetts

RISE Engineering			
Frank Davey	Manager, Special Projects	RISE Engineering	(401) 301-0769 FDavey@RISEengineering.com
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Brendan Smith	Energy Engineer	RISE Engineering	(401) 230-7465 BSmith@RISEengineering.com
Site Contact			
Kenneth Buckland	Director of Planning and Community Development	Town of Wareham	(508) 291-3100 Ext 6501 kbuckland@wareham.ma.us

Facility Overview

Building Use

The building is used as a Middle School for the Town of Wareham, Massachusetts.

Operations Schedule

The building's hours of operation are 6:30 am-6:00 pm (Monday through Friday) from September to June with sporadic usage in the summer.

Equipment Usage

Qty.	Type	Fuel	Make	Model	Condition
1	Hydronic Boiler	Natural Gas	Smith Cast Iron	28A-S/W-13	Functioning
1	Hydronic Boiler	Natural Gas	Smith Cast Iron	28A-S/W-13	Functioning
1	DHW Heater	Natural Gas	Teledyne Laars	PW 0850 IN 09 C 1A CX	Functioning
3	Indirect Tanks	Natural Gas	Aero	AST-115	Functioning

Gross Floor Area

The total heated area of the building is approximately 140,602 square feet.

Analysis of Current Energy Usage

Space Heating

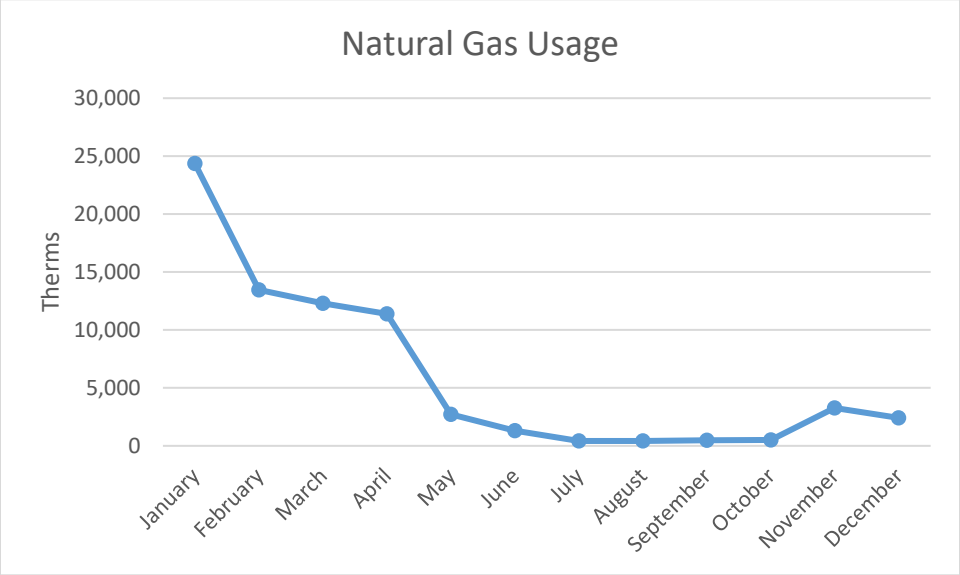
The building is heated by two (2) Smith Cast Iron Hydronic Boilers. The classrooms are heated with unit ventilators and hydronic baseboards. There is an EMS system which allows the thermostats to be controlled centrally.

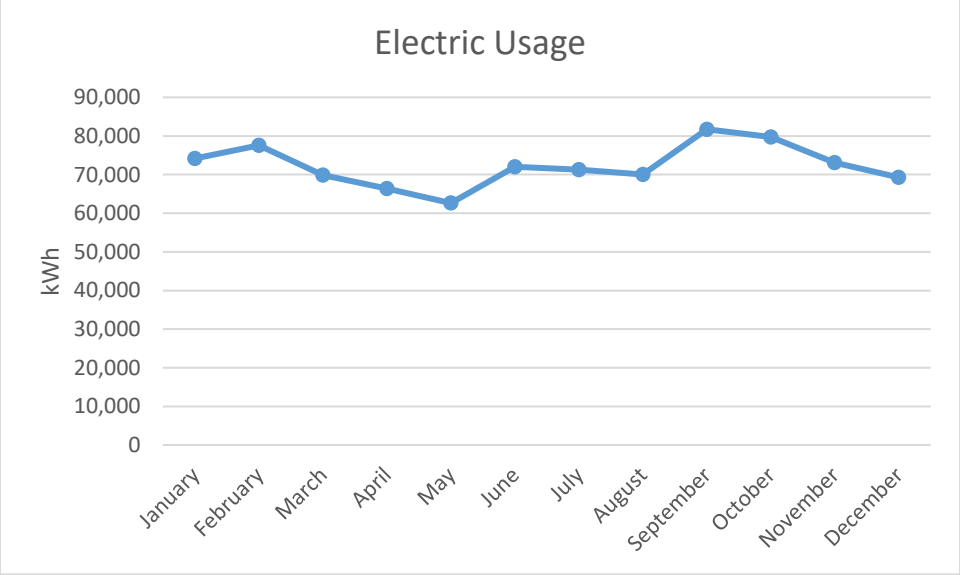
Domestic Hot Water

Domestic hot water is heated by one (1) Teledyne Laars hot water boiler which runs at 85% efficiency with three (3) indirect storage tanks.

Utility Introduction

The following graphs show the natural gas and electric usage over the 12 most recent months of available data.





Proposed / Installed Energy Conservation Measures (ECM)

ECM 1: Kitchen Hood Controls

Kitchen hood controls monitor cooking activity, measure effluence, and automatically adjust the exhaust fan speed accordingly.

Existing Conditions

There is a 13’ by 4’4” hood and a 12’8” by 4’ hood in the kitchen. Neither hood has controls.

Proposed Conservation Measure

Install controls to both kitchen hoods described above to reduce the time each exhaust fan is running at full load.

Summary of Savings and Economic Results for Kitchen Hood Controls					
Electricity Savings		Gas Savings		Total Cost Savings	
kWh	$	therms	$	$	
6,581	$ 1,116.80	3,488	$ 3,522.88	$ 4,639.68	
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years		
			Before Incentive	After Incentive	
$ 19,343.74	$ 5,232.00	$ 14,111.74	4.2	3.0	

ECM 2: Door Weather-Stripping

Weather stripping seals spaces that may exist between doors and door frames to reduce air infiltration and exfiltration while doors are closed. This reduces the load on the heating and cooling systems and increases comfort within the conditioned space.

Existing Conditions

There is one (1) 3’ by 7’ door with no weather stripping.

Proposed Conservation Measure

Install weather stripping in the doors described above to reduce unwanted air flow.

Summary of Savings and Economic Results for Door Weather-Stripping					
Electricity Savings		Gas Savings		Total Cost Savings	
kWh	$	therms	$	$	
12	$ 2.04	18	$ 18.18	$ 20.22	
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years		
			Before Incentive	After Incentive	
$ 1,298.00	$ -	$ 1,298.00	64.2	64.2	

ECM 3: High Efficiency Condensing Boilers

High efficiency condensing boilers may include design improvements, sealed combustion, and using a second heat exchanger to condense flue gases in order to achieve increased efficiency.

Existing Conditions

Currently, there are two (2) Smith Cast Iron hydronic boilers rated at 85%.

Proposed Conservation Measure

Replace the boilers described above with new high efficiency condensing boilers.

Summary of Savings and Economic Results for High Efficiency Condensing Boiler				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	6,230	$ 6,292.30	$ 6,292.30
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 177,000.00	$ 20,000.00	$ 157,000.00	28.1	25.0

ECM 4: High Efficiency Water Heater - Kitchen

High efficiency water heaters implement sealed combustion and a secondary heat exchanger to achieve high thermal efficiencies. Sealed combustion allows the water to be heated from the center, rather than from the bottom, eliminating heat loss. The secondary heat exchanger is able to capture the heat typically lost from exhaust gases to further heat the water.

Existing Conditions

There is currently one (1) 85% efficient water heater implemented in the facility.

Proposed Conservation Measure

Replace the standard efficiency water heater described above with a high efficiency water heater.

Summary of Savings and Economic Results for High Efficiency Condensing Water Heater				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	1,310	$ 1,323.10	$ 1,323.10
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 40,120.00	$ 1,600.00	$ 38,520.00	30.3	29.1

ECM 5: Refrigeration Controllers

Installation of evaporator fan controls and electronically commutated motors (EC motors) on the evaporator fans for the walk-in coolers and freezers. The controls will modulate the evaporator fans based on temperature control. Electronic controls allow less fluctuation in temperature and increases energy

efficiency. EC motors offer increased efficiency of standard brush motors while offering additional controllability and reliability.

Existing Conditions

There is one (1) walk-in cooler and one (1) walk-in freezer existing at the site without refrigeration controllers installed.

Proposed Conditions

Installation of refrigeration controls on the walk-in cooler and freezer.

Summary of Savings and Economic Results for Refrigeration Controllers				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
6,643	$ 1,127.32	0	$ -	$ 1,127.32
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 21,051.20	$ 1,660.75	$ 19,390.45	18.7	17.2

ECM 6: LED Lighting Upgrade

Standard bulbs emit light in all directions, therefore requiring the use of reflection to direct the light. LED bulbs utilize all light being produced by emitting in one direction initially. This results in a 90% increase in efficiency.

Existing Conditions

There is no LED lighting servicing the building in classrooms, hallways, or other rooms.

Proposed Conservation Measure

Replacement of existing inefficient lighting with high efficiency LED bulbs.

Summary of Savings and Economic Results for LED Lighting Upgrade				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
343,704	$ 58,326.57	0	$ -	$ 58,326.57
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 431,905.00	$ 85,926.00	$ 345,979.00	7.4	5.9

ECM 7: Faucet Aerators

Faucet aerators are small attachments to faucets that mix air into the stream of water to maintain pressure while reducing water flow. This reduces the amount of hot water needed. Low flow aerators are generally rated at 1.5 GPM or less.

Existing Conditions

There are no aerators on the seven (7) faucets in the science lab, and 2.2 GPM rated aerators on the faucets in each of the classrooms.

Proposed Conservation Measure

Install low flow aerators (1.5 GPM) to restrict the high flow of water through the faucets described above.

Summary of Savings and Economic Results for Faucet Aerators				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	187	$ 188.87	$ 188.87
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 27.67	$ 27.67	$ -	0.1	0.0

Report Summary

Energy Action Plan

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	therms	$	$	$	yrs.
1	Kitchen Hood Controls	6,581	3,488	$ 4,639.68	$ 19,343.74	$ 5,232.00	3.0
2	Door Weather-Stripping	12	18	$ 20.22	$ 1,298.00	$ -	64.2
3	High Efficiency Condensing Boiler	0	6,230	$ 6,292.30	$ 177,000.00	$ 20,000.00	25.0
4	High Efficiency Condensing Water Heater	0	1,310	$ 1,323.10	$ 40,120.00	$ 1,600.00	29.1
5	Refrigeration Controllers	6,643	0	$ 1,127.32	$ 21,051.20	$ 1,660.75	17.2
6	LED Lighting Upgrade	343,704	0	$ 58,326.57	$ 431,905.00	$ 85,926.00	5.9
7	Faucet Aerators	0	187	$ 188.87	$ 27.67	$ 27.67	0.0
	Totals	**356,940**	**11,233**	**$ 71,918.05**	**$ 690,745.61**	**$ 114,446.42**	**8.0**

Next Steps

To pursue the recommendations outlined in this report, the customer should consult with qualified engineering design firms and mechanical contractors to conduct an in-depth design and cost analysis of proposed measures. Once specific proposals are selected through this process, the customer can apply to National Grid for financial incentives to help defray the cost of implementation.

If you have any questions with the material presented in this report please contact Frank Davey at FDavey@riseengineering.com.

TOWN HALL

Prepared for the Town of Wareham

Overview of Report

RISE Engineering conducted an energy efficiency assessment at Memorial Town Hall located at 54 Marion Rd., Wareham, Massachusetts. The purpose of the audit was to identify energy conservation opportunities.

By: RISE Engineering

Contents

Executive Summary

The purpose of this review is to summarize the existing points of energy use, highlight any issues with regard to elevated energy consumption, and determine cost-effective measures that can be implemented by the customer. These measures will decrease the site's energy consumption and provide a favorable payback to the customer over the years. Incentives may be available from National Grid to help defer the cost of implementation. The table below summarizes the energy conservation measures (ECMs), their energy savings, estimated costs, estimated incentives, and payback.

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	therms	$	$	$	yrs.
1	Heat Pump Water Heater	3,515	0	$ 716.27	$ 3,505.78	$ 878.64	3.7
2	Boiler Reset Controls	0	456	$ 460.56	$ 472.00	$ 225.00	0.5
3	Pipe /Valve/Tank Insulation	0	1,664	$ 1,680.64	$ 7,080.00	$ 2,496.00	2.7
4	LED Lighting Upgrade	6,032	0	$ 1,229.32	$ 12,853.00	$ 1,508.00	9.2
5	Faucet Aerators	388	0	$ 79.07	$ 15.81	$ 15.81	0.0
6	Steam Trap Survey and Repairs	0	817	$ 825.47	$ 1,593.00	$ 1,593.00	0.0
	Totals	**9,935**	**2,937**	**$ 4,991.34**	**$ 25,519.59**	**$ 6,716.45**	**3.8**

Facility / Project Location
Wareham Town Hall 54 Marion Rd, Wareham, Massachusetts

RISE Engineering			
Frank Davey	Manager, Special Projects	RISE Engineering	(401) 301-0769 FDavey@RISEengineering.com
Jean-Paul Vandeputte	Director of Engineering	RISE Engineering	(401) 784-3700 Ext 6129 JPVandeputte@RISEengineering.com
Shane Murphy	Energy Engineer	RISE Engineering	(401) 603-6485 SMurphy@RISEEngineering.com
Brendan Smith	Energy Engineer	RISE Engineering	(401) 230-7465 BSmith@RISEengineering.com
Site Contact			
Kenneth Buckland	Director of Planning and Community Development	Town of Wareham	(508) 291-3100 Ext 6501 kbuckland@wareham.ma.us

Facility Overview

Building Use

The building is used as a town hall for the Town of Wareham, Massachusetts.

Operations Schedule

The building's hours of operation are 8:00 am-6:00 pm (Monday through Thursday).

Equipment Usage

Qty.	Type	Fuel	Make	Model	Condition
1	Steam Boiler	Natural Gas	Weil McLain	H-1094-SF	Functioning
1	Steam Boiler	Natural Gas	Smith Cast Iron	28A-S/W-10	Functioning
1	DHW Heater	Electric	RUUD	RU 0305613936	Functioning

Gross Floor Area

The total heated area of the building is approximately 31,225 square feet.

Analysis of Current Energy Usage

Space Heating

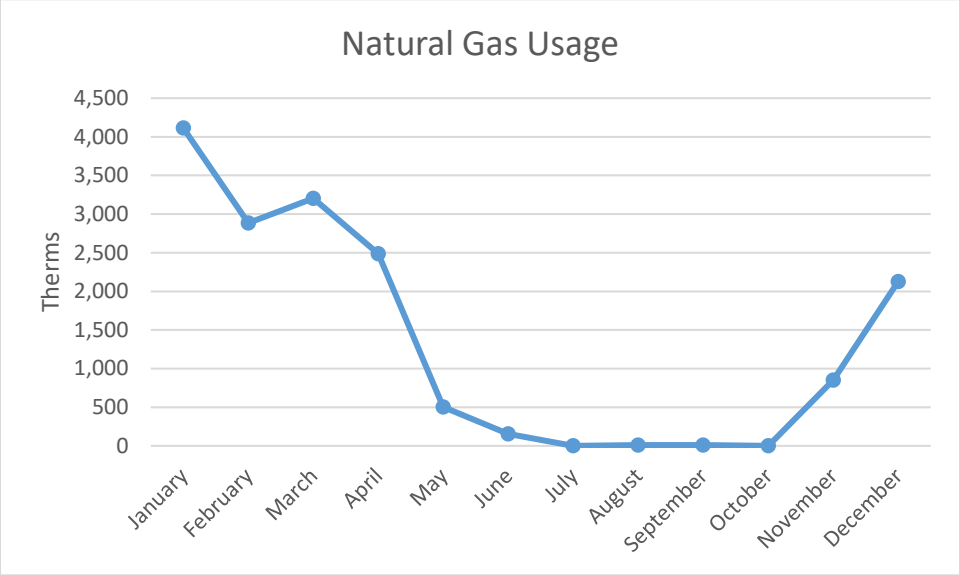
The building is heated by two (2) standard efficiency steam boilers. Each room and office is heated by steam radiators.

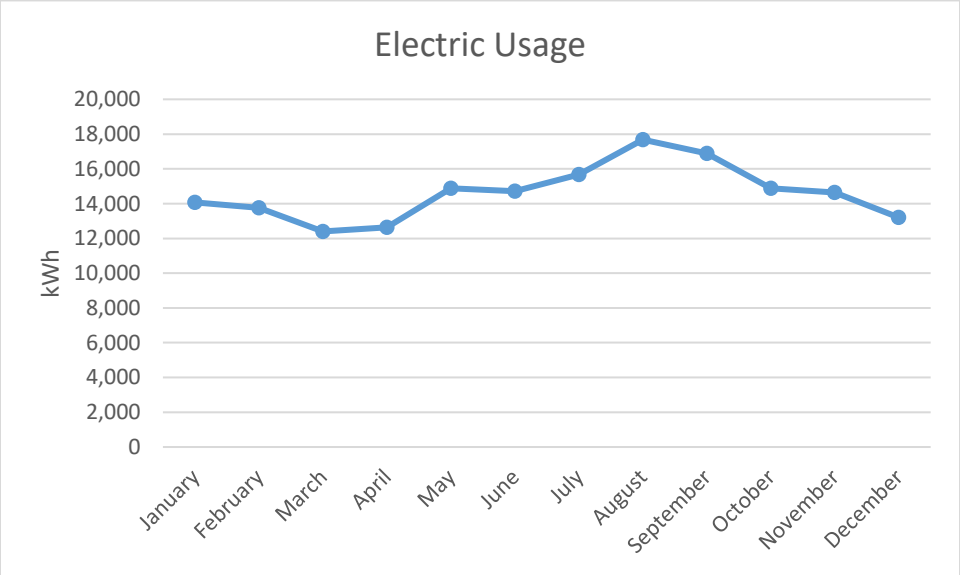
Domestic Hot Water

Domestic hot water is heated by one (1) standard efficiency electric RUUD water heater.

Utility Introduction

The following graphs show the natural gas and electric usage over the 12 most recent months of available data.





Proposed / Installed Energy Conservation Measures (ECM)

ECM 1: Heat Pump Water Heater

Heat pump water heaters use a reverse refrigeration cycle to move heat from one place to another instead of generating heat directly. These units can reach electric efficiencies two to three times higher when compared to conventional electric resistance water heaters.

Existing Conditions

The site is serviced by one (1) standard efficiency 10-gallon electric resistance water heater for domestic hot water.

Proposed Conditions

It is proposed to replace the existing water heater with a 10-gallon high efficiency heat pump water heater.

Summary of Savings and Economic Results for Heat Pump Water Heater				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
3,515	$ 716.27	0	$ -	$ 716.27
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 3,505.78	$ 878.64	$ 2,627.14	4.9	3.7

ECM 2: Boiler Reset Controls

Boiler Controls allow scheduling and varying temperature set-points throughout the day. Some controls compensate for outside temperature or varying load automatically.

Existing Conditions

There are no boiler controls currently implemented.

Proposed Conservation Measure

Install Boiler Controls for existing boiler or newly installed hydronic boiler. RISE performed calculations to quantify savings produced by this measure.

Summary of Savings and Economic Results for Boiler Reset Controls				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	456	$ 460.56	$ 460.56
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 472.00	$ 225.00	$ 247.00	1.0	0.5

ECM 3: Pipe/Valve/Tank Insulation

Insulation is recommended in heating systems to reduce heat loss.

Existing Conditions

There is 185 linear feet of condensate return piping, five (5) 4"-6" gate valves, and one (1) 52" by 28" condensate tank with no insulation.

Proposed Conservation Measure

It is recommended to install insulation on the bare pipes and tanks listed above to reduce the constant loss of energy in the steam, domestic hot water, and condensate systems.

Summary of Savings and Economic Results for Pipe /Valve/Tank Insulation				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	1,664	$ 1,680.64	$ 1,680.64
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 7,080.00	$ 2,496.00	$ 4,584.00	4.2	2.7

ECM 4: LED Lighting Upgrade

Standard bulbs emit light in all directions, therefore requiring the use of reflection to direct the light. LED bulbs utilize all light being produced by emitting in one direction initially. This results in a 90% increase in efficiency.

Existing Conditions

Currently, there is no LED lighting being used at this facility.

Proposed Conservation Measure

Replacement of existing inefficient lighting with high efficiency LED bulbs.

Summary of Savings and Economic Results for LED Lighting Upgrade				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
6,032	$ 1,229.32	0	$ -	$ 1,229.32
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 12,853.00	$ 1,508.00	$ 11,345.00	10.5	9.2

ECM 5: Faucet Aerators

Faucet aerators are small attachments to faucets that mix air into the stream of water to maintain pressure while reducing water flow. This reduces the amount of hot water needed. Low flow aerators are generally rated at 1.5 GPM or less.

Existing Conditions

There are several high flow aerators rated at 2.5-3.0 GPM as well as faucets with no aerators.

Proposed Conservation Measure

Install low flow aerators (1.5 GPM) to restrict the high flow of water through the faucets described above.

Summary of Savings and Economic Results for Faucet Aerators				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
388	$ 65.96	0	$ -	$ 65.96
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 15.81	$ 15.81	$ -	0.2	0.0

ECM 6: Steam Trap Survey and Repairs

Steam traps convert the steam in a system to condensate, transferring that heat to the conditioned space. Steam traps not working at optimal efficiency discharge the unconverted steam and never utilize that heat.

Existing Conditions

There are 90-120 traps that have not been surveyed in the recommended window of time.

Proposed Conservation Measure

RISE suggests contacting the utility for a list of approved vendors to perform the steam trap survey. National Grid will reimburse the cost of the steam trap survey and 50% of the cost of repairs under the Gas Efficiency Program.

Summary of Savings and Economic Results for Steam Trap Survey and Repairs				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	817	$ 825.47	$ 825.47
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 1,593.00	$ 1,593.00	$ -	1.9	0.0

Report Summary

Energy Action Plan

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	therms	$	$	$	yrs.
1	Heat Pump Water Heater	3,515	0	$ 716.27	$ 3,505.78	$ 878.64	3.7
2	Boiler Reset Controls	0	456	$ 460.56	$ 472.00	$ 225.00	0.5
3	Pipe /Valve/Tank Insulation	0	1,664	$ 1,680.64	$ 7,080.00	$ 2,496.00	2.7
4	LED Lighting Upgrade	6,032	0	$ 1,229.32	$ 12,853.00	$ 1,508.00	9.2
5	Faucet Aerators	388	0	$ 79.07	$ 15.81	$ 15.81	0.0
6	Steam Trap Survey and Repairs	0	817	$ 825.47	$ 1,593.00	$ 1,593.00	0.0
	Totals	**9,935**	**2,937**	**$ 4,991.34**	**$ 25,519.59**	**$ 6,716.45**	**3.8**

Next Steps

To pursue the recommendations outlined in this report, the customer should consult with qualified engineering design firms and mechanical contractors to conduct an in-depth design and cost analysis of proposed measures. Once specific proposals are selected through this process, the customer can apply to National Grid for financial incentives to help defray the cost of implementation.

If you have any questions with the material presented in this report please contact Frank Davey at FDavey@riseengineering.com.

BOYS AND GIRLS CLUB / DONOVAN CENTER

Prepared for the Town of Wareham

Overview of Report

RISE Engineering conducted an energy efficiency assessment at the Boys and Girls Club / Donovan Center located at 13 Highland Ave., Wareham, Massachusetts. The purpose of the audit was to identify energy conservation opportunities.

By: RISE Engineering

Contents

Executive Summary

The purpose of this review is to summarize the existing points of energy use, highlight any issues with regard to elevated energy consumption, and determine cost-effective measures that can be implemented by the customer. These measures will decrease the site's energy consumption and provide a favorable payback to the customer over the years. Incentives may be available from National Grid to help defer the cost of implementation. The table below summarizes the energy conservation measures (ECMs), their energy savings, estimated costs, estimated incentives, and payback.

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	therms	$	$	$	yrs.
1	Door Weather-Stripping	0	46	$ 46.46	$ 2,478.00	$ -	53.3
2	High Efficiency Condensing Water Heater	0	216	$ 218.16	$ 5,310.00	$ 1,600.00	17.0
3	Boiler Reset Controls	0	491	$ 495.91	$ 472.00	$ 225.00	0.5
4	Pipe /Valve/Tank Insulation	0	3,505	$ 3,540.05	$ 10,502.00	$ 5,257.50	1.5
5	LED Lighting Upgrade	3,045	0	$ 640.36	$ 11,026.00	$ 761.00	16.0
6	Faucet Aerators	0	119	$ 120.19	$ 27.67	$ 27.67	0.0
7	Steam Trap Survey and Repairs	0	876	$ 885.06	$ 1,593.00	$ 1,593.00	0.0
	Totals	**3,045**	**5,253**	**$ 5,946.20**	**$ 31,408.67**	**$ 9,464.17**	**3.7**

Facility / Project Location
Wareham Boys & Girls Club / Donovan Center 13 Highland Ave, Wareham, Massachusetts

RISE Engineering			
Frank Davey	Manager, Special Projects	RISE Engineering	(401) 301-0769 FDavey@RISEengineering.com
Jean-Paul Vandeputte	Director of Engineering	RISE Engineering	(401) 784-3700 Ext 6129 JPVandeputte@RISEengineering.com
Shane Murphy	Energy Engineer	RISE Engineering	(401) 603-6485 SMurphy@RISEEngineering.com
Brendan Smith	Energy Engineer	RISE Engineering	(401) 230-7465 BSmith@RISEengineering.com
Site Contact			
Kenneth Buckland	Director of Planning and Community Development	Town of Wareham	(508) 291-3100 Ext 6501 kbuckland@wareham.ma.us

Facility Overview

Building Use

A portion of this building is used as a boys and girls club while the remaining portion is used as a day care / learning center in the Town of Wareham, Massachusetts.

Operations Schedule

The building's hours of operation are 8:00 am-5:00 pm (Monday through Friday) from July to August and 2:30 pm-8:00 pm (Monday through Thursday), 2:30 pm-7:00 pm (Friday) from September to June.

Equipment Usage

Qty.	Type	Fuel	Make	Model	Condition
1	Steam Boiler	Natural Gas	Smith Cast Iron	28A-12-060660	Functioning
1	Steam Boiler	Natural Gas	Weil McLain	H-1294-5	Functioning
1	DHW Heater	Natural Gas	RUUD	PR 75-70N	Functioning

Gross floor

The total heated area of the building is approximately 16,502 square feet.

Analysis of Current Energy Usage

Space Heating

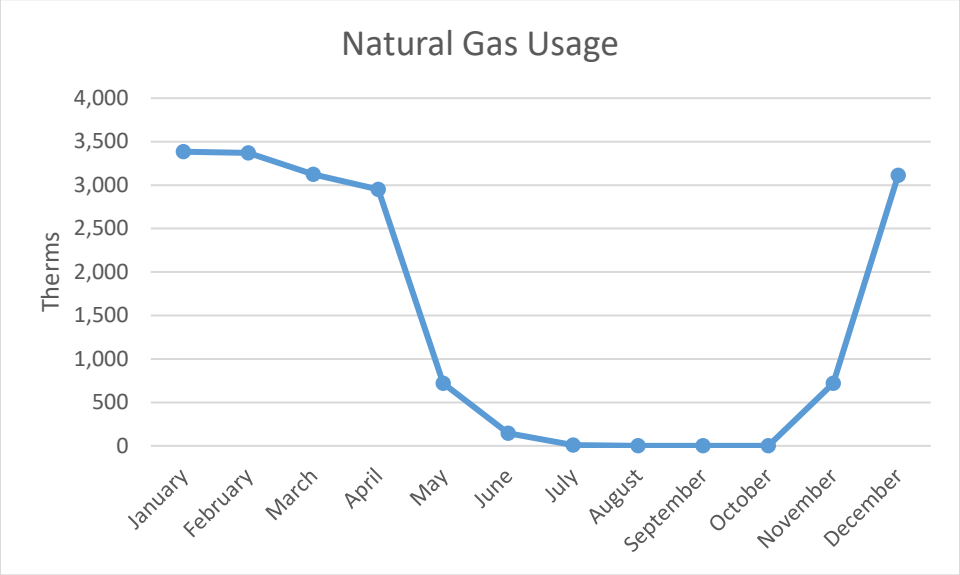
The building is heated by one (1) Smith Cast Iron and one (1) Weil McLain boiler. These boilers alternated, so only one (1) is in service at a time. The boys and girls club portion of the building is heated with steam radiators in each classroom and steam piping along the ceiling in the main gym area. Most classrooms in the Donovan Center are heated with steam-fed unit ventilators.

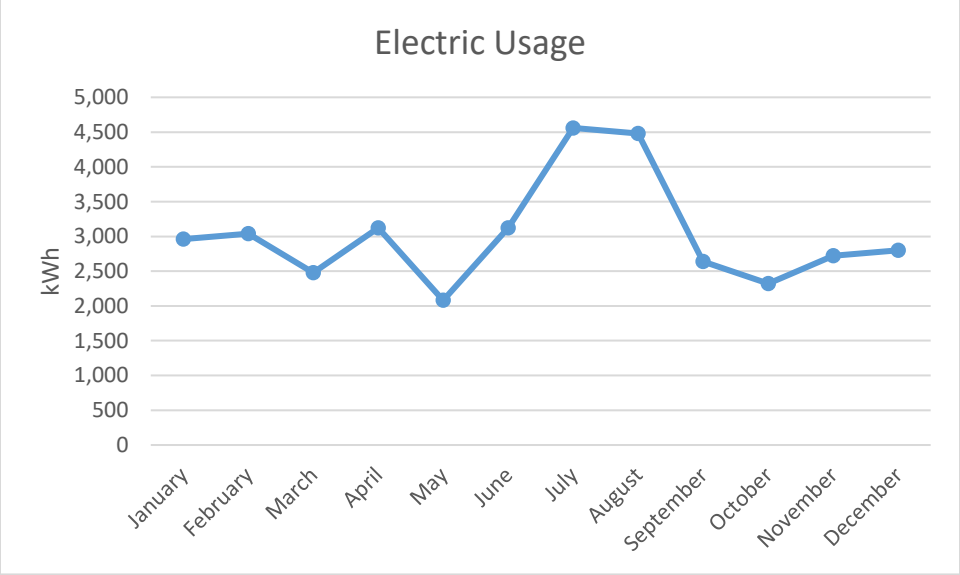
Domestic Hot Water (DHW)

DHW is heated by one (1) gas-fired water heater that services the whole building.

Utility Introduction

The following graphs show the natural gas and electric usage over the 12 most recent months of available data.





Proposed / Installed Energy Conservation Measures (ECM)

ECM 1: Door Weather-Stripping

Weather stripping seals spaces that may exist between doors and door frames to reduce air infiltration and exfiltration while doors are closed. This reduces the load on the heating and cooling systems and increases comfort within the conditioned space.

Existing Conditions

There are two (2) 3' by 7' doors leading outside with no weather stripping.

Proposed Conservation Measure

Install weather stripping in the doors described above to reduce unwanted air flow.

Summary of Savings and Economic Results for Door Weather-Stripping				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	46	$ 46.46	$ 46.46
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 2,478.00	$ -	$ 2,478.00	53.3	53.3

ECM 2: High Efficiency Condensing Water Heater

High efficiency water heaters implement sealed combustion and a secondary heat exchanger to achieve high thermal efficiencies. Sealed combustion allows the water to be heated from the center, rather than from the bottom, eliminating heat loss. The secondary heat exchanger is able to capture the heat typically lost from exhaust gases to further heat the water.

Existing Conditions

There is currently a standard efficiency water heater implemented in the facility.

Proposed Conservation Measure

Replace the standard efficiency water heater described above with a high efficiency water heater.

Summary of Savings and Economic Results for High Efficiency Condensing Water Heater				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	216	$ 218.16	$ 218.16
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 5,310.00	$ 1,600.00	$ 3,710.00	24.3	17.0

ECM 3: Boiler Reset Controls

Boiler Controls allow scheduling and varying temperature set-points throughout the day. Some controls compensate for outside temperature or varying load automatically.

Existing Conditions

There are no boiler controls currently implemented.

Proposed Conservation Measure

Install boiler controls for the existing boiler. RISE performed calculations to quantify savings produced by this measure.

Summary of Savings and Economic Results for Boiler Reset Controls				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	491	$ 495.91	$ 495.91
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 472.00	$ 225.00	$ 247.00	1.0	0.5

ECM 4: Pipe/Valve/Tank Insulation

Insulation is recommended in heating systems to reduce heat loss.

Existing Conditions

There is approximately 50 linear feet of steam piping, 150 linear feet of condensate return piping, 20 linear feet of domestic hot water piping, one (1) condensate tank, one (1) 6” gate valve, one (1) 6” control valve, and two (2) 6” T valves that are not insulated, causing over and under-heating in the building.

Proposed Conservation Measure

It is recommended to install insulation on the bare pipes and tanks listed above to reduce the constant loss of energy in the steam, domestic hot water, and condensate systems.

Summary of Savings and Economic Results for Pipe /Valve/Tank Insulation				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	3,505	$ 3,540.05	$ 3,540.05
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 10,502.00	$ 5,257.50	$ 5,244.50	3.0	1.5

ECM 5: LED Lighting Upgrade

Standard bulbs emit light in all directions, therefore requiring the use of reflection to direct the light. LED bulbs utilize all light being produced by emitting in one direction initially. This results in a 90% increase in efficiency.

Existing Conditions

Currently, there is no LED lighting being used at this facility.

Proposed Conservation Measure

Replacement of existing inefficient lighting with high efficiency LED bulbs.

Summary of Savings and Economic Results for LED Lighting Upgrade				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
3,045	$ 640.36	0	$ -	$ 640.36
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 11,026.00	$ 761.00	$ 10,265.00	17.2	16.0

ECM 6: Faucet Aerators

Faucet aerators are small attachments to faucets that mix air into the stream of water to maintain pressure while reducing water flow. This reduces the amount of hot water needed. Low flow aerators are generally rated at 1.5 GPM or less.

Existing Conditions

Most classrooms and bathrooms in the boys and girls club have no aerators and the rooms in the Donovan Center have 2.0 GPM aerators.

Proposed Conservation Measure

Install low flow aerators (1.5 GPM) to restrict the high flow of water through the faucets described above.

Summary of Savings and Economic Results for Faucet Aerators				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	119	$ 120.19	$ 120.19
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 27.67	$ 27.67	$ -	0.2	0.0

ECM 7: Steam Trap Survey and Repairs

Steam traps convert the steam in a system to condensate, transferring that heat to the conditioned space. Steam traps not working at optimal efficiency discharge the unconverted steam and never utilize that heat. A steam trap survey would include locating, identifying, and testing the functionality of each steam trap in the building through thermal imaging and ultrasonic leak detection.

Existing Conditions

There are 50-80 traps that have not been surveyed in the recommended window of time.

Proposed Conservation Measure

RISE suggests contacting the utility for a list of approved vendors to perform the steam trap survey. National Grid would reimburse the cost of the steam trap survey as well as 50% of the cost of repairs under the Gas Efficiency Program.

Summary of Savings and Economic Results for Steam Trap Survey and Repairs				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	876	$ 885.06	$ 885.06
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 1,593.00	$ 1,593.00	$ -	1.8	0.0

Report Summary

Energy Action Plan

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	therms	$	$	$	yrs.
1	Door Weather-Stripping	0	46	$ 46.46	$ 2,478.00	$ -	53.3
2	High Efficiency Condensing Water Heater	0	216	$ 218.16	$ 5,310.00	$ 1,600.00	17.0
3	Boiler Reset Controls	0	491	$ 495.91	$ 472.00	$ 225.00	0.5
4	Pipe /Valve/Tank Insulation	0	3,505	$ 3,540.05	$ 10,502.00	$ 5,257.50	1.5
5	LED Lighting Upgrade	3,045	0	$ 640.36	$ 11,026.00	$ 761.00	16.0
6	Faucet Aerators	0	119	$ 120.19	$ 27.67	$ 27.67	0.0
7	Steam Trap Survey and Repairs	0	876	$ 885.06	$ 1,593.00	$ 1,593.00	0.0
	Totals	**3,045**	**5,253**	**$ 5,946.20**	**$ 31,408.67**	**$ 9,464.17**	**3.7**

Next Steps

To pursue the recommendations outlined in this report, the customer should consult with qualified engineering design firms and mechanical contractors to conduct an in-depth design and cost analysis of proposed measures. Once specific proposals are selected through this process, the customer can apply to National Grid for financial incentives to help defray the cost of implementation.

If you have any questions with the material presented in this report please contact Frank Davey at FDavey@riseengineering.com.

MULTI-SERVICE CENTER

Prepared for the Town of Wareham

Overview of Report

RISE Engineering conducted an energy efficiency assessment at the Multi-Service Center located at 48 Marion Rd., Wareham, Massachusetts. The purpose of the audit was to identify energy conservation opportunities.

By: RISE Engineering

Contents

Executive Summary

The purpose of this review is to summarize the existing points of energy use, highlight any issues with regard to elevated energy consumption, and determine cost-effective measures that can be implemented by the customer. These measures will decrease the site's energy consumption and provide a favorable payback to the customer over the years. Incentives may be available from National Grid to help defer the cost of implementation. The table below summarizes the energy conservation measures (ECMs), their energy savings, estimated costs, estimated incentives, and payback.

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	therms	$	$	$	yrs.
1	Kitchen Hood Controls	2,232	603	$ 1,072.39	$ 19,343.74	$ -	18.0
2	Door Weather-Stripping	0	92	$ 92.92	$ 1,770.00	$ -	19.0
3	High Efficiency Condensing Water Heater	0	230	$ 232.30	$ 5,310.00	$ 1,600.00	16.0
4	Boiler Reset Controls	0	572	$ 577.72	$ 472.00	$ 225.00	0.4
5	Pipe /Valve/Tank Insulation	0	1,381	$ 1,394.81	$ 5,664.00	$ 2,071.50	2.6
6	LED Lighting Upgrade	5,411	0	$ 1,123.32	$ 14,746.00	$ 1,353.00	11.9
7	Faucet Aerators	0	572	$ 577.72	$ 23.72	$ 23.72	0.0
8	Steam Trap Survey and Repairs	0	794	$ 802.24	$ 1,593.00	$ 1,593.00	0.0
	Totals	**7,643**	**4,244**	**$ 5,873.43**	**$ 48,922.46**	**$ 6,866.22**	**7.2**

Facility / Project Location
Multi-Service Center 48 Marion Rd, Wareham, Massachusetts

RISE Engineering			
Frank Davey	Manager, Special Projects	RISE Engineering	(401) 301-0769 FDavey@RISEengineering.com
Jean-Paul Vandeputte	Director of Engineering	RISE Engineering	(401) 784-3700 Ext 6129 JPVandeputte@RISEengineering.com
Shane Murphy	Energy Engineer	RISE Engineering	(401) 603-6485 SMurphy@RISEEngineering.com
Brendan Smith	Energy Engineer	RISE Engineering	(401) 230-7465 BSmith@RISEengineering.com
Site Contact			
Kenneth Buckland	Director of Planning and Community Development	Town of Wareham	(508) 291-3100 Ext 6501 kbuckland@wareham.ma.us

Facility Overview

Building Use

The building is used as a multi-service center, including a center for seniors for the Town of Wareham, Massachusetts.

Operations Schedule

The building's hours of operation are 8:30 am-4:00 pm (Monday through Friday).

Equipment Usage

Qty.	Type	Fuel	Make	Model	Condition
1	Steam Boiler	Natural Gas	Weil McLain	1088	Functioning
1	DHW Heater	Natural Gas	RUUD	RFD82-156	Functioning

Gross Floor Area

The total heated area of the building is approximately 27,040 square feet.

Analysis of Current Energy Usage

Space Heating

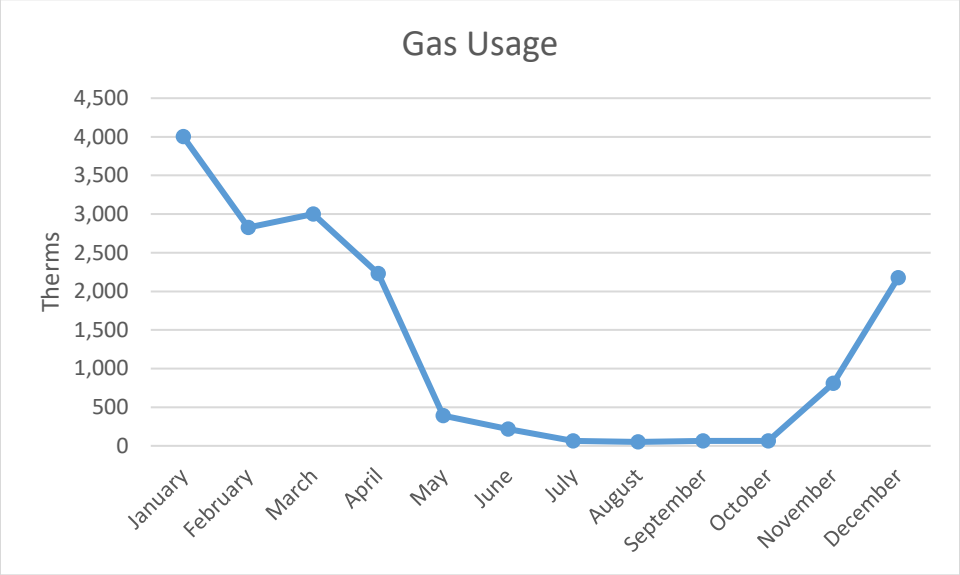
The building is heated by one (1) Weil McLain steam boiler. There are steam radiators located throughout the building and one (1) Modine hydronic unit heater. The community room is serviced by four (4) steam-fed unit ventilators and one (1) Carrier RTU. All other rooms are heated by steam radiators and the remaining two (2) Carrier RTUs.

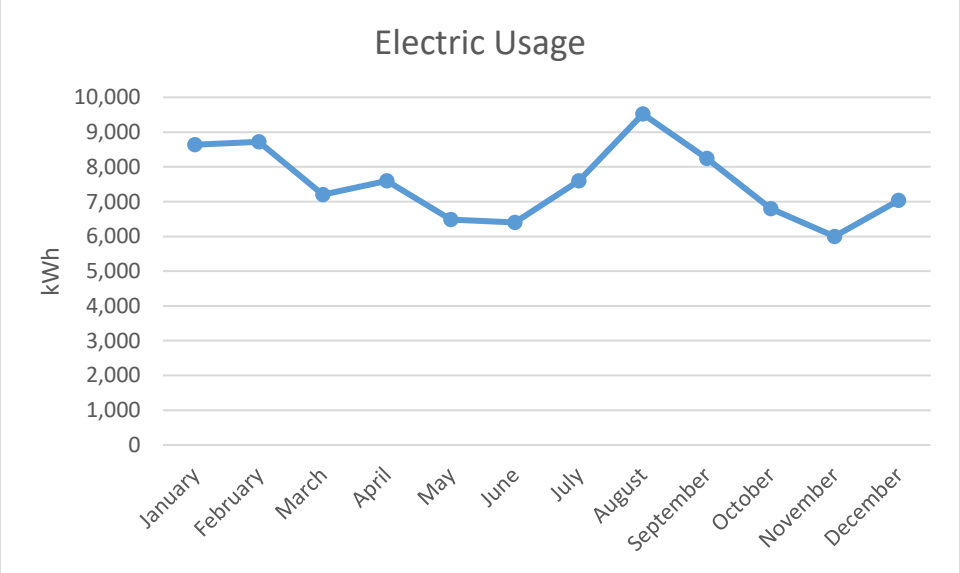
Domestic Hot Water

Domestic hot water is heated by one (1) RUUD gas fired water heater.

Utility Introduction

The following graphs show the natural gas and electric usage over the 12 most recent months of available data.





Proposed / Installed Energy Conservation Measures (ECM)

ECM 1: Kitchen Hood Controls

Kitchen hood controls monitor cooking activity, measure effluence, and automatically adjust the exhaust fan speed accordingly.

Existing Conditions

There is a gas range stove with a 4' x 3' kitchen stove with no controls.

Proposed Conservation Measure

Install controls to the kitchen hood described above to reduce the time the exhaust fan is running at full load.

Summary of Savings and Economic Results for Kitchen Hood Controls				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
2,232	$ 463.36	603	$ 609.03	$ 1,072.39
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 19,343.74	$ -	$ 19,343.74	18.0	18.0

ECM 2: Door Weather-Stripping

Weather stripping seals spaces that may exist between doors and door frames to reduce air infiltration and exfiltration while doors are closed. This reduces the load on the heating and cooling systems and increases comfort within the conditioned space.

Existing Conditions

There are eight (8) 3' x 7' doors leading outside with no weather stripping.

Proposed Conservation Measure

Install weather stripping in the doors described above to reduce unwanted air flow.

Summary of Savings and Economic Results for Door Weather-Stripping				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	92	$ 92.92	$ 92.92
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 1,770.00	$ -	$ 1,770.00	19.0	19.0

ECM 3: High Efficiency Water Heater

High efficiency water heaters implement sealed combustion and a secondary heat exchanger to achieve high thermal efficiencies. Sealed combustion allows the water to be heated from the center, rather than

from the bottom, eliminating heat loss. The secondary heat exchanger is able to capture the heat typically lost from exhaust gases to further heat the water.

Existing Conditions

There is currently a standard efficiency water heater implemented in the facility.

Proposed Conservation Measure

Replace the standard efficiency water heater described above with a high efficiency water heater.

Summary of Savings and Economic Results for High Efficiency Condensing Water Heater				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	230	$ 232.30	$ 232.30
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 5,310.00	$ 1,600.00	$ 3,710.00	22.9	16.0

ECM 4: Boiler Reset Controls

Boiler Controls allow scheduling and varying temperature set-points throughout the day. Some controls compensate for outside temperature or varying load automatically.

Existing Conditions

There are no boiler controls currently implemented.

Proposed Conservation Measure

Install Boiler Controls for existing boiler or newly installed hydronic boiler. RISE performed calculations to quantify savings produced by this measure.

Summary of Savings and Economic Results for Boiler Reset Controls				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	572	$ 577.72	$ 577.72
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 472.00	$ 225.00	$ 247.00	0.8	0.4

ECM 5: Pipe/Valve/Tank Insulation

Insulation is recommended in heating systems to reduce heat loss.

Existing Conditions

There are two (2) 3” control valves, one (1) 2.5’ x 2.5’ x 2.5’ condensate tank, one (1) 8” gate valve, 5 linear feet of steam pipe, and 80 linear feet of condensate return piping that is uninsulated. There is also 4’ of 3” steam pipe with existing insulation that has been compromised due to water exposure.

Proposed Conservation Measure

It is recommended to install insulation on the bare pipes and tanks listed above to reduce the constant loss of energy in the steam, domestic hot water, and condensate systems.

Summary of Savings and Economic Results for Pipe /Valve/Tank Insulation				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	1,381	$ 1,394.81	$ 1,394.81
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 5,664.00	$ 2,071.50	$ 3,592.50	4.1	2.6

ECM 6: LED Lighting Upgrade

Standard bulbs emit light in all directions, therefore requiring the use of reflection to direct the light. LED bulbs utilize all light being produced by emitting in one direction initially. This results in up to a 90% increase in efficiency.

Existing Conditions

Existing T8 and T12 fluorescent, CFLs, incandescent, and halogen bulbs on site.

Proposed Conservation Measure

Replacement of existing inefficient lighting with high efficiency LED bulbs.

Summary of Savings and Economic Results for LED Lighting Upgrade				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
5,411	$ 1,123.32	0	$ -	$ 1,123.32
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 14,746.00	$ 1,353.00	$ 13,393.00	13.1	11.9

ECM 7: Faucet Aerators

Faucet aerators are small attachments to faucets that mix air into the stream of water to maintain pressure while reducing water flow. This reduces the amount of hot water needed. Low flow aerators are generally rated at 1.5 GPM or less.

Existing Conditions

There are several high flow aerators rated at 2.0-2.5 GPM as well as faucets with no aerators.

Proposed Conservation Measure

Install low flow aerators (1.5 GPM) to restrict the high flow of water through the faucets described above.

Summary of Savings and Economic Results for Faucet Aerators				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	572	$ 577.72	$ 577.72
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 23.72	$ 23.72	$ -	0.0	0.0

ECM 8: Steam Trap Survey and Repairs

Steam traps convert the steam in a system to condensate, transferring that heat to the conditioned space. Steam traps not working at optimal efficiency discharge the unconverted steam and never utilize that heat.

Existing Conditions

There are 60-80 traps that have not been surveyed in the recommended window of time.

Proposed Conservation Measure

RISE suggests contacting the utility for a list of approved vendors to perform the steam trap survey. National Grid will reimburse the cost of the steam trap survey as well as 50% of the cost of repairs under the Gas Efficiency Program.

Summary of Savings and Economic Results for Steam Trap Survey and Repairs				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	794	$ 802.24	$ 802.24
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 1,593.00	$ 1,593.00	$ -	2.0	0.0

Report Summary

Energy Action Plan

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	therms	$	$	$	yrs.
1	Kitchen Hood Controls	2,232	603	$ 1,072.39	$ 19,343.74	$ -	18.0
2	Door Weather-Stripping	0	92	$ 92.92	$ 1,770.00	$ -	19.0
3	High Efficiency Condensing Water Heater	0	230	$ 232.30	$ 5,310.00	$ 1,600.00	16.0
4	Boiler Reset Controls	0	572	$ 577.72	$ 472.00	$ 225.00	0.4
5	Pipe /Valve/Tank Insulation	0	1,381	$ 1,394.81	$ 5,664.00	$ 2,071.50	2.6
6	LED Lighting Upgrade	5,411	0	$ 1,123.32	$ 14,746.00	$ 1,353.00	11.9
7	Faucet Aerators	0	572	$ 577.72	$ 23.72	$ 23.72	0.0
8	Steam Trap Survey and Repairs	0	794	$ 802.24	$ 1,593.00	$ 1,593.00	0.0
	Totals	**7,643**	**4,244**	**$ 5,873.43**	**$ 48,922.46**	**$ 6,866.22**	**7.2**

Next Steps

To pursue the recommendations outlined in this report, the customer should consult with qualified engineering design firms and mechanical contractors to conduct an in-depth design and cost analysis of proposed measures. Once specific proposals are selected through this process, the customer can apply to National Grid for financial incentives to help defray the cost of implementation.

If you have any questions with the material presented in this report please contact Frank Davey at FDavey@riseengineering.com.

POLICE STATION

Prepared for the Town of Wareham

Overview of Report

RISE Engineering conducted an energy efficiency assessment at the Wareham Police Station located at 2515 Cranberry Hwy., Wareham, Massachusetts. The purpose of the audit was to identify energy conservation opportunities.

By: RISE Engineering

Contents

Executive Summary

The purpose of this review is to summarize the existing points of energy use, highlight any issues with regard to elevated energy consumption, and determine cost-effective measures that can be implemented by the customer. These measures will decrease the site's energy consumption and provide a favorable payback to the customer over the years. Incentives may be available from National Grid to help defer the cost of implementation. The table below summarizes the energy conservation measures (ECMs), their energy savings, estimated costs, estimated incentives, and payback.

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	therms	$	$	$	yrs.
1	Door Weather-Stripping	43	57	$ 66.26	$ 1,156.40	$ -	17.5
2	High Efficiency Condensing Water Heater	0	54	$ 54.54	$ 4,130.00	$ 1,600.00	46.4
3	Pipe /Valve/Tank Insulation	0	224	$ 226.24	$ 4,484.00	$ -	19.8
4	LED Lighting Upgrade	2,870	0	$ 579.74	$ 4,613.00	$ 717.00	6.7
5	Faucet Aerators	0	34	$ 34.34	$ 7.91	$ 7.91	0.0
6	Programmable Thermostats	0	320	$ 323.20	$ 2,124.00	$ 250.00	5.8
	Totals	**2,913**	**689**	**$ 1,284.32**	**$ 16,515.31**	**$ 2,574.91**	**10.9**

Facility / Project Location
Wareham Police Station 2515 Cranberry Hwy, Wareham, Massachusetts

RISE Engineering			
Frank Davey	Manager, Special Projects	RISE Engineering	(401) 301-0769 FDavey@RISEengineering.com
Jean-Paul Vandeputte	Director of Engineering	RISE Engineering	(401) 784-3700 Ext 6129 JPVandeputte@RISEengineering.com
Shane Murphy	Energy Engineer	RISE Engineering	(401) 603-6485 SMurphy@RISEEngineering.com
Brendan Smith	Energy Engineer	RISE Engineering	(401) 230-7465 BSmith@RISEengineering.com
Site Contact			
Kenneth Buckland	Director of Planning and Community Development	Town of Wareham	(508) 291-3100 Ext 6501 kbuckland@wareham.ma.us

Facility Overview

Building Use

The building is used as a Police Station for the Town of Wareham, Massachusetts.

Operations Schedule

The building's hours of operation are 24 hours per day (Monday through Sunday).

Equipment Usage

Qty.	Type	Fuel	Make	Model	Condition
2	HE Hydronic Boiler	Natural Gas	Weil McLain	Ultra 299	Functioning
1	DHW Heater	Natural Gas	RUUD	PH2-50-408	Functioning

Gross Floor Area

The total heated area of the building is approximately 6,856 square feet.

Analysis of Current Energy Usage

Space Heating

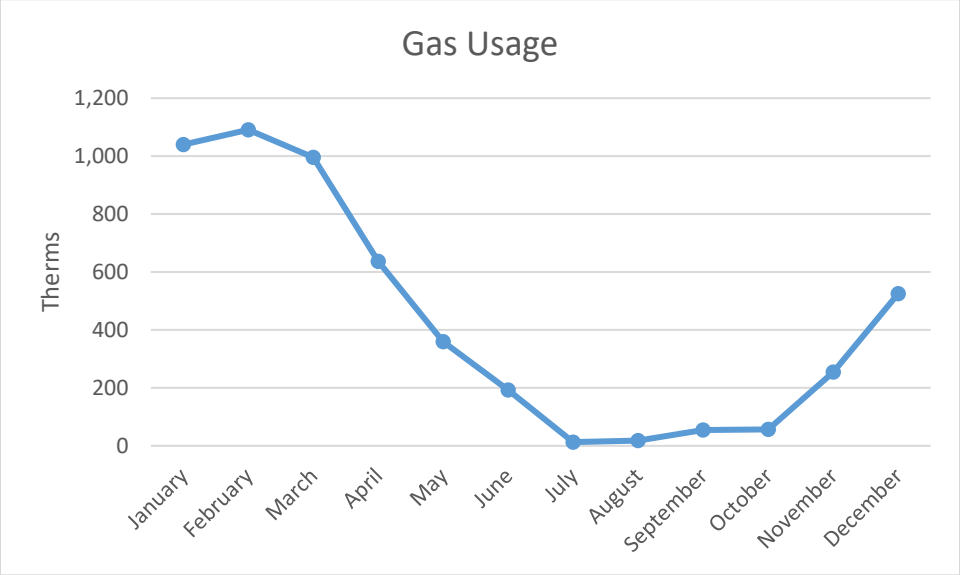
The building is heated with two (2) high efficiency condensing Weil McLain boilers. There are hydronic baseboards located throughout the building. The men's cellblock is heated with a forced hot air unit.

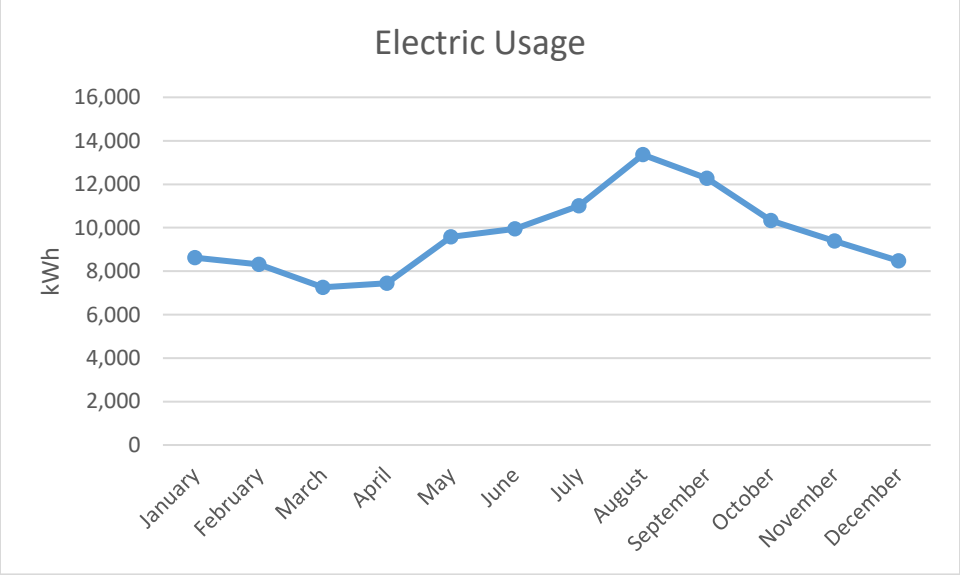
Domestic Hot Water (DHW)

Domestic hot water is heated by one (1) gas fired DHW heater.

Utility Introduction

The Police Station currently has a natural gas intensity index of 0.76 therms/sqft. The following graphs show the natural gas and electric usage over the 12 most recent months of available data.





Proposed / Installed Energy Conservation Measures (ECM)

ECM 1: Door Weather-Stripping

Weather stripping seals spaces that may exist between doors and door frames to reduce air infiltration and exfiltration while doors are closed. This reduces the load on the heating and cooling systems and increases comfort within the conditioned space.

Existing Conditions

There are four (4) 3' x 7' doors that lead outside with no weather stripping.

Proposed Conservation Measure

Install weather stripping in the doors described above to reduce unwanted air flow.

Summary of Savings and Economic Results for Door Weather-Stripping					
Electricity Savings		Gas Savings		Total Cost Savings	
kWh	$	therms	$	$	
43	$ 8.69	57	$ 57.57	$ 66.26	
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years		
			Before Incentive	After Incentive	
$ 1,156.40	$ -	$ 1,156.40	17.5	17.5	

ECM 2: High Efficiency Condensing Water Heater

High efficiency water heaters implement sealed combustion and a secondary heat exchanger to achieve high thermal efficiencies. Sealed combustion allows the water to be heated from the center, rather than from the bottom, eliminating heat loss. The secondary heat exchanger is able to capture the heat typically lost from exhaust gases to further heat the water.

Existing Conditions

There is currently a standard efficiency water heater implemented in the facility.

Proposed Conservation Measure

Replace the standard efficiency water heater described above with a high efficiency water heater.

Summary of Savings and Economic Results for High Efficiency Condensing Water Heater					
Electricity Savings		Gas Savings		Total Cost Savings	
kWh	$	therms	$	$	
0	$ -	54	$ 54.54	$ 54.54	
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years		
			Before Incentive	After Incentive	
$ 4,130.00	$ 1,600.00	$ 2,530.00	75.7	46.4	

ECM 3: Pipe/Valve/Tank Insulation

Pipe insulation is recommended in heating systems to reduce heat loss.

Existing Conditions

There is 18 linear feet of steel pipe and 22 linear feet of copper pipe for heating output, 20 linear feet of steel piping for heating return, and 14 linear feet of copper piping for domestic hot water that is uninsulated.

Proposed Conservation Measure

It is recommended to install insulation on the bare pipes and tanks listed above to reduce the constant loss of energy in the steam, domestic hot water, and condensate systems.

Summary of Savings and Economic Results for Pipe /Valve/Tank Insulation				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	224	$ 226.24	$ 226.24
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 4,484.00	$ -	$ 4,484.00	19.8	19.8

ECM 4: LED Lighting Upgrade

Standard bulbs emit light in all directions, therefore requiring the use of reflection to direct the light. LED bulbs utilize all light being produced by emitting in one direction initially. This results in up to a 90% increase in efficiency.

Existing Conditions

Existing T8 and T12 fluorescent, CFLs, incandescent, and halogen bulbs on site.

Proposed Conservation Measure

Replacement of existing inefficient lighting with high efficiency LED bulbs.

Summary of Savings and Economic Results for LED Lighting Upgrade				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
2,870	$ 579.74	0	$ -	$ 579.74
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 4,613.00	$ 717.00	$ 3,896.00	8.0	6.7

ECM 5: Faucet Aerators

Faucet aerators are small attachments to faucets that mix air into the stream of water to maintain pressure while reducing water flow. This reduces the amount of hot water needed. Low flow aerators are generally rated at 1.5 GPM or less.

Existing Conditions

There are several high flow aerators rated at 2.5 GPM as well as faucets with no aerators.

Proposed Conservation Measure

Install low flow aerators (1.5 GPM) to restrict the high flow of water through the faucets described above.

Summary of Savings and Economic Results for Faucet Aerators				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	34	$ 34.34	$ 34.34
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 7.91	$ 7.91	$ -	0.2	0.0

ECM 6: Programmable Thermostats

Heating and cooling set-points can be programmed for occupied and unoccupied times. Night set-back controls and scheduling are also featured.

Existing Conditions

There are only manual heating controls.

Proposed Conservation Measure

Replace manual thermostats with programmable thermostats in classrooms so setback temperatures may be controlled remotely for unoccupied, or nighttime durations.

Summary of Savings and Economic Results for Programmable Thermostats				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	320	$ 323.20	$ 323.20
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 2,124.00	$ 250.00	$ 1,874.00	6.6	5.8

Report Summary

Energy Action Plan

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	therms	$	$	$	yrs.
1	Door Weather-Stripping	43	57	$ 66.26	$ 1,156.40	$ -	17.5
2	High Efficiency Condensing Water Heater	0	54	$ 54.54	$ 4,130.00	$ 1,600.00	46.4
3	Pipe /Valve/Tank Insulation	0	224	$ 226.24	$ 4,484.00	$ -	19.8
4	LED Lighting Upgrade	2,870	0	$ 579.74	$ 4,613.00	$ 717.00	6.7
5	Faucet Aerators	0	34	$ 34.34	$ 7.91	$ 7.91	0.0
6	Programmable Thermostats	0	320	$ 323.20	$ 2,124.00	$ 250.00	5.8
	Totals	**2,913**	**689**	**$ 1,284.32**	**$ 16,515.31**	**$ 2,574.91**	**10.9**

Next Steps

To pursue the recommendations outlined in this report, the customer should consult with qualified engineering design firms and mechanical contractors to conduct an in-depth design and cost analysis of proposed measures. Once specific proposals are selected through this process, the customer can apply to National Grid for financial incentives to help defray the cost of implementation.

If you have any questions with the material presented in this report please contact Frank Davey at FDavey@riseengineering.com.

WAREHAM FREE LIBRARY

Prepared for the Town of Wareham

Overview of Report

RISE Engineering conducted an energy efficiency assessment at Wareham Free Library located at 59 Marion Rd., Wareham, Massachusetts. The purpose of the audit was to identify energy conservation opportunities.

By: RISE Engineering

Contents

Executive Summary

The purpose of this review is to summarize the existing points of energy use, highlight any issues with regard to elevated energy consumption, and determine cost-effective measures that can be implemented by the customer. These measures will decrease the site's energy consumption and provide a favorable payback to the customer over the years. Incentives may be available from National Grid to help defer the cost of implementation. The table below summarizes the energy conservation measures (ECMs), their energy savings, estimated costs, estimated incentives, and payback.

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	therms	$	$	$	yrs.
1	Heat Pump Water Heater	3,954	0	$ 792.75	$ 7,011.56	$ 988.47	7.6
2	LED Lighting Upgrade	4,447	0	$ 891.62	$ 14,315.00	$ 1,112.00	14.8
3	Faucet Aerators	679	0	$ 136.14	$ 27.67	$ 27.67	0.0
4	Programmable Thermostats	0	480	$ 484.80	$ 3,186.00	$ 375.00	5.8
	Totals	**9,080**	**480**	**$ 2,305.32**	**$ 24,540.23**	**$ 2,503.14**	**9.6**

Facility / Project Location
Wareham Free Library 59 Marion Rd, Wareham, Massachusetts

RISE Engineering			
Frank Davey	Manager, Special Projects	RISE Engineering	(401) 301-0769 FDavey@RISEengineering.com
Jean-Paul Vandeputte	Director of Engineering	RISE Engineering	(401) 784-3700 Ext 6129 JPVandeputte@RISEengineering.com
Shane Murphy	Energy Engineer	RISE Engineering	(401) 603-6485 SMurphy@RISEEngineering.com
Brendan Smith	Energy Engineer	RISE Engineering	(401) 230-7465 BSmith@RISEengineering.com
Site Contact			
Kenneth Buckland	Director of Planning and Community Development	Town of Wareham	(508) 291-3100 Ext 6501 kbuckland@wareham.ma.us

Facility Overview

Building Use

The building is used as a free public library for the Town of Wareham, Massachusetts.

Operations Schedule

The building's hours of operation are 10:00am-7:00pm (Tuesday and Thursday), 10:00am-5:00pm (Wednesday), and 9:00am-2:00pm (Saturday).

Equipment Usage

Qty.	Type	Fuel	Make	Model	Condition
3	HE Hydronic Boiler	Natural Gas	Weil McLain	Ultra 230	Functioning
2	Water Heater	Electric	Gama	E62-40R-045DV	Functioning

Gross Floor Area

The total heated area of the building is approximately 19,700 square feet.

Analysis of Current Energy Usage

Space Heating

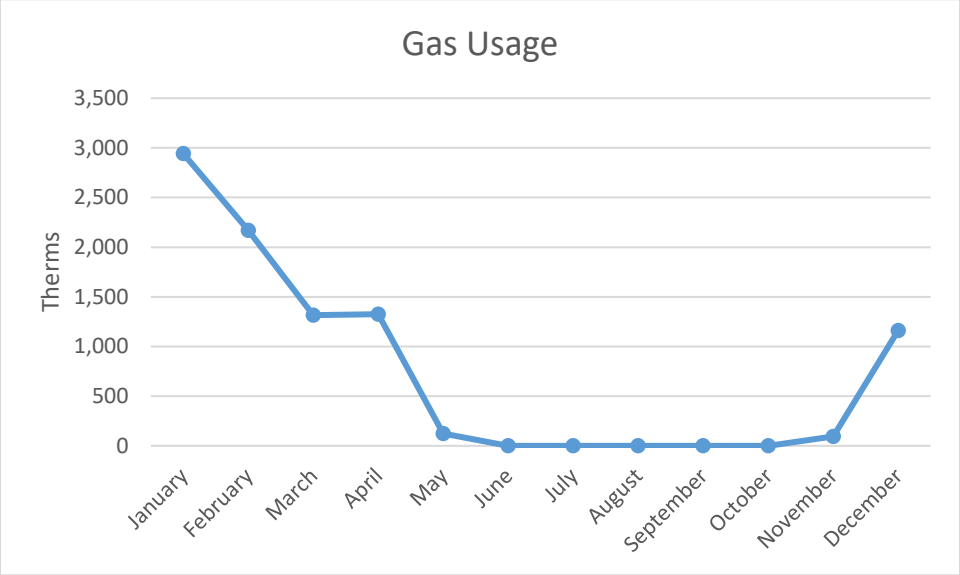
The building is heated by three (3) Weil McLain boilers. There are eight (8) air handlers with hot and chilled water coils that service the building. The heated water travels through air handlers and hydronic baseboards to heat the building.

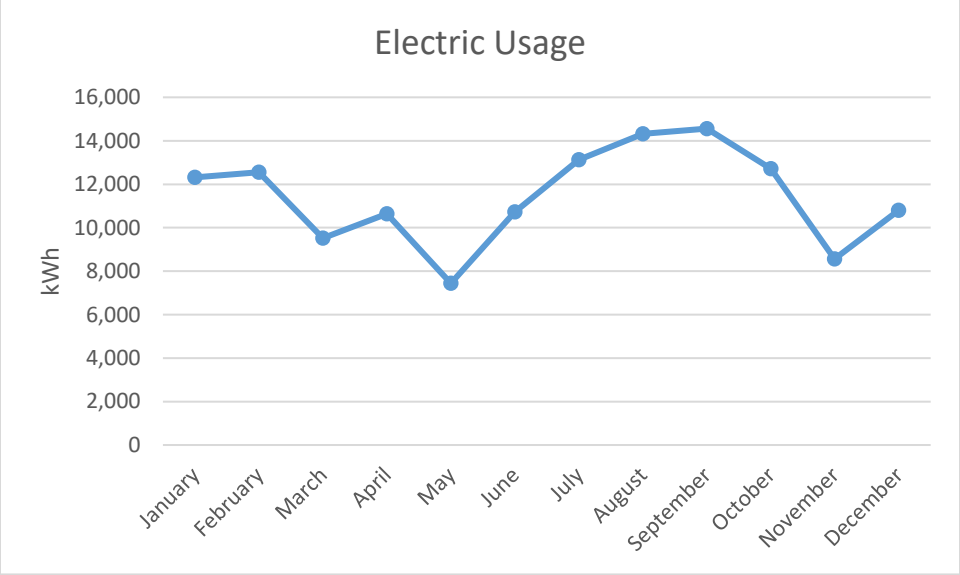
Domestic Hot Water

Domestic hot water is heated by two (2) electric water heaters.

Utility Introduction

The following graphs show the natural gas and electric usage over the 12 most recent months of available data.





Proposed / Installed Energy Conservation Measures (ECM)

ECM 1: Heat Pump Water Heater

Heat pump water heaters use a reverse refrigeration cycle to move heat from one place to another instead of generating heat directly. These units can reach electric efficiencies two to three times higher when compared to conventional electric resistance water heaters.

Existing Conditions

The site is serviced by two (2) standard efficiency electric resistance water heater for domestic hot water.

Proposed Conditions

It is proposed to replace the existing water heaters with two high efficiency heat pump water heaters.

Summary of Savings and Economic Results for Heat Pump Water Heater				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
3,954	$ 792.75	0	$ -	$ 792.75
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 7,011.56	$ 988.47	$ 6,023.09	8.8	7.6

ECM 2: LED Lighting Upgrade

Standard bulbs emit light in all directions, therefore requiring the use of reflection to direct the light. LED bulbs utilize all light being produced by emitting in one direction initially. This results in up to a 90% increase in efficiency.

Existing Conditions

There are standard efficiency light bulbs on site.

Proposed Conservation Measure

Replacement of existing inefficient lighting with high efficiency LED bulbs.

Summary of Savings and Economic Results for LED Lighting Upgrade				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
4,447	$ 891.62	0	$ -	$ 891.62
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 14,315.00	$ 1,112.00	$ 13,203.00	16.1	14.8

ECM 3: Faucet Aerators

Faucet aerators are small attachments to faucets that mix air into the stream of water to maintain pressure while reducing water flow. This reduces the amount of hot water needed. Low flow aerators are generally rated at 1.5 GPM or less.

Existing Conditions

There are several faucet aerators in the building rated at 2.2-2.75 GPM.

Proposed Conservation Measure

Install low flow aerators (1.5 GPM) to restrict the flow of water through the faucets described above.

Summary of Savings and Economic Results for Faucet Aerators				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
679	$ 136.14	0	$ -	$ 136.14
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 27.67	$ 27.67	$ -	0.2	0.0

ECM 4: Programmable Thermostats

Heating and cooling set-points can be programmed for occupied and unoccupied times. Night set-back controls and scheduling are also featured.

Existing Conditions

Currently, there are manual thermostats found throughout the building

Proposed Conservation Measure

Replace manual thermostats with programmable thermostats in classrooms so setback temperatures may be controlled remotely for unoccupied, or nighttime durations.

Summary of Savings and Economic Results for Programmable Thermostats				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	480	$ 484.80	$ 484.80
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 3,186.00	$ 375.00	$ 2,811.00	6.6	5.8

Report Summary

Energy Action Plan

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	therms	$	$	$	yrs.
1	Heat Pump Water Heater	3,954	0	$ 792.75	$ 7,011.56	$ 988.47	7.6
2	LED Lighting Upgrade	4,447	0	$ 891.62	$ 14,315.00	$ 1,112.00	14.8
3	Faucet Aerators	679	0	$ 136.14	$ 27.67	$ 27.67	0.0
4	Programmable Thermostats	0	480	$ 484.80	$ 3,186.00	$ 375.00	5.8
	Totals	**9,080**	**480**	**$ 2,305.32**	**$ 24,540.23**	**$ 2,503.14**	**9.6**

Next Steps

To pursue the recommendations outlined in this report, the customer should consult with qualified engineering design firms and mechanical contractors to conduct an in-depth design and cost analysis of proposed measures. Once specific proposals are selected through this process, the customer can apply to National Grid for financial incentives to help defray the cost of implementation.

If you have any questions with the material presented in this report please contact Frank Davey at FDavey@riseengineering.com.

WASTEWATER TREATMENT FACILITY

Prepared for the Town of Wareham

Overview of Report

RISE Engineering conducted an energy efficiency assessment at Wareham Wastewater Treatment Facility located at 6 Tony's Ln, Wareham, Massachusetts. The purpose of the audit was to identify energy conservation opportunities.

By: RISE Engineering

Contents

Executive Summary

The purpose of this review is to summarize the existing points of energy use, highlight any issues with regard to elevated energy consumption, and determine cost-effective measures that can be implemented by the customer. These measures will decrease the site's energy consumption and provide a favorable payback to the customer over the years. Incentives may be available from National Grid to help defer the cost of implementation. The table below summarizes the energy conservation measures (ECMs), their energy savings, estimated costs, estimated incentives, and payback.

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	therms	$	$	$	yrs.
1	High Efficiency Condensing Boiler	0	4,251	$ 4,293.51	$ 164,020.00	$ 22,500.00	33.0
2	VFDs on Hot Water Circulation Pumps	22,782	0	$ 3,866.11	$ 34,220.00	$ 6,800.00	7.1
3	LED Lighting Upgrade	49,721	0	$ 8,437.65	$ 58,649.00	$ 12,430.00	5.5
	Totals	**72,503**	**4,251**	**$ 16,597.27**	**$ 256,889.00**	**$ 41,730.00**	**13.0**

Facility / Project Location
Wareham Wastewater Treatment Facility 6 Tony's Ln, Wareham, Massachusetts

RISE Engineering			
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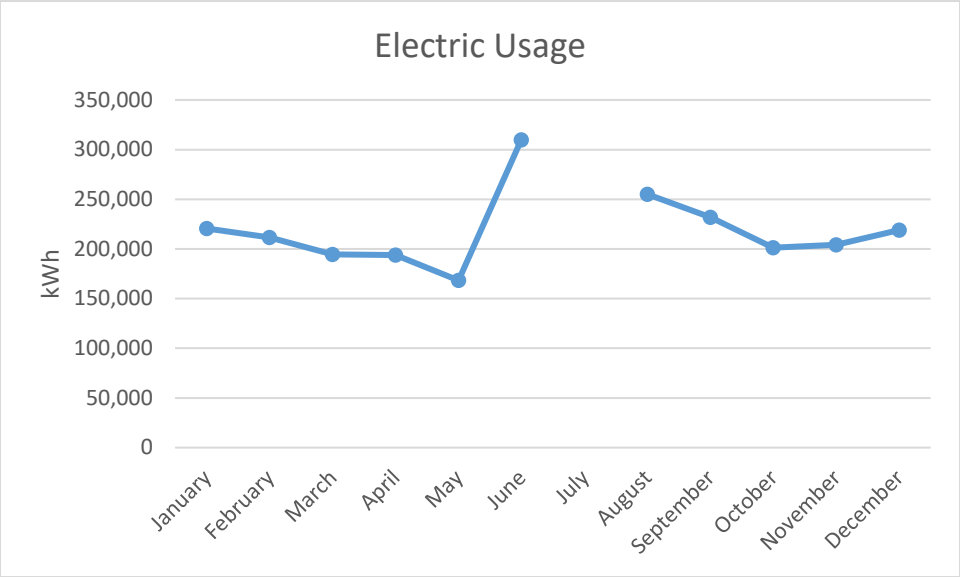
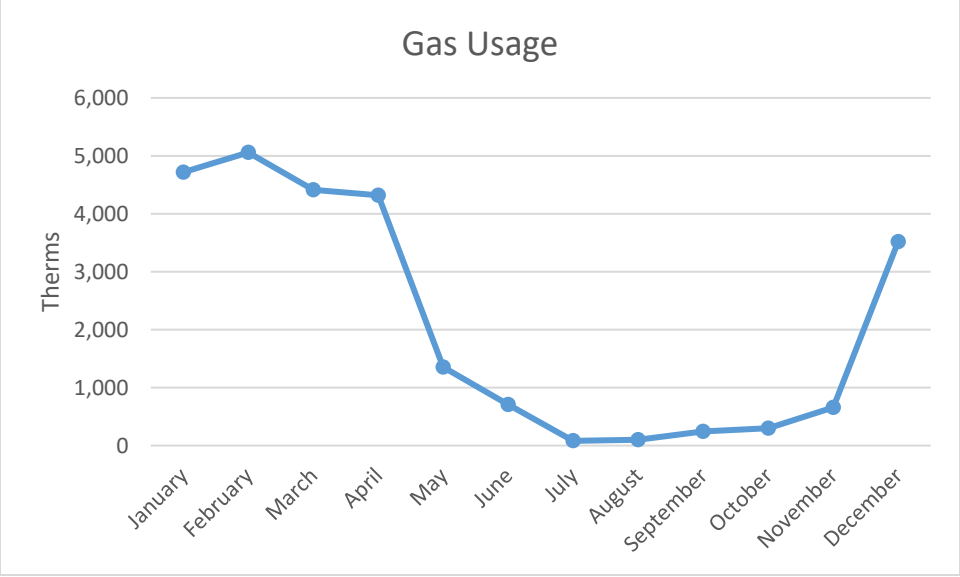
Jean-Paul Vandeputte	Director of Engineering	RISE Engineering	(401) 784-3700 Ext 6129 JPVandeputte@RISEengineering.com
Shane Murphy	Energy Engineer	RISE Engineering	(401) 603-6485 SMurphy@RISEEngineering.com
Brendan Smith	Energy Engineer	RISE Engineering	(401) 230-7465 BSmith@RISEengineering.com
Site Contact			
Kenneth Buckland	Director of Planning and Community Development	Town of Wareham	(508) 291-3100 Ext 6501 kbuckland@wareham.ma.us

Utility Introduction

The following graphs show the natural gas and electric usage over the 12 most recent months of available data.





Building 1 – Operations

Equipment Usage

Qty.	Type	Fuel	Make	Model	Condition
1	Hydronic Boiler	Natural Gas	Smith Cast Iron	19A-SW-08	Functioning
1	Water Heater	Electric	Rheem	ES120-24-G	Functioning

Space Heating

The building is heated with one (1) Smith Cast Iron hydronic boiler which provides forced hot water to unit heaters and AHUs.

Domestic Hot Water

Domestic hot water is heated by one (1) Rheem electric water heater.

Building 2 – Dewatering

Equipment Usage

Qty.	Type	Fuel	Make	Model	Condition
1	Hydronic Boiler	Natural Gas	Smith Cast Iron	19A-SW-08	Functioning
1	Water Heater	Electric	A.O. Smith	DEL 10 102	Functioning

Space Heating

The building is heated with one (1) Smith Cast Iron hydronic boiler which provides forced hot water to unit heaters and AHUs.

Domestic Hot Water

Domestic hot water is heated by one (1) Smith electric water heater.

Building 3 – Filter Blower

Equipment Usage

Qty.	Type	Fuel	Make	Model	Condition
1	Hydronic Boiler	Natural Gas	Smith Cast Iron	19A-SW-10	Functioning
2	Water Heater	Natural Gas	A.O. Smith	BTR 197 110	Not in Use

Space Heating

The building is heated with one (1) Smith Cast Iron hydronic boiler which provides forced hot water to unit heaters and AHUs.

Domestic Hot Water

Domestic hot water is not used in the building. Site contact stated that the water heaters run off of city water but the plant only uses plant water. Due to this, the water heaters are abandoned in place.

Proposed / Installed Energy Conservation Measures (ECM)

ECM 1: High Efficiency Condensing Boilers

High efficiency condensing boilers may include design improvements, sealed combustion, and using a second heat exchanger to condense flue gases in order to achieve increased efficiency.

Existing Conditions

There are three (3) standard efficiency hydronic boilers that heat the operations, dewatering, and filter-blower buildings.

Proposed Conservation Measure

Replace the standard efficiency boilers described above with new high efficiency condensing boilers.

Summary of Savings and Economic Results for High Efficiency Condensing Boiler				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
0	$ -	4,251	$ 4,293.51	$ 4,293.51
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 164,020.00	$ 22,500.00	$ 141,520.00	38.2	33.0

ECM 2: VFDs on Hydronic Pumps

Variable frequency drives control the motor speed of pumps by varying the incoming frequency and voltage that power the motor. The power supplied to the pump is varied by the VFD to match the demand. This prevents excess consumption cause by direct on-line operation.

Existing Conditions

The hydronic pumps that circulate the hot water produced by the three (3) standard efficiency boilers in the three (3) buildings currently have no controls.

Proposed Conservation Measure

VFDs will be installed on the hydronic pumps to vary the energy consumed based on demand.

Summary of Savings and Economic Results for VFDs on Hot Water Circulation Pumps				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
22,782	$ 3,866.11	0	$ -	$ 3,866.11
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 34,220.00	$ 6,800.00	$ 27,420.00	8.9	7.1

ECM 3: LED Lighting Upgrade

Standard bulbs emit light in all directions, therefore requiring the use of reflection to direct the light. LED bulbs utilize all light being produced by emitting in one direction initially. This results in a 90% increase in efficiency.

Existing Conditions

Currently, there is no interior LED lighting in buildings 1-5.

Proposed Conservation Measure

Replacement of existing inefficient lighting with high efficiency LED bulbs.

Summary of Savings and Economic Results for LED Lighting Upgrade				
Electricity Savings		Gas Savings		Total Cost Savings
kWh	$	therms	$	$
49,721	$ 8,437.65	0	$ -	$ 8,437.65
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 58,649.00	$ 12,430.00	$ 46,219.00	7.0	5.5

Report Summary

Energy Action Plan

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	therms	$	$	$	yrs.
1	High Efficiency Condensing Boiler	0	4,251	$ 4,293.51	$ 164,020.00	$ 22,500.00	33.0
2	VFDs on Hot Water Circulation Pumps	22,782	0	$ 3,866.11	$ 34,220.00	$ 6,800.00	7.1
3	LED Lighting Upgrade	49,721	0	$ 8,437.65	$ 58,649.00	$ 12,430.00	5.5
	Totals	**72,503**	**4,251**	**$ 16,597.27**	**$ 256,889.00**	**$ 41,730.00**	**13.0**

Next Steps

To pursue the recommendations outlined in this report, the customer should consult with qualified engineering design firms and mechanical contractors to conduct an in-depth design and cost analysis of proposed measures. Once specific proposals are selected through this process, the customer can apply to National Grid for financial incentives to help defray the cost of implementation.

If you have any questions with the material presented in this report please contact Frank Davey at FDavey@riseengineering.com.

Policies that Affect Fleet Gas and Diesel Usage

The adoption of the policies below for municipal vehicles will result in the savings of additional energy and assist Wareham in meeting the 20% energy reduction threshold.

Adoption of a Town-Wide Anti-Idling Policy for Municipal Vehicles: Idling vehicles contribute significantly to air pollution and waste fuel, increasing fleet management costs. Municipalities across the Commonwealth and the nation have seen significant cost and greenhouse gas emission reductions since implementing Town-wide "no-idling" policies for municipal vehicles. According to the U.S. Department of Energy https://www.fueleconomy.gov/feg/maintain.jsp communities that adopt a town-wide anti-idling policy for municipal vehicles can expect to achieve a 3% savings in vehicle fuel use.

Closely Monitor Tire Pressure, Use 100% Synthetic Oil and Use Fuel Efficient Tires: By maintaining appropriate air pressure in vehicle tires, using 100% synthetic oil and fuel efficient tires, communities can expect to achieve a 3% savings in vehicle fuel use.

Anti-Idling Policy		
All FY 2018 Gasoline Usage (Gallons)	64,218	
All FY 2018 Diesel Usage (Gallons)	79,679	
Percent Savings	3%	Idling vehicles contribute significantly to air pollution and waste fuel, increasing fleet management costs. Municipalities across the Commonwealth and the nation have seen significant cost and greenhouse gas emission reductions since implementing Town-wide "no-idling" policies for municipal vehicles. In many cases this has been as much as a 3% decrease.
Gallons of Gasoline Saved per Year	1,927	
Gallons of Diesel Saved per Year	2,390	
MMBTUs Saved per Year	**573**	
Closely Monitor Tire Air Pressure, Use 100% Synthetic Oil & Use Fuel Efficient Tires		
All FY 2018 Gasoline Usage (Gallons)	64,218	
All FY 2018 Diesel Usage (Gallons)	79,679	
Percent Savings	3%	Maintaining appropriate air pressure in vehicle tires, using 100% synthetic oil and using fuel efficient tires can decrease a vehicles fuel consumption by as much as 3%.
Gallons of Gasoline Saved per Year	1,927	
Gallons of Diesel Saved per Year	2,390	
MMBTUs Saved per Year	**573**	
Total MMBTUs Saved	**1,146**	

Source: U.S. Department of Energy: https://www.fueleconomy.gov/feg/maintain.jsp

MMBtu Conversion Chart

Fuel Energy Content of Common Fossil Fuels per DOE/EIA

BTU Content of Common Energy Units – (1 million Btu equals 1 MMBtu

- 1 kilowatt hour of electricity = 0.003412 MMBtu
- 1 therm = 0.1 MMBtu
- 1 ccf (100 cubic foot) of natural gas = 0.1028 MMBtu (based on U.S. consumption, 2007)
- 1 gallon heating oil = 0.139 MMBtu
- 1 gallon of propane = 0.091 MMBtu
- 1 cord of wood = 20 MMBtu
- 1 gallon of gasoline = 0.124 MMBtu (based on U.S. Consumption, 2007)
- 1 gallon of E100 ethanol = 0.084 MMBtu
- 1 gallon of E85 ethanol = 0.095 MMBtu
- 1 gallon of diesel fuel = 0.139 MMBtu
- 1 gallon of B100 biodiesel = 0.129 MMBtu
- 1 gallon of B20 biodiesel = 0.136 MMBtu
- 1 gallon of B10 biodiesel = 0.137 MMBtu
- 1 gallon of B5 biodiesel = 0.138 MMBtu
- 1 barrel of residual fuel oil = 6.287 MMBtu