



Green Communities Criterion 3 City of Revere – Energy Use Baseline & Energy Reduction Action Plan

May 30, 2011

Prepared for:

City of Revere
281 Broadway
Revere, MA 02151

Prepared by:

Metropolitan Area Planning Council
60 Temple Place
Boston, MA 02111
www.mapc.org



TABLE OF CONTENTS

I.	INTRODUCTION AND EXECUTIVE SUMMARY.....	3
A.	Narrative Summary of City.....	3
B.	Summary of Municipal Energy Uses	3
C.	Summary of Energy Use Baseline and Plans for Reductions	6
D.	Summary of Goals and Strategies to be used in Implementing Action Plan.....	6
II.	ENERGY USE BASELINE INVENTORY.....	6
A.	Baseline Inventory Tool & Summary of Baseline Year	6
B.	Existing Municipal Energy Use.....	8
C.	Existing Efficiency Measures Implemented in Last 2 Years.....	9
D.	Areas of Least Efficiency/Greatest Waste	9
E.	Areas That Can Be Most Easily Addressed	9
III.	Summary of Energy Audits	10
IV.	Summary of Energy Use Reduction Measures	10
A.	Overview of Short- and Long-Term Goals.....	10
B.	Getting to 20%.....	11
C.	Measurement and Verification Plan for Projected Reductions.....	16
D.	Summary of Long-Term Energy Reduction Goals.....	16
V.	RENEWABLE ENERGY PROJECTS.....	17
VI.	CONCLUSION.....	17
A.	Resources.....	17
B.	Acknowledgements	18
	Appendix A: Baseline Energy Use by Facility and Fuel Type (native units, FY 2009).....	19
	Appendix B: Baseline Energy Use by Facility and Fuel Type (MMBTU, FY 2009).....	20
	Appendix C: Energy Conservation Measures Under Contract	21
	Appendix D: Ameresco - Estimated First-Year Energy Savings in Revere Schools.....	22
	Appendix E: Ameresco - Proposed Future ECMs in City Buildings	23
	Appendix F: Letters Verifying Adoption of Energy Plan	24

I. INTRODUCTION AND EXECUTIVE SUMMARY

A. Narrative Summary of City

The City of Revere (population: 51,755 as of the 2010 census) is located in eastern Massachusetts, about five miles north of downtown Boston. Revere borders Winthrop, East Boston and Chelsea to the South, Everett and Malden to the West, Saugus and Lynn to the north and the Atlantic Ocean to the east. Settled in 1630 and home to the nation's oldest public beach, Revere was originally known as North Chelsea but was incorporated as a town in 1871 and as a city in 1914.

In complement to its rich historical past, Revere is a modern city committed to improving its energy efficiency, reducing its fossil fuel consumption and adopting 21st-century renewable energy technologies. In 2009, the City contracted with Ameresco Inc., an independent energy solutions company, to carry out a Comprehensive Energy Audit in municipal buildings. Substantial energy efficiency projects and retrofits are being carried out in Revere Schools based on the recommendations from this audit, and the City recently took advantage of Energy Efficiency and Conservation Block Grant (EECBG) funding to install a 42-kW building integrated photovoltaic (BIPV) system on Beachmont Elementary School. The BIPV system replaced an outdated, inefficient roof and significantly alleviated the City's carbon footprint.

B. Summary of Municipal Energy Uses

1. Buildings

The City has 25 municipal buildings that are comprised of schools, fire and police stations, youth and senior centers, the Department of Public Works building, the library and City Hall (see Table 1, *Revere Building Inventory*). Utilities are supplied through a number of different providers. At present, National Grid provides for electricity and natural gas services. A few buildings still heat using oil from East Coast Petroleum; the Revere Public High School recently made the transition from oil to natural gas heat.

2. Vehicles

The City maintains a fleet of 142 vehicles, divided between departments as follows:

- 62 Department of Public Works vehicles
- 29 Fire Department vehicles
- 45 Law Enforcement vehicles
- 1 Parks & Recreation vehicle
- 9 School Department vehicles (including 2 school buses)
- 2 Elderly Affairs vehicles
- 3 Clerks Office vehicles
- 1 Inspectional Vehicle

For a full inventory of vehicles categorized as non-exempt under the City's Fuel Efficient Vehicle Policy, refer to *Section IV.D., Summary of Long-Term Energy Reduction Goals*.

Three departments are responsible for purchasing diesel and gasoline fuel in bulk for their vehicles: the Fire Department, Police Department, and Department of Public Works. The DPW shares its fuel purchases with the remaining departments (School Department, Elderly Affairs, and other vehicles).

3. *Street/Traffic Lights*

All street lighting is owned and operated by National Grid, and is therefore excluded from the baseline energy consumption calculation. The City owns 100% of traffic lights on municipal roads, although there are a handful of traffic lights on state highways (i.e. Route 60, 1A, 145, Bennington St, Revere Beach Ave, and Ocean Ave) that are owned and operated by the state and also excluded from the baseline.

4. *Water/Sewer*

The City owns and operates 14 pump stations. Electric service is provided by National Grid.

Table 1: City of Revere Building Inventory				
Facility Name	Address	Building Size (Sq. Ft.)	Utility Type*	Included in Baseline?
General City Buildings				
American Legion Hall	245-247 Broadway	11,898	E, O	Yes
City Hall	281 Broadway	31,219	NG, E, O	Yes
DPW Building	321R Charger St.	29,440	NG, E, O	Yes
Carnegie Library	179 Beach St.	10,227	E, O	Yes
Senior Center	25 Winthrop Ave.	13,777	NG, E	Yes
Youth Center	150 Beach St.	11,712	NG, E	Yes
Fire Stations				
Central Fire Station	400 Broadway	14,689	NG, E	Yes
Freeman St. Station	4 Freeman St.	5,358	NG, E	Yes
Alden Mills Fire Station	140 Lynnway	3,500	NG, E	Yes
North Revere Fire Station	3 Overlook Ridge Dr.		NG, E	Yes
Fire Engine 1/Ladder 1	360 Revere Beach Pkwy.		E	Yes
Walden St.	13 Walden St.		NG, E, O	Yes**
Winthrop Ave.	927 Winthrop St.		NG, E, O	Yes**
Police Stations				
Crescent Ave.	100 Crescent Ave.		E	Yes**
Pleasant/Hyde Station	23 Pleasant St.		NG, E, O	Yes**
Police Headquarters	400 Revere Beach Pkwy.		E	Yes
School Buildings				
Abraham Lincoln School	68 Tuckerman Rd.	87,017	NG, E, O	Yes
Beachmont ES/MS	15 Everard St.	117,894	NG, E	Yes
Ltg. Garfield ES/MS	140 Garfield Ave.	200,000	NG, E	Yes
Paul Revere ES	395 Revere St.	58,464	NG, E	Yes***
Revere High School/Seacoast School	101 School St.	324,375	NG, E, O	Yes
Rumney Marsh Academy	140 American Legion Hwy.		E	Yes
Susan B. Anthony/A. C. Whelan School	107 Newhall St.	180,000	E	Yes
William McKinley ES	65 Yeamans St.	43,570	E	Yes

*Legend: NG – Natural Gas, E – Electricity, O - #2 Heating Oil

**Closed but included in baseline due to energy use associated with upkeep.

***Torn down in 2009 and rebuilt on a different location in 2010; FY08 data used in baseline.

C. Summary of Energy Use Baseline and Plans for Reductions

Detailed information on the energy baseline inventory can be found in section II.A. Grand total energy consumption by the City of Revere in the baseline year was 99,559 MMBTU.

Facility Type	MMBtu used in Baseline Year	% of Total Baseline Energy Consumption	Projected Planned MMBtu Savings*	% of Total Baseline Energy Consumption
Buildings	87,369	88.2%	22,968	23.2%
Traffic Lights	80	0.1%		
Water/Sewer	601	0.6%		
Vehicles**	11,510	11.1%		
Total	99,559	100%	22,968	23.2%

*Does not include savings that result as a consequence of renewable energy projects, or the Revere High School boiler replacement project that was completed during FY 2009.

**Data taken from FY 2010.

D. Summary of Goals and Strategies to be used in Implementing Action Plan

The City of Revere hopes to become a Green Community in order to pursue other projects in the future that will continue to enhance its utilization of renewable energy technologies and energy efficiency measures.

Ameresco Inc. will continue to be involved in the implementation of all Energy Conservation measures (ECMs) currently under contract (see Appendix B) and is responsible for ensuring energy cost savings over the duration of their contract. Not including the renewable energy project or the Revere High School boiler replacement project, these ECMs represent the potential for over **23% reductions in energy use** from the Fiscal Year (FY) 2009 baseline. Ameresco’s assistance in implementing and monitoring these projects will be instrumental in reaching, at minimum, the goal of a 20% reduction in energy use by the end of FY 2014.

II. ENERGY USE BASELINE INVENTORY

A. Baseline Inventory Tool & Summary of Baseline Year

1. Inventory Tool Used

The City of Revere used the Massachusetts Energy Insight (MEI) tool to generate the baseline energy use inventory for municipally-owned buildings and other facilities. MEI is a free, web-based tool developed by Peregrine Energy Group and made available to cities and towns in Massachusetts through the Department of Energy Resources (DOER) as part of the Massachusetts Green Communities Program. Electricity and natural gas usage for municipal accounts is pre-loaded by major utilities into the MEI program; fuel oil and gasoline/diesel data was entered manually by City of Revere staff members.

Data was uploaded in the form of kilowatt-hours for electricity, therms for natural gas, and gallons for fuel oil, gasoline and diesel fuel. For consistency, these figures were subsequently converted into MMBTUs using the following conversion factors:

Table 3: Conversion Factors		
Fuel	Units	Factor
Electricity	MMBTU/kWh	0.003412
Natural Gas	MMBTU/therm	0.1
Oil -- heating (#2)	MMBTU/gallon	0.139
Gasoline	MMBTU/gallon	0.124
Diesel fuel	MMBTU/gallon	0.139

2. Explanation of the Baseline Year

The City of Revere chose FY 2009 (July 2008-June 2009) as the year in which to conduct a baseline energy use inventory. However, working with imperfect data sets made it necessary to occasionally extrapolate data from outside the baseline year. The City believes these extrapolations are justifiable and the overall consumption figure accurately reflects energy use in FY 2009.

Specifically, the City of Revere switched to a new system for recording fuel purchasing data in 2009, and fuel consumption data before mid-2009 was no longer available upon the writing of this report. Since the City maintains a relatively constant fleet of vehicles, purchasing new vehicles only when old ones are retired, fuel consumption data from FY 2010 was used in the construction of the baseline and is assumed to be equivalent to usage in FY 2009.

In addition, the Paul Revere Elementary School was torn down in 2009 but rebuilt in 2010. Since this constitutes a building replacement, energy consumption data from the building in FY 2008 was used in the baseline for this report.

In regards to calculating the projected energy savings, the Energy Audit Report prepared by Ameresco, Inc. for the City of Revere establishes a baseline using FY 2008 data and adjusted against a 30-year weather average for Boston.¹ The estimated savings from the adoption of the 22 Energy Conservation Measures (ECMs), described later in more detail, were calculated in relation to this weather-adjusted FY 2008 baseline. It was not used as the primary baseline in this Energy Reduction Report as it does not include information on traffic lights, pump stations or municipal vehicle fuel consumption, but the energy savings

¹ From the report: "A baseline model was developed for each audited building. Weather adjusted utility data for Fiscal 2008 was used to calibrate the model(s). The energy end-use breakdown for natural gas and oil was calculated from inventoried equipment ratings, local bin weather data, operational characteristics obtained from personnel, and building envelope characteristics. Where equipment data could not be obtained, engineering experience and judgment was used. The major fuel heating end-uses found in the City buildings audited includes Heating Usage, (which consist of mechanical ventilation, conduction, and infiltration), Domestic Hot Water Usage, Distribution Losses, and Cooking. Electrical usage includes Lighting, Cooling, HVAC Fan/Pumps, Refrigeration, and Office Equipment."

calculations are assumed to remain accurate when applied to the FY 2009 baseline for the following reasons:

1. **Ameresco did not begin implementation of the ECMs until after the end of FY 2009, which eliminates the risk of “double-counting” reductions.** The only exception is the Revere High School boiler replacement project, which was conducted during FY 2009 and was therefore excluded from energy savings calculations.
2. **Reductions in overall baseline energy consumption between FY 2008 and FY 2009 can be largely attributed to changes in non-ECM building operations.** Specifically, the following buildings were either demolished or closed in the summer of 2008, at the beginning of the FY 2009 baseline year (for more details, see Section IV.B.2, *Additions and New Construction*): Walden Street Fire Station, Winthrop Ave Fire Station, Crescent Ave Police Station, and the Pleasant Ave Police Station. Energy use data is still available for these facilities in the MassEnergyInsight system during the FY 2009 baseline year, which can largely be attributed to lighting or heating systems being maintained for security or resale purposes. This data was included in the baseline energy inventory but represents a negligible source of energy consumption.

B. Existing Municipal Energy Use

The City of Revere developed a Fiscal Year (FY) 2009 baseline inventory of municipal buildings, vehicles and other facilities by annual energy use and type. The total energy use in FY 2009 was as follows (see Appendix A for the detailed baseline energy use inventory):

Table 4. Total Municipal Energy Use	
Facility Type	Aggregate MMBtu
Buildings	87,369
Traffic Lights	80
Water/Sewer	601
Vehicles*	11,510
Total	99,559

*Data taken from FY 2010.

1. Municipal Buildings

Buildings constitute the bulk of municipal energy use in the City of Revere. Cost and energy use data was uploaded to the MassEnergyInsight tool by energy type. Natural gas and electricity was pre-loaded by the utilities for each account; heating oil account information was uploaded manually. **The total energy use for municipal buildings was 87,369 MMBtu, over 88% of the City’s overall consumption.**

2. Traffic Lights

Utility information from National Grid is pre-loaded into the MassEnergyInsight tool for all traffic light accounts. Energy use from traffic lights in FY 2009 was minimal, at only 80 MMBtu.

3. Vehicles

The second largest category of energy consumption in the City of Revere comes from municipal vehicle fuel consumption. The vehicle fleet ranges from school buses, police cars and fire trucks to parking control vehicles and vehicles for elderly affairs. At 11,510 MMBTU, vehicle energy consumption (in FY 2010) is equivalent to about 11% of total energy use in the constructed baseline year. Data on vehicle fuel use was collected from the oldest available fuel purchasing statements (June 2009-July 2010) and entered manually by City staff.

4. *Water/Sewer*

The 601 MMBTUs attributed to water and sewer functions can be traced to electricity used by pump stations in the City of Revere. The pump stations have their own account in the MassEnergyInsight system and are documented separately.

C. Existing Efficiency Measures Implemented in Last 2 Years

At the time of the submission of this application, Ameresco has just completed the 18-month construction phase of Revere's Comprehensive Energy Audit. Their contract with Revere ensured the implementation of all recommended Energy Conservation Measures in Revere's schools, which began during the summer of 2009 and was completed in December 2010. The only exception to this was the Revere High School boiler replacement project, which took place prior to summer 2009. It has an estimated savings of 2,321 MMBtu. Although these savings may not have been fully realized during the baseline year, it was excluded entirely from overall energy savings estimates to avoid the risk of double-counting.

The first year of post-construction energy savings will be observed in CY 2011. Ameresco estimates that first-year electricity savings from these installed ECMs, including the Beachmont School roof replacement, will total 2,146,268 kWh (7,323 MMBtu). (For a detailed estimate of first-year energy savings, see Appendix C). Excluding renewable energy-related retrofits at Beachmont Elementary School, estimated first-year savings total around 2,006,879 kWh (6,847 MMBtu).

The work done so far has proved extremely successful. In February 2011, the City of Revere Public Schools and Ameresco, Inc. were awarded "Best Energy Performance Contracting Project - Public" by the Association of Energy Engineers: New England (AEENE).

D. Areas of Least Efficiency/Greatest Waste

Buildings represent the largest portion of energy consumption in the City of Revere, and schools constitute the largest portion of building energy use. During the Comprehensive Energy Audit conducted by Ameresco Inc., the City requested that recommendations for energy efficiency projects be targeted specifically at school buildings. **The single largest energy user in the City, Revere High School (RHS), consumed 25,974 MMBtu in FY 2009, over a quarter of total City energy usage.** Opportunities for energy conservation in school buildings are therefore substantial. Implementation of the ECMs in RHS alone will result in savings of up to 11,759 MMBtu annually, representing over a 12% reduction from the FY 2009 baseline (9,538 MMBtu and 10%, excluding the boiler replacements).

E. Areas That Can Be Most Easily Addressed

Of the 22 Energy Conservation Measures (ECMs) proposed in the Ameresco report, the most easily implemented project is a school-wide lighting system upgrade, replacing old fixtures with more energy-efficient T8 fluorescent lamps. This project is estimated to save 616,244 kWh (2,102 MMBTU) and

\$97,164 in combined maintenance and utility costs annually. Lighting retrofits are generally considered to be the “low-hanging fruit” of energy efficiency, as they are relatively inexpensive and easy to implement.

The most substantial project, in terms of energy and cost savings, is the installation of a new, integrated Energy Management System (EMS) in all school buildings. This project is estimated to save up to 457,728 kWh of electricity, 70,055 therms of natural gas and 33,480 gallons of heating oil, for a **combined savings of 13,221 MMBtu and \$265,144 in utility cost savings**. This ECM alone would achieve **13% reductions** from the FY 2009 baseline. This new system will be networked and easily expandable, providing for better energy management of building operations as they are added to the system.

III. Summary of Energy Audits

In 2008, Ameresco conducted an energy audit of all school buildings and most municipal buildings in Revere and proposed 22 energy conservation measures (ECMs) to be implemented in select Revere schools (see Table 3, *Energy Conservation Measures*). These ECMs represent the culmination of a comprehensive study which included extensive site examination, analysis of historical utility billing data for all utility services, building energy modeling, development engineering, and an investment grade financial assessment.

The package of improvements suggested in the Ameresco report requires no upfront capital funding from the City. Ameresco anticipates that project costs will be initially reduced with utility rebates of nearly \$500,000, to \$9.8M which will be repaid over a 15-year term with guaranteed-savings starting at over \$900,000 annually.

Cumulatively, these measures represent 25,901 MMBtu in energy savings. Two ECMs were not included in this report’s energy savings projections, for the following reasons:

- **The Roof Replacement ECM** (projected savings: 612 MMBtu) includes a building-integrated photovoltaic (BIPV) installation and is therefore considered a renewable energy project.
- **The Revere High School Boiler Replacement ECM** (estimated savings: 2,321 MMBtu) was implemented during the baseline year, FY 2009. While marginal savings over the baseline year may be observed in subsequent years, it was excluded entirely from energy savings calculations to avoid the risk of double-counting.

Total energy savings, minus these two ECMs, are projected to be 22,968 MMBtu, a 23.2% reduction from the FY2009 baseline.

IV. Summary of Energy Use Reduction Measures

A. Overview of Short- and Long-Term Goals

The City of Revere is committed to the goal of efficient energy consumption, and intends to reduce its energy use by a minimum of 20% within the next five (5) years. Through the implementation of the 22 ECMs in Revere Schools, the City will enjoy substantial energy savings. If the maximum savings are realized from all ECMs (not counting the PV installation) this will represent about a 23% reduction from the FY 2009 baseline. This, coupled with opportunities for savings embodied in other municipal

buildings, vehicles and street lighting suggest that the City of Revere will achieve reductions far and beyond the 20% target.

B. Getting to 20%

The cumulative savings of the energy conservation measures (ECMs) proposed by Ameresco, not including savings from the onsite photovoltaic installation on Beachmont Elementary School or the boiler replacements at Revere High School, will be about 22,968 MMBtu, a reduction of 23.2% from the FY 2009 baseline. Implementation of all ECMs was overseen by Ameresco and was completed by the end of December 2010 (for complete lists of ECMs currently under contract, see Appendix B). The first year of post-construction energy savings will be observed beginning in CY 2011 (for a detailed estimate of first-year savings by ECM, see Appendix C).

1. *Prioritized List of Specific Projects and Projected Energy Savings*

Project #1 – Revere High School (Savings: 13,055 MMBtu)						
Energy Conservation Measures (ECMs)		Electricity Savings (kwh)	Gas Savings (therms)	#2 Oil Savings (gallons)	Total Savings (MMBtu)	Utility & Maintenance Savings (\$)
1	Lighting System Improvements	192,276	-3,646		291	
2	Lighting Controls	36,875	-699		56	
3	EMS	323,491	25,984	32,223	8,181	
4	Boiler Replacements*		5,465	12,764	2,321	\$45,871
5	High Efficiency Transformers	70,354			240	
6	Computer Load Management	313,838	-4,918	-415	521	\$32,254
7	Vending Machine Controls	48,880			167	\$6,292
8	Replace Standard Efficiency Motors	10,861			37	
9	Pipe Insulation		144		14	
10	Infiltration & Weatherization	730	12,234		1,226	
	Revere High School Subtotal	997,305	34,564	44,572	13,055	

*Note: Boiler replacements in Revere High School took place during the baseline year, FY 2009. As some of the effects of this ECM are already captured in the energy baseline, it cannot be fully counted in future energy savings projections.

Project #2 – Lieutenant Garfield Elementary/Middle School (Savings: 5,272 MMBtu)						
Energy Conservation Measures (ECMs)		Electricity Savings (kwh)	Gas Savings (therms)	Total Savings (MMBtu)	Water/Sewer Savings (gallons)	Utility & Maintenance Savings (\$)
1	Lighting System Improvements	257,749	-4,031	1,373		
2	Lighting Controls	36,262	-743	67		
3	EMS	83,716	9,090	1,195		
4	High Efficiency Transformers	72,610		248		

5	Replace Standard Efficiency Motors	8,913		30		
6	Pipe Insulation	20,593	56	76		
7	Pool Cover	20,106	4,718	540	29,410	\$9,785
8	Infiltration & Weatherization	913	7,723	775		
9	Cooling Tower Replacement	38,204		130	185,160	\$6,053
10	Replace Pool Dehumidification Unit	31,007	6,624	768		\$14,215
11	Pool Setpoint Modifications	73,630	6,872	938	56,152	\$20,415
12	Water Conservation		443	44	90,000	
	Garfield ES/MS Subtotal	643,703	30,752	5,272		

Project #3 – William McKinley Elementary School (Savings: 2,733 MMBtu)					
	Energy Conservation Measures (ECMs)	Electricity Savings (kwh)	Gas Savings (therms)	Total Savings (MMBtu)	Utility & Maintenance Savings (\$)
1	Lighting System Improvements	21,033	-357	36	
2	Lighting Controls	13,419	-228	23	
3	EMS	3,758	12,920	1,305	\$13,282
4	Steam Trap Replacements		8,631	863	\$3,516
5	Install Thermostatic Radiator Valves		2,285	229	
6	Pipe Insulation		269	27	
7	Attic Insulation		2,505	251	
	McKinley Elementary School Subtotal	38,210	26,025	2,733	

Project #4 – Abraham Lincoln Elementary School (Savings: 1,055 MMBtu)					
	Energy Conservation Measures (ECMs)	Electricity Savings (kwh)	#2 Oil Savings (gallons)	Total Savings (MMBtu)	Utility & Maintenance Savings (\$)
1	Lighting System Improvements	57,104	-721	95	
2	Lighting Controls	31,716	-400	53	
3	EMS	4,088	1,258	189	
4	Replace Standard Efficiency Motors	2,714		9	
5	Pipe Insulation		543	75	
6	Infiltration & Weatherization	8	2,285	318	
7	Classroom Unit Ventilator Replacements		2,276	316	\$6,827

	Lincoln Elementary School Subtotal	95,630	5,241	1,055	
--	---	---------------	--------------	--------------	--

Total Savings from Projects #1 through #4	22,114 MMBtu
--	---------------------

A detailed summary of estimated first-year savings by school and ECM can be found in Appendix C.

Since construction of ECMs was ongoing during FY 2010, which was the first year of the 5-year energy reduction plan, some changes over the FY 2009 baseline can be observed in each of these project buildings:

Table 5. Actual Savings in Revere Buildings, FY 2009-2010			
Building	FY2009 Usage (MMBtu)	FY2010 Usage (MMBtu)	+/-
Revere HS	25,974	24,057	1,917
Garfield	16,040	16,913	-873
McKinley	602	545	57
Lincoln	4,253	4,177	76
Total	46,869	45,692	1,177

The first full year of post-construction energy savings will be observed from January 2011 through December 2011; if this complies with Ameresco’s projections, then the 23% reduction from the FY 2009 baseline should be accomplished half-way through the third year of the 5-year energy reduction plan (i.e. FY 2012).

2. *Additions and New Construction.*

Revere has constructed a number of new facilities over the past few years. The Paul Revere Elementary School was torn down in June 2008 and re-opened in a new location in September 2010. The new facility was constructed using the most up-to-date technology, including high-efficiency boilers. Energy performance of the school will continue to be monitored in MassEnergyInsight; if performance is poorer than anticipated, system audits and operational changes will be deployed.

Two new fire stations (located on Revere Beach Parkway and Overlook Ridge Drive) and one new police station (located on Revere Beach Parkway) were opened in June 2008 and are included in the FY 2009 baseline. Consumption data for these newly-opened buildings may consequently be lower than average and could increase in subsequent years. The new police headquarters replaced stations on Crescent Ave and Pleasant Street, which were subsequently closed. Similarly, the Walden Street and Winthrop Street fire stations were closed upon the opening of the new fire stations – Winthrop Street station is currently being used by the city for storage. The Crescent Ave. station was demolished entirely.

As mentioned earlier, some residual energy consumption data from these facilities continues to trickle into the MassEnergyInsight system due to use associated with upkeep and billing period overlap. This was included in the FY 2009 baseline but represents a negligible category of consumption that will remain low or approach zero as time progresses.

3. *Estimated Capital and Operating Costs*

The Ameresco report assumes a 15-year financing term and requires no upfront capital investments on the part of the City. The following table shows the financial summary as calculated by Ameresco.

Table 6. Estimated Project Costs	
Financing Term (after construction)	15 years
Capital Cost	\$10,309,616
Net Assumed Financed Capital Cost	\$9,821,426
Assumed Escalation Rate	3.00%
Estimated Tax-exempt Interest Rate	5.00%
Estimated Rebates	\$488,191
Guaranteed Cost Savings / Year 1	\$905,231
Net Excess Cumulative Cash Flow	\$19,945

4. *Schedule for Implementation*

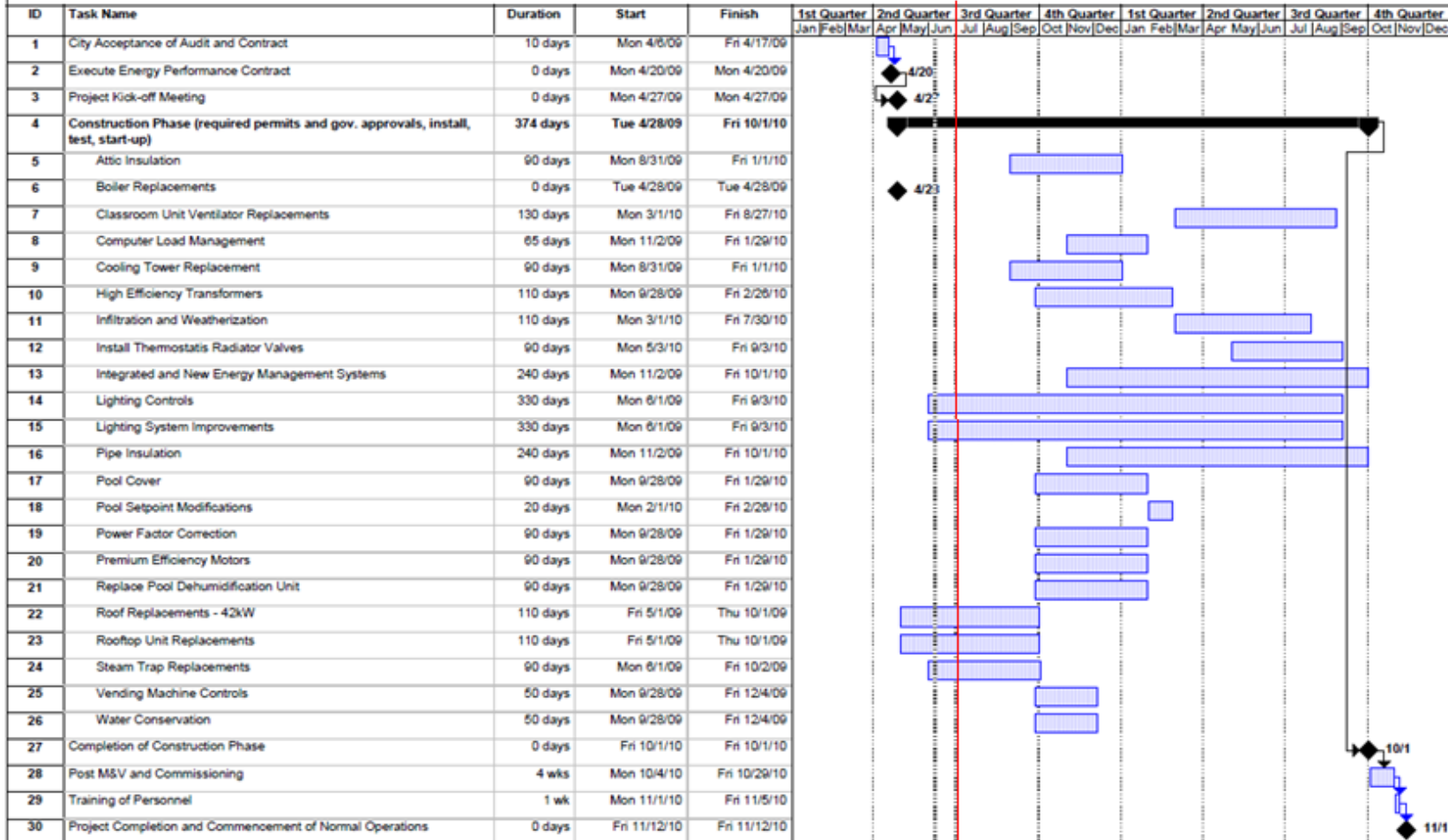
The construction phase for all energy conservation measures in the maintenance contract with Ameresco, except the Revere High School boiler replacements, took place during FY2010 and the first half of FY2011. CY 2011 will be the first year of post-construction savings. Ameresco will submit a report within 90 days of the closing of each period.

The Revere High School boiler replacements were implemented during FY 2009; consequently, savings from that measure began to be observed during the baseline year.

See following page for Ameresco’s estimated schedule for implementation.

PRELIMINARY PROJECT SCHEDULE
Energy Savings Project

End of FY 2009



Project: City of Revere
Date: Mon 5/5/09

Task		Rolled Up Task		Project Summary		Deadline	
Progress		Rolled Up Milestone		Split			
Milestone		Rolled Up Progress		Rolled Up Split			
Summary		External Tasks		External Milestone			

C. Measurement and Verification Plan for Projected Reductions

The City of Revere will use the MassEnergyInsight tool to measure and track energy consumption over the next five years. Utility data will be automatically updated for all accounts in the system; it will be the responsibility of the City to ensure that heating oil and gasoline/diesel fuel information continues to be updated on regular basis.

As part of its contract with the City, Ameresco is responsible for monitoring and verifying the performance of all implemented ECMs in order to confirm its guaranteed energy savings. The installation of integrated Energy Management Software will help in this respect.

D. Summary of Long-Term Energy Reduction Goals

Due to budget constraints, only ECMs for school buildings were chosen for implementation in the ESCO contract. However, a number of ECMs were also proposed for non-school buildings, and will be pursued subject to additional funding. These include:

- **Boiler replacements in the Carnegie Library and American Legion building**
- **Steam trap replacements in the City Hall, Carnegie Library and Youth Center**
- **Installation of thermostatic radiator valves at City Hall, Carnegie Library, Freeman St. Fire Station, Youth Center and American Legion building**
- **Attic insulation in the City Hall and Freeman St. Fire Station**

For a full summary of proposed ECMs and their associated costs and savings, see Appendix D.

Measures are now under contract for projects in the Carnegie Library and the boiler replacements in the American Legion building. The City intends to prioritize its next energy conservation efforts on buildings in the following order: City Hall, Youth Center, Senior Center, and the DPW building. If all proposed ECMs were implemented, they would result in approximately 2,848 MMBtu in energy savings with a payback time of just fewer than 8 years.

As part of the Green Communities application process, the City of Revere has also adopted a fuel-efficient vehicle purchasing policy. The fuel-efficient vehicle purchasing policy requires all departments purchase only fuel efficient vehicles whenever such vehicles are commercially available and practicable.

Heavy-duty vehicles, such as fire-trucks, ambulances, and public works trucks, as well as police cruisers, are exempt from this policy. The City identified four non-exempt vehicles that will be replaced with fuel efficient models as money becomes available and in accordance with the natural replacement rate (approximately 1 or 2 per year), with the understanding that premature purchases of new vehicles can often represent inefficient use of materials and financial resources. The savings from vehicle replacements will vary based on what technology is commercially available at the time of replacement, and availability of funds.

Table 7. Non-Exempt Vehicles							
VEH#	YEAR	MAKE	MODEL	DEPARTMENT	GVW (lbs)	COST NEW	PLATE #
1	1997	DODGE	Caravan	PARKS&REC			M65371
2	2004	CHEVROLET	EXPRESS	SCHOOL DEPT	7,200	\$18,510	M68078
3	2004	FORD	F250 PU	SCHOOL DEPT		\$18,500	M65365
4	2008	FORD	EXPLORER	ELDER AFFAIRS		\$29,315.00	M35966

Other possible methods for reducing fuel consumption that may be considered by the City in their 5-year plan to reduce energy usage include:

- Adoption of anti-idling technologies or policies.
- Replacement of heavy-duty exempt vehicles with hybrid exempt vehicles
- Downsize large vehicles to more appropriately-sized vehicles.
- Analysis and development of a plan to reduce commute distances, make school routes more efficient, and otherwise reduce vehicle miles traveled.

The City of Revere has also adopted the Massachusetts “stretch” energy code, which will ensure that new construction is built to a higher-than-average standard of efficiency and help reduce the growth rate of new energy demand.

V. RENEWABLE ENERGY PROJECTS

In fall 2009, the City of Revere completed installation of a 42-kW building-integrated photovoltaic (BIPV) system on the roof of the Beachmont Elementary School, using funding from the Energy Efficiency and Conservation Block Grants (EECBG). The savings from this project are an estimated \$15,828 in cost savings and 612 MMBtu in energy savings (combined electricity and natural gas), as well as a reduced demand of 204 kW.

The Ameresco audit investigated potential sites for wind energy, including the Beachmont School and Garfield School, but did not find any suitable locations at the buildings they audited. Revere may continue exploration of potential sites for renewable energy pending funds.

VI. CONCLUSION

The City of Revere is committed to taking action to reduce its consumption of conventional energy sources, both through energy efficiency measures and a transition to clean, safe, sustainable generation technologies. Revere is confident that it can meet and exceed a 20% reduction in municipal energy use by 2014 through the implementation of energy conservation measures in the schools, and intends to follow up on new opportunities to save energy and invest in a clean energy future.

A. Resources

Comprehensive Energy Audit. Prepared for the City of Revere, Massachusetts. 3 April 2009. Ameresco.

MassEnergyInsight. Web-based tool. URL: <http://www.massenergyinsight.net>

City of Revere. Website. URL: <http://www.revere.org>

B. Acknowledgements

This document was prepared by staff at the Metropolitan Area Planning Council (MAPC) on the behalf of the City of Revere, with input and data provided by city staff and Ameresco, Inc. Inquiries should be addressed to:

Mayor Thomas Ambrosino
City of Revere
281 Broadway
Revere, MA 02151
tambrosino@revere.org
(781) 286-8110

Helen Aki, LEED AP
MAPC Energy Services Coordinator
60 Temple Place
Boston, MA 02111
haki@mapc.org
(617) 451-2770 x 2054

Harold Meyer
Business Development Manager
Ameresco, Inc.
111 Speen Street, Suite 410
Framingham, MA 01701
h Meyer@ameresco.com

Appendix A: Baseline Energy Use by Facility and Fuel Type (native units, FY 2009)

Facility Name	Building Size (Sq. Ft.)	Electric (kWH)	Gas (therms)	#2 Oil (gallons)	Gasoline (gallons)* FY10	Diesel (gallons)* FY10	Site Energy Use (MMBTU)
Abraham Lincoln School	87,017	325,615	2,740	20,633			4,253
Alden Mills Fire Station	3,500	6,448	3,390				361
American Legion Hall	11,898	83,822		5,101			995
Beachmont School.	117,894	885,991	65,490				9,572
Central Fire Station	14,689	140,680	7,870				1,267
City Hall	31,219	336,753	15,200				2,669
DPW Building	29,440	163,540	30	9,583			1,893
DPW Vehicles*					29,141	14,816	5,673
Fire - Walden St.		5,275	260	920			172
Fire - Winthrop Ave.		2,638	80	949			149
Fire Department Vehicles						11,391	1,583
Fire Engine 1/Ladder 1		121,923					416
Freeman St. Station	5,358	20,516	5,550				625
Garfield School	200,000	1,922,919	94,790				16,040
North Revere Fire Station		40,739	800				219
Paul Revere School	58,464	179,074	55,890				6,200
Police - Crescent Ave. Station		2,345					8
Police - Pleasant/Hyde Station		21,688	10				75
Police - Prospect Ave. Radio Tower		9,672					33
Police Department Vehicles					34,302		4,253
Police Headquarters		497,362					1,697
Pump Stations		176,143					601
Revere High School/Seacoast School	324,375	2,708,382	162,460	3,504			25,974
Revere Public Library	10,227	76,202		4,540			891
Rumney Marsh Academy		792,790	34,210				6,126
Senior Center	13,777	71,805	4,060				651
Susan B. Anthony/A. C. Whelan School	180,000	1,479,484					5,048
Traffic Lights		23,447					80
William McKinley ES	43,570	176,436					602
Youth Center	11,712	59,203	12,310				1,433
Total (native units)		10,330,891	465,140	45,230	63,443	26,207	99,559

*Includes fuel used by School Department, Elderly Affairs, and other administrative City vehicles.

Appendix B: Baseline Energy Use by Facility and Fuel Type (MMBTU, FY 2009)

Facility Name	Building Size (Sq. Ft.)	Electric (MMBTU)	Gas (MMBTU)	Oil (MMBTU)	Gasoline/Diesel (MMBTU)* FY10	Site Energy Use (MMBTU)	Site EUI (kBtu/Sq.Ft.)
Abraham Lincoln School	87,017	1,111	274	2,868		4,253	48.88
Alden Mills Fire Station	3,500	22	339			361	103.14
American Legion Hall	11,898	286		709		995	83.63
Beachmont School.	117,894	3,023	6,549			9,572	81.19
Central Fire Station	14,689	480	787			1,267	86.26
City Hall	31,219	1,149	1,520			2,669	85.49
DPW Building	29,440	558	3	1,332		1,893	64.30
DPW Vehicles*					5,673	5,449	n/a
Fire - Walden St.		18	26	128		172	
Fire - Winthrop Ave.		9	8	132		149	
Fire Department Vehicles					1,583	1,412	n/a
Fire Engine 1/Ladder 1		416				416	
Freeman St. Station	5,358	70	555			625	116.65
Garfield School	200,000	6,561	9,479			16,040	80.20
North Revere Fire Station		139	80			219	
Paul Revere School	58,464	611	5,589			6,200	106.05
Police - Crescent Ave. Station		8				8	
Police - Pleasant/Hyde Station		74	1			75	
Police - Prospect Ave. Radio Tower		33				33	
Police Department Vehicles					4,253	4,253	n/a
Police Headquarters		1,697				1,697	
Pump Stations		601				601	n/a
Revere High School/Seacoast School	324,375	9,241	16,246	487		25,974	80.07
Revere Public Library	10,227	260		631		891	87.12
Rumney Marsh Academy		2,705	3,421			6,126	
Senior Center	13,777	245	406			651	47.25
Susan B. Anthony/A. C. Whelan School	180,000	5,048				5,048	28.04
Traffic Lights		80				80	n/a
William McKinley ES	43,570	602				602	13.82
Youth Center	11,712	202	1,231			1,433	122.35
Total MMBTU		35,249	46,514	6,287	11,510	99,559	

*Includes fuel used by School Department, Elderly Affairs, and other administrative City vehicles.

Appendix C: Energy Conservation Measures Under Contract

ECM Description		Applicable Location	Annual Savings (\$)	Electricity (kW)	Electricity (kWh)	Gas (Therms)	#2 Fuel Oil (Gal)
1	Lighting System Improvements	Schools	\$97,164	2,778	616,244	-9,406	-721
2	Lighting Control Upgrades	Schools	\$18,079		165,749	-2,234	-400
3	New Integrated Energy Management System	Schools	\$265,144		457,728	70,055	33,480
4	Boiler Replacements	RHS	\$45,871			5,465	12,764
5	Roof Replacement/BIPV *	Beachmont	\$15,828	204	51,419	4,364	
6	Steam Trap Replacements	McKinley	\$13,282			8,631	
7	Rooftop Unit Replacements	Beachmont	\$12,429	229	87,970		
8	Install Thermostatic Radiator Valves	McKinley	\$3,516			2,285	
9	High Efficiency Transformers	Beachmont, Garfield, RHS	\$26,667	268	196,763		
10	Computer Load Management	RHS	\$32,254		313,838	-4,918	-415
11	Vending Machine Controls	RHS	\$6,292		48,880		
12	Upgrade Standard Efficiency Motors	Garfield, Lincoln, RHS	\$3,382	80	22,488		
13	Pipe Insulation	Lincoln, McKinley, RHS	\$45,157		20,593	469	543
14	Attic Insulation	McKinley	\$3,854			2,505	
15	Pool Cover	Garfield	\$9,785		20,106	4,718	
16	Infiltration and Weatherization	RHS, Garfield, Lincoln	\$35,690		1,650	19,957	2,285
17	Cooling Tower Replacement	Garfield	\$6,053		38,204		
18	Classroom Unit Ventilator Replacements	Lincoln	\$6,827				2,276
19	Pool Dehumidification Unit	Garfield	\$14,215		31,007	6,624	
20	Power Factor Correction	RHS	\$1,031	235			
21	Pool Setpoint Modification	Garfield	\$20,415		73,630	6,872	
22	Sink Aerators	Garfield, West Revere	\$3,047			1,152	
Savings Subtotals (native units)			\$685,982	3,794	2,146,269	116,539	49,812
MMBTu Savings Subtotals					7,323	11,654	6,924
Total MMBTu Savings					25,900		
Total MMBTu Savings (not including BIPV)					25,289		

*Not included in other savings calculations, as it includes an onsite renewable energy project.

Appendix D: Ameresco - Estimated First-Year Energy Savings in Revere Schools

Building	Revere High School	Beachmont School	Garfield School	Abraham Lincoln School	McKinley School	West Revere School	Totals (kWh)	Totals (MMBtu)	% Saved by ECM
Square Footage	248,800	117,894	200,000	87,017	39,711	180,000	873,422		
Lighting System Improvements	192,276	88,083	257,749	57,104	21,033	0	616,244	2,103	7.5%
Lighting Controls	36,875	36,262	47,477	31,716	13,419	0	165,749	566	2.0%
EMS	323,491	37,146	83,716	4,088	3,758	5,529	457,728	1,562	5.6%
Roof Replacements	0	51,419	0	0	0	0	51,419	175	0.6%
Rooftop Unit Replacements	0	87,970	0	0	0	0	87,970	300	1.1%
High Efficiency Transformers	70,354	53,799	72,610	0	0	0	196,763	671	2.4%
Computer Power Management	94,145	42,302	63,988	32,508	16,323	64,572	313,838	1,071	3.8%
Vending Machine Controls	21,395	4,997	0	14,992	2,499	4,997	48,880	167	0.6%
Premium Efficiency Motors	10,861	0	8,913	2,714	0	0	22,488	77	0.3%
Pipe Insulation	0	0	20,593	0	0	0	20,593	70	0.3%
Pool Cover	0	0	20,106	0	0	0	20,106	69	0.2%
Infiltration and Weatherization	730	0	913	8	0	0	1,650	6	0.0%
Cooling Tower Replacement	0	0	38,204	0	0	0	38,204	130	0.5%
Replace Pool Dehumidification Unit	0	0	31,007	0	0	0	31,007	106	0.4%
Power Factor Correction	0	0	0	0	0	0	0	0	0.0%
Pool Setpoint Modifications	0	0	73,630	0	0	0	73,630	251	0.9%
Savings	750,125	401,978	718,905	143,130	57,032	75,098	2,146,268	7,323	

Existing (kWh)	2,961,837	1,059,000	2,007,000	344,480	178,720	1,612,000	8,163,037	27,852
Post-Usage (kWh)	2,211,712	657,022	1,288,095	201,350	121,688	1,536,902	6,016,769	20,529
Existing (kWh/sf)	11.9	12.9	13.9	14.9	15.9	16.9	16.9	0.058
Saved (kWh/sf)	3.0	3.4	3.6	1.6	1.4	0.4	2.5	0.008
% Saved	25.3%	38.0%	35.8%	41.5%	31.9%	4.7%	26.3%	26.3%

% Savings from Baseline	7.88%
--------------------------------	--------------

Appendix E: Ameresco - Proposed Future ECMs in City Buildings

Measure Name	Measure Costs	kW	kWh	Therms	Gals, #2	KGals (water/sewer)	O&M Savings	Savings	Simple Payback (years)
Lighting System Improvements - Alden_Fire	\$ 4,147	14	1,155	(20)	-	-	\$ 70	\$ 266	15.59
Integrated and New Energy Management Systems - Alden_Fire	\$ 26,423	-	-	-	-	-	\$ -	\$ -	-
Lighting System Improvements - Central_Fire	\$ 11,557	37	9,318	(149)	-	-	\$ 180	\$ 1,548	7.46
Lighting Controls - Central_Fire	\$ 1,297	-	824	(13)	-	-	\$ -	\$ 100	13.02
Integrated and New Energy Management Systems - Central_Fire	\$ 35,713	-	-	-	-	-	\$ -	\$ -	-
Water Conservation - Central_Fire	\$ 137	-	-	181	-	37	\$ -	\$ 486	0.28
Lighting System Improvements - City_Hall	\$ 45,385	208	62,330	(965)	-	-	\$ 896	\$ 8,778	5.17
Integrated and New Energy Management Systems - City_Hall	\$ 54,698	-	-	6,094	-	-	\$ -	\$ 9,378	5.83
Steam Trap Replacements - City_Hall	\$ 25,292	-	-	1,611	-	-	\$ -	\$ 2,479	10.20
Install Thermostatic Radiator Valves - City_Hall	\$ 24,942	-	36,000	381	-	-	\$ -	\$ 5,203	4.79
Computer Power Management - City_Hall	\$ 1,914	-	8,131	(135)	-	-	\$ -	\$ 835	2.29
Pipe Insulation - City_Hall	\$ 10,715	-	-	1,319	-	-	\$ -	\$ 2,030	5.28
Attic Insulation - City_Hall	\$ 24,782	-	-	2,536	-	-	\$ -	\$ 3,902	6.35
Water Conservation - City_Hall	\$ 4,090	-	3,177	-	-	57	\$ -	\$ 723	5.66
Lighting System Improvements - DPW_Bldg	\$ 55,551	121	18,689	(340)	-	-	\$ 381	\$ 3,363	16.52
Lighting Controls - DPW_Bldg	\$ 4,419	-	2,589	(47)	-	-	\$ -	\$ 302	14.65
Integrated and New Energy Management Systems - DPW_Bldg	\$ 49,144	-	2,037	2,116	2,900	-	\$ -	\$ 12,364	3.97
Waste Oil Heaters - DPW_Bldg	\$ 17,029	-	-	1,600	-	-	\$ -	\$ 2,546	6.69
Vending Machine Controls - DPW_Bldg	\$ 711	-	2,820	-	-	-	\$ -	\$ 410	1.73
Lighting System Improvements - Freeman_Fire	\$ 4,684	21	6,920	(117)	-	-	\$ 88	\$ 1,263	3.71
Integrated and New Energy Management Systems - Freeman_Fire	\$ 26,591	-	-	-	-	-	\$ -	\$ -	-
Vending Machine Controls - Freeman_Fire	\$ 438	-	2,618	-	-	-	\$ -	\$ 515	0.85
Pipe Insulation - Freeman_Fire	\$ 4,241	-	-	598	-	-	\$ -	\$ 952	4.45
Attic Insulation - Freeman_Fire	\$ 4,208	-	-	721	-	-	\$ -	\$ 1,147	3.67
Water Conservation - Freeman_Fire	\$ 69	-	-	11	-	2	\$ -	\$ 30	2.28
Lighting System Improvements - Legion_Hall	\$ 9,857	54	18,528	-	(216)	-	\$ 150	\$ 3,147	3.13
Integrated and New Energy Management Systems - Legion_Hall	\$ 30,631	-	-	-	712	-	\$ -	\$ 2,137	14.34
Computer Power Management - Legion_Hall	\$ 1,439	-	1,564	-	(19)	-	\$ -	\$ 249	5.77
Vending Machine Controls - Legion_Hall	\$ 438	-	2,162	-	-	-	\$ -	\$ 425	1.03
Pipe Insulation - Legion_Hall	\$ 8,326	-	-	-	71	-	\$ -	\$ 213	39.14
Lighting System Improvements - Senior_Center	\$ 9,800	41	8,015	(128)	-	-	\$ 192	\$ 1,565	6.26
Lighting Controls - Senior_Center	\$ 1,798	-	1,197	(19)	-	-	\$ -	\$ 205	8.77
Integrated and New Energy Management Systems - Senior_Center	\$ 53,985	-	-	659	-	-	\$ -	\$ 1,049	51.45
Kitchen Appliance Replacements - Senior_Center	\$ 40,306	216	4,742	(180)	-	-	\$ -	\$ 647	62.31
Computer Power Management - Senior_Center	\$ 1,439	-	1,526	(27)	-	-	\$ -	\$ 258	5.58
Pipe Insulation - Senior_Center	\$ 541	-	-	5	-	-	\$ -	\$ 8	70.30
Water Conservation - Senior_Center	\$ 120	-	-	23	-	5	\$ -	\$ 64	1.88
Lighting System Improvements - Youth	\$ 15,557	47	9,120	(148)	-	-	\$ 255	\$ 1,811	8.59
Lighting Controls - Youth	\$ 2,640	-	1,936	(32)	-	-	\$ -	\$ 330	7.99
Integrated and New Energy Management Systems - Youth	\$ 28,443	-	-	4,250	-	-	\$ -	\$ 6,821	4.17
Steam Trap Replacements - Youth	\$ 8,234	-	-	665	-	-	\$ -	\$ 1,067	7.72
Computer Power Management - Youth	\$ 1,379	-	741	(13)	-	-	\$ -	\$ 125	11.08
Vending Machine Controls - Youth	\$ 711	-	2,655	-	-	-	\$ -	\$ 522	1.36
Pipe Insulation - Youth	\$ 1,292	-	-	136	-	-	\$ -	\$ 219	5.91
Water Conservation - Youth	\$ 6,611	-	-	34	-	441	\$ -	\$ 2,503	2.64
Total Selected	\$ 661,725	758	208,794	20,607	3,448	542	\$ 2,213	\$ 81,985	7.86

Appendix F: Letters Verifying Adoption of Energy Plan