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**Local Government Energy Program
Energy Audit Report**

For

***Middletown Township
Public Library-Bayshore Branch
180 Main Street
Port Monmouth, NJ 07758***

Project Number: LGEA41



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INTRODUCTION

Launched in 2008, the Local Government Energy Audit (LGEA) Program provides subsidized energy audits for municipal and local government-owned facilities, including offices, courtrooms, town halls, police and fire stations, sanitation buildings, transportation structures, schools and community centers. The Program will subsidize 75% of the cost of the audit. If the net cost of the installed measures recommended by the audit, after applying eligible NJ SmartStart Buildings incentives, exceeds the remaining cost of the audit, then the additional 25% will also be paid by the program. The Board of Public Utilities (BPU) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

On December 8, 2009, Steven Winter Associates, Inc. (SWA) and PMK Group, Inc., a business unit of Birdsall Services Group (BSG-PMK) (collectively “SWA/BSG-PMK”), performed an energy audit and assessment for the Public Library-Bayshore Branch Building. The building is located at 180 Main Street, Port Monmouth, New Jersey 07758, in Monmouth County. The current conditions and energy-related information were collected in order to analyze and facilitate the implementation of energy conservation measures for the building.

The Public Library –Bayshore Branch was built in 1895. The building’s two floors have a total area of 2,933 square feet and consists of a circulation area, a reading materials area, and restrooms. The second floor is used for storage. The building is open from 1:00 PM to 5:00 PM and 6:00 PM to 8:00 PM Monday and Wednesday, 1:00 PM to 5:00 PM Tuesday and Friday, and 9:00 AM to 12:00 PM and 1:00 PM to 5:00 PM on Thursday. The building is occupied by one to two employees on a regular basis.

Energy data and building information collected in the field were analyzed to determine the baseline energy performance of each building. Using spreadsheet-based calculation methods, SWA and BSG-PMK estimated the energy and cost savings associated with the installation of each of the recommended energy conservation measures. The findings for the building are summarized in this report.

The goal of this energy audit is to provide sufficient information to make decisions regarding the implementation of the most appropriate and most cost effective energy conservation measures for the buildings.

EXECUTIVE SUMMARY

This document contains the energy audit report for the Public Library-Bayshore Branch Building, located at 180 Main Street, Port Monmouth, New Jersey 07758.

Based on the field visit performed by BSG-PMK staff on December 8, 2009, and the results of a comprehensive energy analysis, this report describes the site's current conditions and recommendations for improvements. Suggestions for measures related to energy conservation and improved comfort are provided in the scope of work. Energy and resource savings are estimated for each measure that results in a reduction of heating, cooling, and electric usage.

Current conditions

In the most recent full year of data collected, October, 2008 through September, 2009, the Facility consumed a total of 23,295 kWh of electricity for a total cost of \$4,288 and 1,848 therms of natural gas, for a total cost of \$2,822.

With electricity and fossil fuel combined, the building consumed 270 MMBtus of energy at a total cost of \$7,110.

SWA/BSG-PMK has entered energy information about the Facility in the US Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* energy benchmarking system. In order to compare commercial buildings equitably, the *Portfolio Manager* ratings convey the consumption of each type of energy in a single common unit. The EPA uses source energy to represent the total amount of raw fuel required to operate the building. The site energy use intensity for the complex is 92.0 kBtu/sq.ft/year. After energy efficiency improvements are made, future utility bills can be added to the *Portfolio Manager* and the site energy use intensity for a different time period can be compared to the year 2009 baseline to track the changes in energy consumption associated with the energy improvements.

SWA/BSG-PMK also recommends that the Township of Middletown contact third party energy suppliers in order to negotiate a lower electricity rate and a lower natural gas rate. Comparing the current electric and gas rates to average utility rates of similar type buildings in New Jersey, it may be possible to save up to \$0.034/kWh, which would have equated to \$793 in electric costs for the past 12 months, and \$0.027/therm, which would have equated to \$50 in gas costs for the past 12 months.

Buildings achieving an Energy Star rating of 75 are eligible to apply for the Energy Star award and receive the Energy Star plaque to convey superior performance. These ratings also greatly help when applying for Leadership in Energy and Environmental Design (LEED) building certification through the United States Green Building Council (USGBC). SWA/BSG-PMK encourages the Township of Middletown to continue entering utility data in *Energy Star Portfolio Manager* in order to track whether normalized source energy use over time. The building performance rating could not be determined because this is a mixed-use facility, comprised by non-eligible space types categorized as "Other".

(Refer to Section 1.3 for Energy Star Rating)

Category I Recommendations: Capital Improvement Measures

- Based on the results of SWA/BSG-PMK's survey, no capital improvement measures are recommended.

Category II Recommendations: Operations and Maintenance

- All weather stripping should be repaired and replaced as necessary including door sweeps. Attic emergency door is to be included.
- Replace attic roof insulation. Install insulation with vapor barrier to the underside of the floor joist in crawl space.
- Excess natural gas is consumed during the summer months, particularly in June. This can be eliminated completely by either shutting off the gas during the summer, or by turning off the heat and installing thermostat locking protective covers to restrict access to the temperature controls.

Category III Recommendations: Energy Conservation Measures - Upgrades with associated energy savings

At this time, SWA/BSG-PMK highly recommends a total of three (3) Energy Conservation Measures (ECMs) for the Bayshore Library which are summarized in the following tables. The total investment cost for the ECMs is **\$11,947**. SWA/BSG-PMK estimates a first year savings of **\$2,109** with a simple payback of **5.7 years**. SWA/BSG-PMK estimates that implementing the highly recommended ECMs will reduce the carbon footprint of the building by **16,101 lbs of CO₂**.

There are various incentives that the Township of Middletown could apply for that could also help lower the cost of installing the ECMs. SWA/BSG-PMK recommends that the Township apply for the NJ SmartStart program through the New Jersey Office of Clean Energy. This incentive can help provide technical assistance for the building in the implementation phase of any energy conservation project. A new NJ Clean Power program, Direct Install, could also assist to cover up to 80% of the capital investment. In order to qualify, the facility being upgraded must not have had a peak demand that exceeded 200 kW in any of the preceding 12 months; the highest peak demand for the complex in the previous year was 14 kW.

The following table summarizes the proposed Energy Conservation Measures (ECM) and their economic relevance:

ROI: Return on Investment (%)

Assumptions:

Discount rate: 3.2% per DOE FEMP guidelines

Electricity rate \$0.18 \$/kWh (cooling season only)

Energy price escalation rate: 0% per DOE FEMP guidelines

Gas rate \$1.53 \$/therm

Area of Building (SF) 2,933

Avg. Annual Demand: 0.00699

Table 1 - Highly Recommended 0-5 Year Payback ECMs																			
ECM #	ECM description	Source	Est. Installed Cost, \$	Est. Incentives, \$	Net Est. ECM Cost with Incentives, \$	kWh, 1st Yr Savings	kW, Demand Reduction/Mo	Therms, 1st Yr Savings	kBtu/sq ft, 1st Yr Savings	Est. Operating Cost, 1st Yr Savings, \$	Total 1st Yr Savings, \$	Life of Measure, Yrs	Est. Lifetime Energy Cost Savings, \$	Simple Payback, Yrs	Lifetime Return on Investment, %	Annual Return on Investment, %	Internal Rate of Return, %	Net Present Value, \$	CO ₂ Reduced, lbs/yr
1	Pipe Insulation	RS Means CostWorks 2009	\$1,280	\$0	\$1,280	0	0.00	256	8.73	\$0	\$392	20	\$5,721	3.27	1734.73%	87%	30%	\$4,547	2,995
TOTAL			\$1,280	\$0	\$1,280	0	0.00	256	8.73	\$0.00	\$392	-	\$5,721	3.27	-	-	-	\$4,547	2,995

Table 2 - Recommended 5-10 Year Payback ECMs																			
ECM #	ECM description	Source	Est. Installed Cost, \$	Est. Incentives, \$	Net Est. ECM Cost with Incentives, \$	kWh, 1st Yr Savings	kW, Demand Reduction/Mo	Therms, 1st Yr Savings	kBtu/sq ft, 1st Yr Savings	Est. Operating Cost, 1st Yr Savings, \$	Total 1st Yr Savings, \$	Life of Measure, Yrs	Est. Lifetime Energy Cost Savings, \$	Simple Payback, Yrs	Lifetime Return on Investment, %	Annual Return on Investment, %	Internal Rate of Return, %	Net Present Value, \$	CO ₂ Reduced, lbs/yr
2	Lighting Upgrades	Empirical Data	\$4,207	\$720	\$3,487	3,444	2.01	0	4.01	\$0	\$620	15	\$7,295	5.62	728%	49%	16%	\$3,914	4,719
	Occupancy Sensors		\$200	\$20	\$180	225	0.13	0	0.26	\$0	\$40	10	\$341	4.45	897%	90%	18%	\$165	308
3	Upgrade Boiler & Install OAR	Similar Projects	\$35,000	\$28,000	\$7,000	0	0.00	691	23.54	\$0	\$1,057	25	\$17,995	6.63	628%	25%	15%	\$11,398	8,080
TOTAL			\$39,407	\$28,740	\$10,667	3,669	2.14	691	27.81	\$0.00	\$1,717	-	\$25,632	6.21	-	-	-	\$15,477	13,106

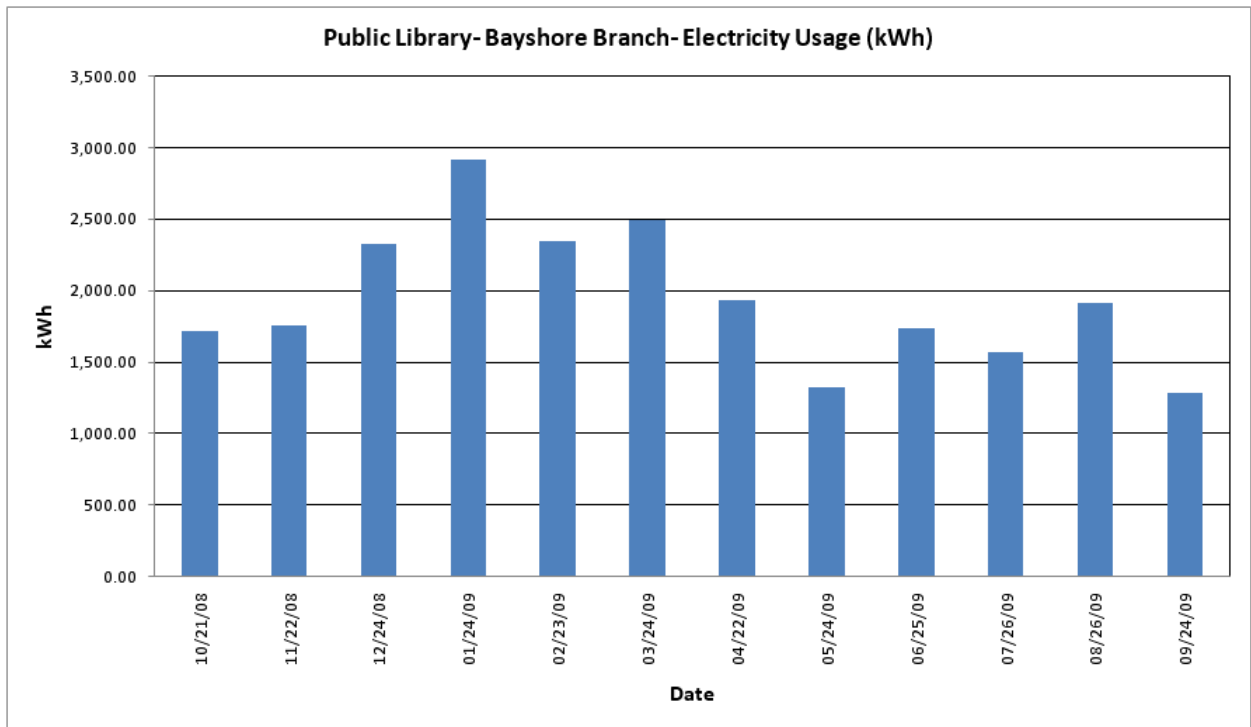
1. HISTORIC ENERGY CONSUMPTION

1.1 ENERGY USAGE AND COST ANALYSIS

SWA/BSG-PMK analyzed utility bills from November, 2007 through December, 2009 that were received from the utility companies supplying the Public Library- Bayshore Branch with electric and natural gas.

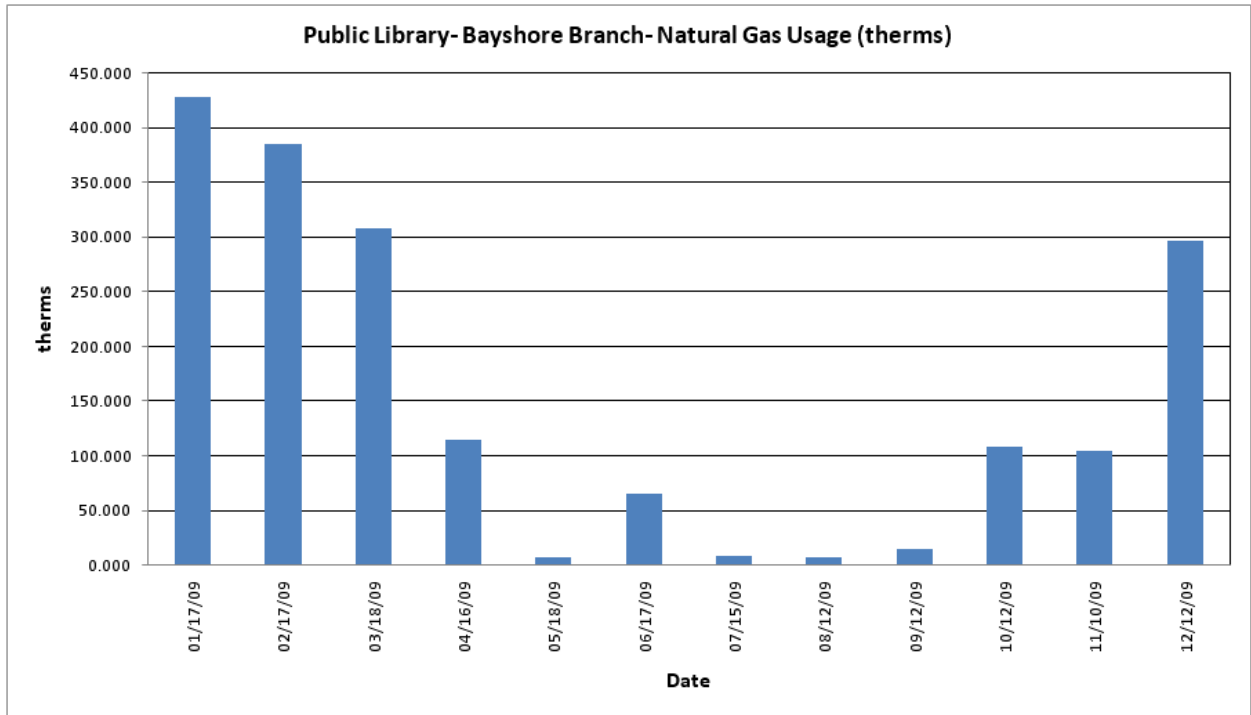
Electricity - The Public Library- Bayshore Branch is currently served by one electric meter and purchases electricity from Jersey Central Power & Light at **an average rate of \$0.18/kWh** based on 12 months of utility bills from October, 2008 through September, 2009. The building consumed **23,295 kWh or \$4,288 worth of electricity** during that time span.

The following chart shows electricity usage for the building based on utility bills from October, 2008 through September, 2009:



Natural Gas - The Public Library- Bayshore Branch purchases gas from New Jersey Natural Gas at **an average rate of \$1.53/therm** based on 12 months of utility bills from January, 2009 through December, 2009. The building consumed **1,848 therms or \$2,822 worth of natural gas** during that time span.

The following chart shows the natural gas consumption for the complex based on natural gas bills for the 12 month period of January, 2009 through December, 2009:



Excess natural gas is consumed during the summer months, particularly in June. This can be eliminated completely by either shutting off the gas during the summer, or by turning off the heat and installing thermostat locking protective covers to restrict access to the temperature controls.

1.2 UTILITY RATE

The Public Library- Bayshore Branch currently purchases electricity from Jersey Central Power & Light for electricity use (kWh) with a separate (kW) demand charge. The complex currently pays an average rate of approximately \$0.18/kWh based on the 12 months of utility bills of October, 2008 through September, 2009.

The Public Library- Bayshore Branch currently purchases natural gas supply and transmission from New Jersey Natural Gas at an average aggregated rate of \$1.53/therm based on 12 months of utility bills from January, 2009 through December, 2009.

1.3 ENERGY BENCHMARKING

The building information and utility data were entered into the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. SWA/BSG-PMK recommends that the Borough maintain the Portfolio Manager account at the link below. As the account is maintained, SWA/BSG-PMK can share with the Township and allow future data to be added and tracked using the benchmarking tool.

http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager

Username: middletowntownship
Password: middletown

Buildings achieving an Energy Star rating of 75 are eligible to apply for the Energy Star award and receive the Energy Star plaque to convey superior performance. These ratings also greatly help when applying for Leadership in Energy and Environmental Design (LEED) building certification through the United States Green Building Council (USGBC). SWA/BSG-PMK encourages the Township to continue entering utility data in Energy Star Portfolio Manager in order to track whether normalized source energy use over time.

The Site Energy Use Intensity is 92.0 kBtu/ft²yr compared to the national average of 104.0 kBtu/ft²yr for commercial buildings classified similarly by the Energy Star Portfolio Manager. Implementing this report's recommendations will reduce use by approximately 36.5 kBtu/ft²yr, which, when implemented, would lower the building's energy consumption.



STATEMENT OF ENERGY PERFORMANCE Public Library- Bayshore Branch

Building ID: 2061709
For 12-month Period Ending: September 30, 2009¹
Date SEP becomes ineligible: N/A

Date SEP Generated: February 16, 2010

Facility
Public Library- Bayshore Branch
180 Main Street
Port Monmouth, NJ 07758

Facility Owner
Middletown Township
1 Kings Highway
Middletown, NJ 07749

Primary Contact for this Facility
Jason Greenspan
1 King's Highway
Middletown, NJ 07737

Year Built: 1895
Gross Floor Area (ft²): 2,933

Energy Performance Rating² (1-100) N/A

Site Energy Use Summary³

Electricity - Grid Purchase(kBtu)	79,655
Natural Gas (kBtu) ⁴	190,449
Total Energy (kBtu)	270,104

Energy Intensity⁵

Site (kBtu/ft ² /yr)	92
Source (kBtu/ft ² /yr)	159

Emissions (based on site energy use)

Greenhouse Gas Emissions (MtCO ₂ e/year)	22
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Electric Distribution Utility

FirstEnergy - Jersey Central Power & Lt Co

National Average Comparison

National Average Site EUI	104
National Average Source EUI	246
% Difference from National Average Source EUI	-35%
Building Type	Library

Stamp of Certifying Professional
Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this statement is accurate.

Meets Industry Standards⁶ for Indoor Environmental Conditions:

Ventilation for Acceptable Indoor Air Quality	N/A
Acceptable Thermal Environmental Conditions	N/A
Adequate Illumination	N/A

Certifying Professional
N/A

Notes:

1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Natural Gas values in units of volume (e.g. cubic feet) are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, annualized to a 12-month period.
6. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

The government estimates the average time needed to fill out this form is 6 hours (includes the time for entering energy data, PE facility inspection, and notarizing the SEP) and welcomes suggestions for reducing this level of effort. Send comments (referencing OMB control number) to the Director, Collection Strategies Division, U.S., EPA (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460.

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1 Building Characteristics

The Public Library –Bayshore Branch was built in 1895. The building’s two floors have a total area of 2,933 square feet which consists of a circulation area, a reading materials area, and restrooms. The second floor is used for storage.

2.2 Building Occupancy Profiles

The building is open from 1:00 PM to 5:00 PM and 6:00 PM to 8:00 PM Monday and Wednesday, 1:00 PM to 5:00 PM Tuesday and Friday, and 9:00 AM to 12:00 PM and 1:00 PM to 5:00 PM on Thursday. The building is occupied by one to two employees on a regular basis.

2.3 Building Envelope

2.3.1 Exterior Walls

The exterior walls are constructed from nominal lumber with tongue and groove sheathing clad with foam board insulation and vinyl siding. The perimeter walls are insulated with bat insulation finished with drywall. The walls are in good condition.



2.3.2 Roof

The library has two roof sections. The original structure has a roof constructed with nominal rafters; however, the cedar roof has been removed and replaced with plywood sheathing finished with asphalt shingles. The added perimeter section is a black built up asphalt roof that contains six skylights. The front portion of the building is finished with a green shed roof section. The roofs appear to be fairly new and in good condition.

2.3.3 Base

There is a basement crawl space under the building with a mixture of dirt and gravel, the foundation walls are a mixture of original brick and masonry block. The base is in fair condition.



2.3.4 Windows

There are newly installed thermal pane wood framed windows t clad with vinyl. throughout the first floor of the building. All are in good condition.

2.3.5 Exterior doors

The doors are exterior grade insulated hollow metal construction. The exterior doors are in good condition.

Category II Repair and Maintenance- All weather stripping should be repaired and replaced as necessary including door sweeps. Attic emergency door is to be included.

2.3.6 Building air tightness

The building other than the lower level doors is moderately tight, based on the condition of the windows and doors and interviews with occupants, however the insulation in the attic is in need of replacement as the roof replacement project has caused much of the insulation to hang down and fall to the attic floor.

The floor above the crawl space is also not insulated.

Category II Repair and Maintenance- Replace attic roof insulation. Install insulation with vapor barrier to the underside of the floor joist in crawl space.

2.4 HVAC Systems

2.4.1 Heating

Heating is provided by a natural gas, hot water boiler, with a capacity of 250 MBH. The Hydrotherm unit, installed in 1988, has model number R-250B and is nearing the end of its useful life. The unit is served by two Bell & Gossett circulation pumps, both with model number 100 K80. By the front entrance, there is an old cabinet heater.

Category III Recommendations – ECM #3: Replace the current boiler and its pumps with high-efficiency equivalents, and install hot water outdoor air reset control (OAR). These controllers reduce the maximum boiler water temperature depending on the outside air temperature; for instance, if the outside air temperature is 0°F, the boiler temperature will be 180°F, but if the outside air temperature is 40°F, the boiler temperature will only need to be 130°F.



Cabinet heater



Hydrotherm boiler

2.4.2 Cooling

The only cooling in the building was provided by two Frigidaire window air-conditioners, both of which are in good condition. One unit, model number FAS296R2A, has 28,500 BTUs of cooling and an Energy Efficiency Ratio (EER) of 8.5, and the other, model number A6K32E7B-A, has 32,000 BTUs of cooling and an EER of 8.5.



Frigidaire A/C unit

2.4.3 Ventilation

Ventilation is provided by an exhaust fan, an attic louver, doors, and windows.

2.4.4 Domestic Hot Water

A 19 gallon, 2.5 kW AO Smith water heater, with model number ELJC20917, provides domestic water heating. The unit is in good condition.

2.5 Electrical systems

2.5.1 Lighting

A complete inventory of all interior, exterior, and exit sign light fixtures were examined and documented in Appendix A of this report including an estimated total lighting power consumption. Our initial findings indicate that performing a detailed lighting upgrade per the recommendations in Appendix A will result in an annual savings of \$647.78 based on the current \$0.18/kWh and the current occupancy schedule. Implementation of this ECM will cost approximately \$4,407.00. Currently the Board of Public Utilities (BPU) would offer an estimated rebate of \$740.00, yielding a net cost of \$3,667.00 for this project. With a yearly savings of \$647.78 the payback on this ECM would be approximately 5.7 years.

Category III Recommendation - ECM #2: Recommend upgrading all T-12 lighting fixtures with magnetic ballasts to T-8 fixtures with electronic ballasts, as well as various other lighting upgrades outlined in Appendix A. Also recommend installing lighting sensors to certain areas where lights typically remain lit when unoccupied for long periods of time.

Refer to Appendix A for further details.

2.5.2 Appliances and process

The building contains four personal computers.

2.5.3 Elevators

There are no elevators in the facility.

2.5.4 Other electrical systems

There are no other major electrical systems in the building.

3. EQUIPMENT LIST

Building System	Description	Location	Model #	Fuel	Space Served	Estimated Remaining Useful Life %
Cooling	Window AC Unit, 28,500 BTU/Hr, EER 8.5	First Floor	Frigidare #FAS296R2A	Electric	Library	70%
Cooling	Window AC Unit, 32,000 BTU/Hr, EER 8.5	First Floor	Fedders #A6K32E7B-A	Electric	Library	80%
Heating	Gas Fired Boiler, 250,000 BTU/Hr, 80% efficient	Mechanical Room	HydroTherm M# R-250B	Natural Gas	Entire building	12%
Heating	Circulation Pump	Mechanical Room	Bell & Gossett Series 100 K80	Electric	Boiler	0%
Heating	Circulation Pump	Mechanical Room	Bell & Gossett Series 100 K80	Electric	Boiler	0%
Domestic Hot Water	Domestic Hot Water Heater, 19 gal, 2500W	Loft	A.O. Smith #ELJC20917	Electric	Entire building	69%
Heating	Cabinet Heater	Entrance	Nameplate not accessible	Electric	Entrance	20%

Note: The remaining useful life of a system (in %) is the relationship between the system manufactured and/or installed date and the standard life expectancy of similar equipment based on ASHRAE (2003), ASHRAE Handbook: HVAC Applications, Chapter 36.

4. ENERGY CONSERVATION MEASURES

Based on the assessment of the Public Library – Bayshore Branch, BSG-PMK has separated the investment opportunities into three recommended categories:

1. Capital Improvements - Upgrades not directly associated with energy savings
2. Operations and Maintenance - Low Cost / No Cost Measures
3. Energy Conservation Measures - Higher cost upgrades with associated energy savings

Category I Recommendations: Capital Improvement Measures

Based on the results of SWA/BSG-PMK’s survey, no capital improvement measures are recommended.

Category II Recommendations: Operations and Maintenance

All weather stripping should be repaired and replaced as necessary including door sweeps. Attic emergency door is to be included.

Replace attic roof insulation. Install insulation with vapor barrier to the underside of the floor joist in crawl space.

Category III Recommendations: Energy Conservation Measures

Summary table

ECM #	Description
1	Pipe Insulation
2	Lighting Upgrades & Occupancy Sensors
3	Upgrade Boiler & Install OAR

ECM#1: Pipe Insulation

Description:

In the cellar of the Bayshore Library, there is approximately 200 feet of 1”-diameter hot water piping that is not insulated. Due to the fact that metal piping has a thermal resistance (R-value) of almost 0, heat is lost as water passes through the pipes. It is recommended that this piping system be insulated.

Recommended lighting upgrades are detailed in Appendix A.

Installation cost: \$1,280 @ \$6.40 per foot

Source of cost estimate: RS Means CostWorks 2009

Economics (without incentives):

ECM description	Source	Est. Installed Cost, \$	Est. Incentives, \$	Net Est. ECM Cost with Incentives, \$	kWh, 1st Yr Savings	kW, Demand Reduction/Mo	Therms, 1st Yr Savings	kBtu/sq ft, 1st Yr Savings	Est. Operating Cost, 1st Yr Savings, \$	Total 1st Yr Savings, \$	Life of Measure, Yrs	Est. Lifetime Energy Cost Savings, \$	Simple Payback, Yrs	Lifetime Return on Investment, %	Annual Return on Investment, %	Internal Rate of Return, %	Net Present Value, \$	CO ₂ Reduced, lbs/yr
Pipe Insulation	RS Means CostWorks 2009	\$1,280	\$0	\$1,280	0	0.00	256	8.73	\$0	\$392	20	\$5,721	3.27	1734.73%	87%	30%	\$4,547	2,995

Assumptions:

The natural gas cost used in this ECM was \$1.53/therm, which was the Bayshore Library’s average rate for the 12-month period ranging from October, 2008 through September, 2009. A simple ECM for pipe insulation was referenced from *Energy Conservation for Housing – A Workbook*. Insulation for 1”-diameter piping in a natural gas heating system has a “savings factor” of 1.28 therms/foot. At \$6.40/foot, the total cost of the insulation is \$1,280. The savings are calculated with the following equation:

$$(\text{Cost of Gas}) \times (\text{Savings Factor}) \times (\text{Length of Pipe}) = \text{Savings (in \$)}$$

Rebates/financial incentives:

No rebates or incentives for pipe insulation could be found.

ECM#2: Lighting Upgrades & Occupancy Sensors

Description:

Lighting at the Library – Bayshore Branch consists primarily of T-12 fluorescent lamps with magnetic ballasts. The exterior was lit with H.I.D. fixtures and a few exterior incandescent lamps that should be replaced with compact fluorescents. It is recommended that all T-12 fixtures with magnetic ballasts be retrofit with T-8 lamps and electronic ballasts. Lighting replacement generally yields a very good payback, due to the fact that most lighting usage in commercial buildings is fairly high and the installation is relatively inexpensive.

Recommended lighting upgrades are detailed in Appendix A.

Installation cost:

Summary	Lighting (Only)	Sensors (Only)	Complete Lighting Upgrade
Cost	\$4,207.00	\$200.00	\$4,407.00
Rebate	\$720.00	\$20.00	\$740.00
Net Cost	\$3,487.00	\$180.00	\$3,667.00
Savings (k Wh)	3,444	225	3,599
Savings (\$)	\$619.98	\$40.44	\$647.78
Payback	5.6	4.5	5.7
Variables:		Assumptions:	
\$0.18	Avg. Electric Rate (\$/k Wh)	25%	Occupancy Sensor Savings (Avg)
	Avg. Demand Rate (\$/kW)	40%	Occupancy Sensor Savings(>Avg)
1404	Operating Hours/Year		
6	Operating Hours/Work Day		

Source of cost estimate: Empirical Data

Economics (without incentives):

ECM description	Source	Est. Installed Cost, \$	Est. Incentives, \$	Net Est. ECM Cost with Incentives, \$	kWh, 1st Yr Savings	kW, Demand Reduction/Mo	Therms, 1st Yr Savings	kBtu/sq ft, 1st Yr Savings	Est. Operating Cost, 1st Yr Savings, \$	Total 1st Yr Savings, \$	Life of Measure, Yrs	Est. Lifetime Energy Cost Savings, \$	Simple Payback, Yrs	Lifetime Return on Investment, %	Annual Return on Investment, %	Internal Rate of Return, %	Net Present Value, \$	CO ₂ Reduced, lbs/yr
Lighting Upgrades	Empirical Data	\$4,207	\$720	\$3,487	3,444	2.01	0	4.01	\$0	\$620	15	\$7,295	5.62	728%	49%	16%	\$3,914	4,719
Occupancy Sensors		\$200	\$20	\$180	225	0.13	0	0.26	\$0	\$40	10	\$341	4.45	897%	90%	18%	\$165	308

Assumptions:

The electric cost used in this ECM was \$0.18/kWh, which was the Library – Bayshore Branch’s average rate for the 12-month period ranging from October, 2008 through September, 2009. The replacements for each lighting fixture, the costs to replace or retrofit each one, and the rebates and wattages for each fixture are located in Appendix A.

Rebates/financial incentives:

The New Jersey SmartStart offers rebates for upgrading lighting fixtures and installing lighting controls. The total rebate this ECM qualifies for is \$740.

ECM#3: Boiler Upgrade & Install OAR

Description:

Heating is provided by a hot water, natural gas Hydrotherm boiler. The unit is near its useful life of 25 years, and should be replaced by a more efficient unit. The pumps associated with the heating system, which have passed their useful lives, should also be replaced with high-efficiency units. Hot water outdoor air reset control (OAR) should also be installed. These controllers reduce the maximum boiler water temperature depending on the outside air temperature; for instance, if the outside air temperature is 0°F, the boiler temperature will be 180°F, but if the outside air temperature is 40°F, the boiler temperature will only need to be 130°F. Outdoor air reset generally decreases heating costs by 8-15%.

Installation cost:

Estimated installed cost: \$35,000
 Source of cost estimate: Similar projects

Economics:

ECM #	ECM description	Source	Est. Installed Cost, \$	Est. Incentives, \$	Net Est. ECM Cost with Incentives, \$	kWh, 1st Yr Savings	kW, Demand Reduction/Mo	Therms, 1st Yr Savings	kBtu/sq ft, 1st Yr Savings	Est. Operating Cost, 1st Yr Savings, \$	Total 1st Yr Savings, \$	Life of Measure, Yrs	Est. Lifetime Energy Cost Savings, \$	Simple Payback, Yrs	Lifetime Return on Investment, %	Annual Return on Investment, %	Internal Rate of Return, %	Net Present Value, \$	CO ₂ Reduced, lbs/yr
3	Upgrade Boiler & Install OAR	Similar Projects	\$35,000	\$28,000	\$7,000	0	0.00	691	23.54	\$0	\$1,057	25	\$17,995	6.63	628%	25%	15%	\$11,398	8,080

Assumptions:

The cost per therm of natural gas that was used, taken from twelve months of the Bayshore Library’s energy bills, was \$1.53. Also taken from the energy bills was the annual heating consumption for the system, 1,848 therms. In the new system, the replacement is 94% efficient; in the old system, the efficiency, due to the age and condition of the unit, was assumed to be 64%, or 80% of the original efficiency of the system, which was 80%. An additional 8% of the proposed fuel consumption was added to the savings, representing the energy saved by the outdoor air reset control. The savings was calculated using the following series of equations:

Current gas input: 1,848 therms

Current/proposed gas output: $1,848 \text{ therms} \times 64\% = 1,183 \text{ therms}$

Proposed gas input (pre-OAR): $\frac{1,183 \text{ therms}}{94\%} = 1,258 \text{ therms}$

Proposed gas input (post-OAR): $1,258 \text{ therms} \times (100\% - 8\%) = 1,158 \text{ therms}$

Savings: $1,848 \text{ therms} - 1,158 \text{ therms} = 691 \text{ therms}$

(Note: Rounding error of ± 1)

Rebates/financial incentives:

This ECM may be eligible for incentives through New Jersey's Direct Install Program, which can incentivize up to 80% of the total installation cost, which we estimate to be \$28,000 for this measure. Please note that these incentive levels are estimates based on SWA's expected project cost and assumption of project eligibility. Actual incentive levels and project eligibility can only be determined through an Energy Assessment performed by a Direct Install Contractor.

5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES

5.1 EXISTING SYSTEMS

There are currently no existing renewable energy systems.

5.2 SOLAR PHOTOVOLTAIC

Photovoltaic (PV) technology would not be cost beneficial to this project since there is such a high cost of installation and small area of viable space available.

5.3 Solar Thermal Collectors

Solar thermal collectors are not cost effective for this project and are not recommended due to the low amount of domestic hot water use throughout the building.

5.4 Combined Heat and Power

CHP is not applicable to this project because of the HVAC system type and limited domestic hot water usage.

5.5 Geothermal

Geothermal is not applicable to this project because it would require modifications to the existing heat distribution system, which would not be cost effective.

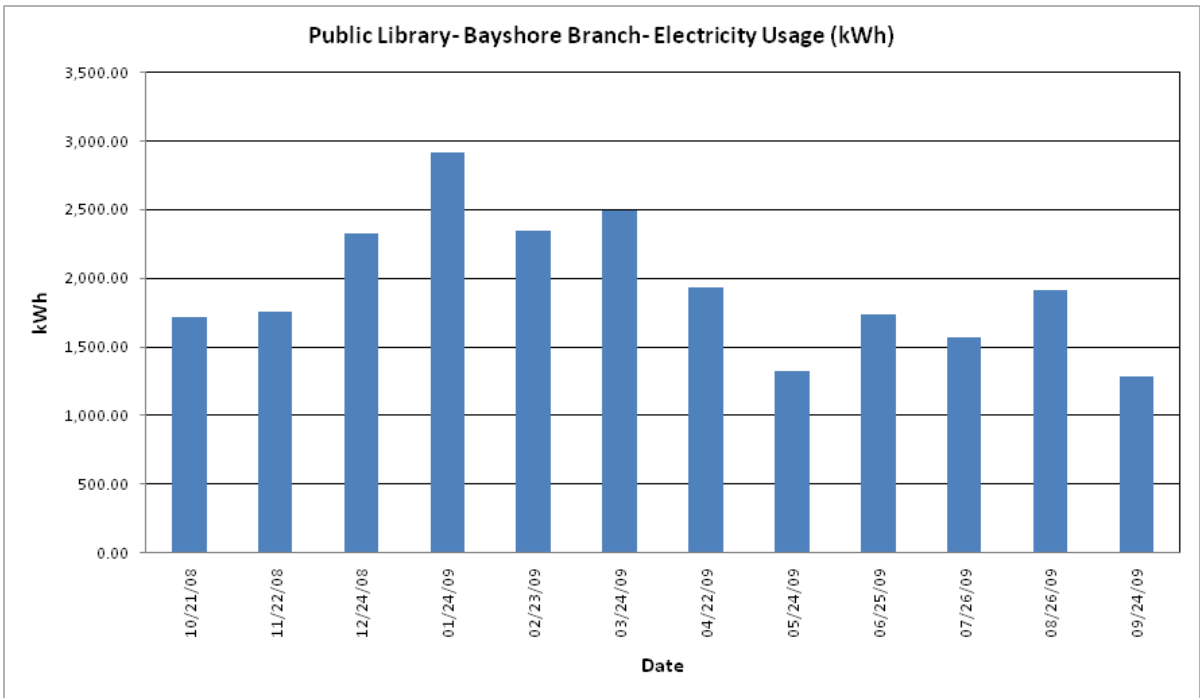
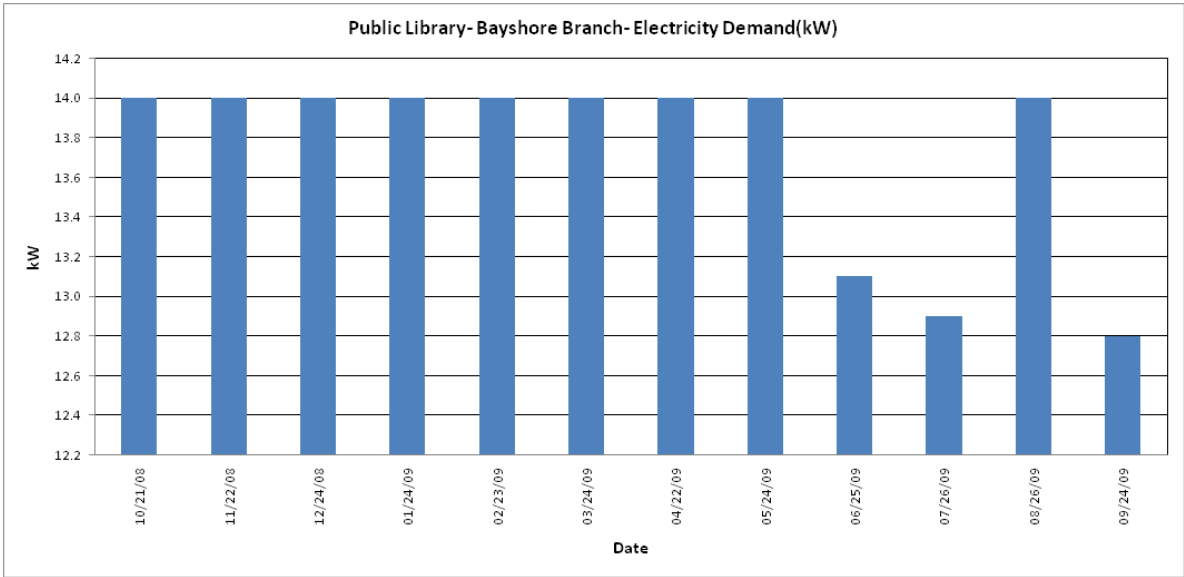
5.6 Wind

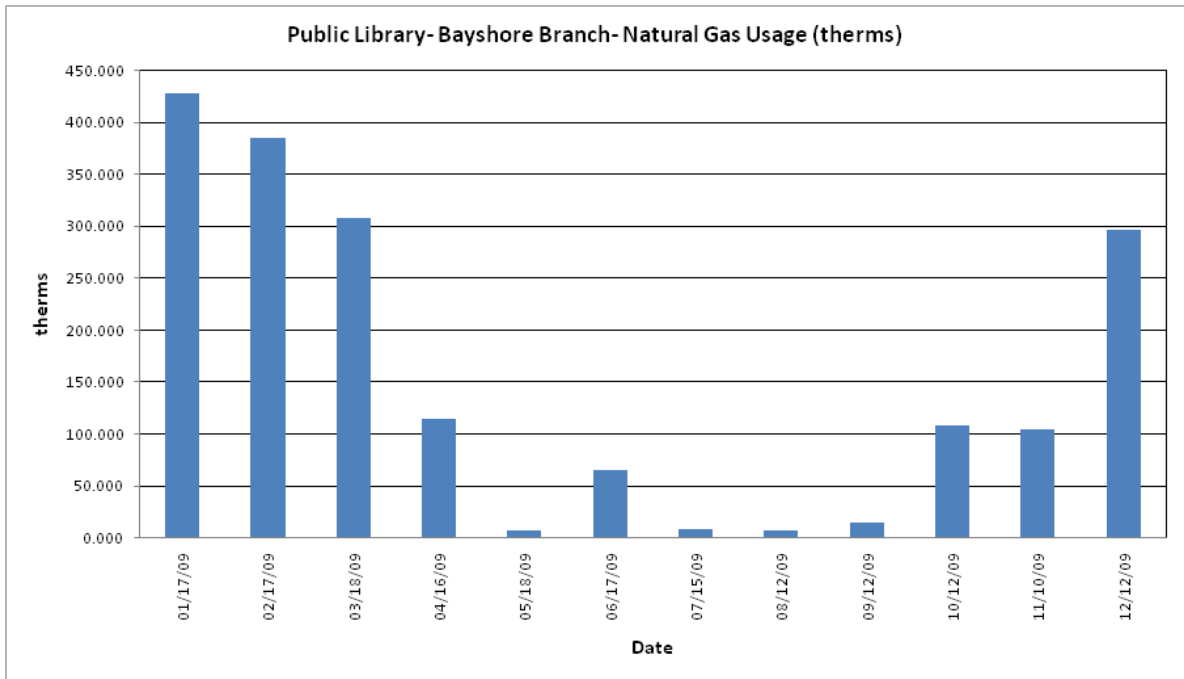
Wind power production is not appropriate for this location because required land is not available for the wind turbine. Also, the available wind energy resource is very low.

6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1 Load profiles

The average electrical peak demand for the facility during previous year was 13.7 kW and the maximum peak demand was 14.0 kW. The electric and gas load profiles for this project are presented in the following charts. The first chart shows the electric demand (in kW) for the previous 12 months and the other two charts show electric (in kWh) and gas usage (in therms), respectively.





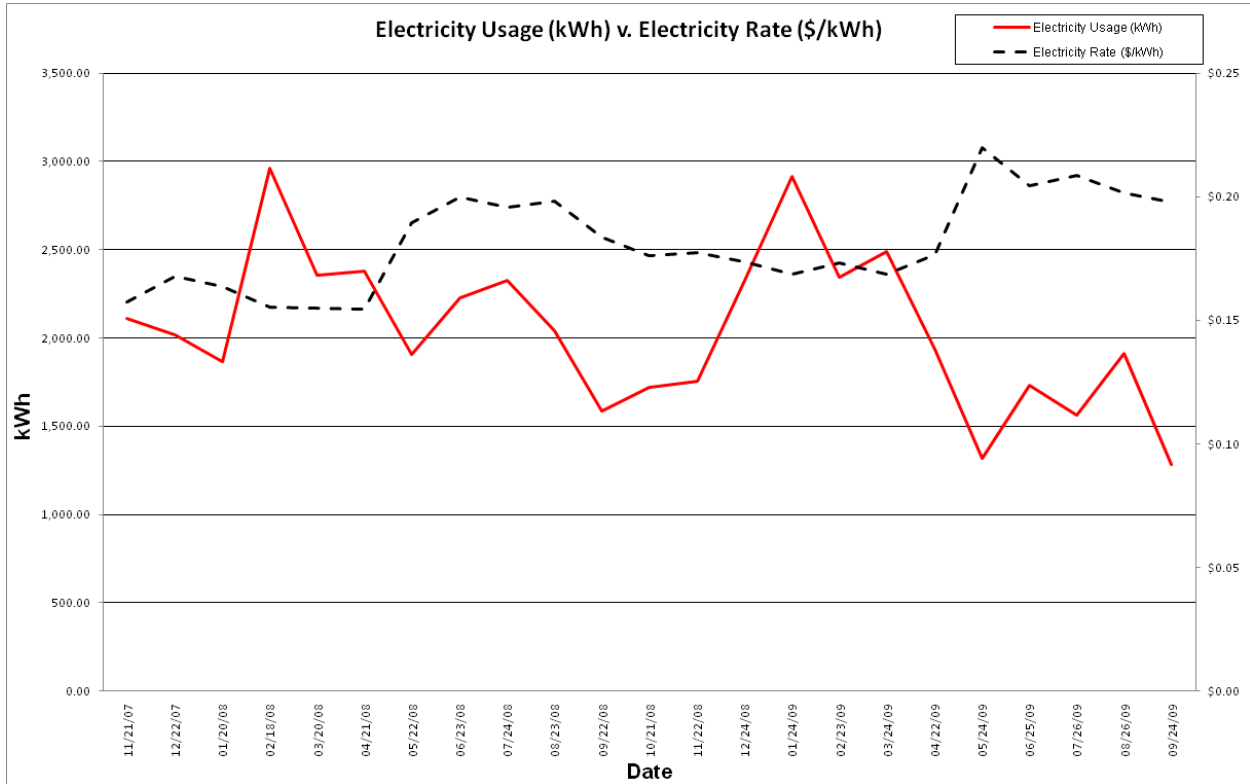
6.2 Energy Procurement strategies

Billing analysis shows price fluctuations of over 20% over the course of the year for the building’s electrical and natural gas accounts. This may be reflective of the utility tariffs under which the building owner secures its’ energy supply. These tariffs often include seasonally adjusted demand charges, or seasonally adjusted usage charges which reflect the markets for the underlying energy commodity. For example, a utility often has tariffs which charge more for electricity in the summer when demand for capacity is high and, the marginal producer of electricity is a higher cost generator who otherwise would not be running in the winter, or shoulder seasons.

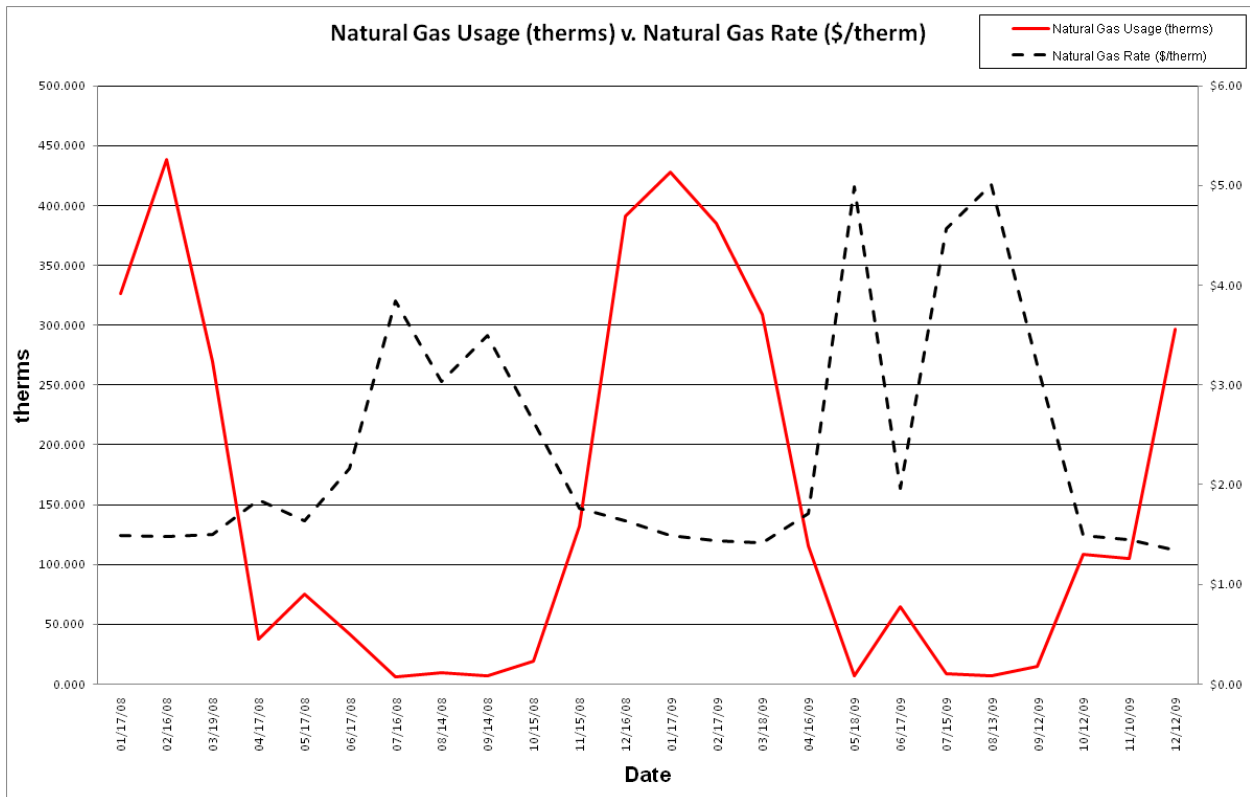
Buildings which have a large variation in monthly billing rates can often reduce the costs associated with energy procurement by selecting a third party energy supplier who can provide them with fixed pricing over the course of a contract term as well as attain purchasing economies which may not be available on a utilities default tariff (basic generation service in the case of electric and basic gas service in the case of natural gas).

SWA/BSG-PMK recommends that the Township of Middletown contact third party energy suppliers in order to negotiate a lower electricity rate and a lower natural gas rate. Comparing the current electric and gas rates to average utility rates of similar type buildings in New Jersey, it may be possible to save up to \$0.034/kWh, which would have equated to \$793 in electric costs for the past 12 months, and \$0.027/therm, which would have equated to \$50 in gas costs for the past 12 months.

Contact the NJ Energy Choice Program for further information on companies that can act as third party (non-utility) energy suppliers. Purchasing energy from a third party supplier can reduce price fluctuations and can ultimately reduce the annual cost of energy for the facility. Appendix B contains a complete list of third party energy suppliers.



Electricity prices generally reflect electricity usage



Natural gas prices and usage levels fluctuate over the course of the year

7. METHOD OF ANALYSIS

7.1 Assumptions and tools

Energy modeling tool: established / standard industry assumptions, E-Quest
Cost estimates: RS Means 2009 (Facilities Maintenance & Repair Cost Data)
RS Means 2009 (Building Construction Cost Data)
RS Means 2009 (Mechanical Cost Data)
Published and established specialized equipment material and labor costs.
Cost estimates also based on utility bill analysis and prior experience with similar projects

7.2 Disclaimer

This engineering audit was prepared using the most current and accurate fuel consumption data available for the site. The estimates that it projects are intended to help guide the owner toward best energy choices. The costs and savings are subject to fluctuations in weather, variations in quality of maintenance, changes in prices of fuel, materials, and labor, and other factors. Although we cannot guarantee savings or costs, we suggest that you use this report for economic analysis of the building and as a means to estimate future cash flow.

THE RECOMMENDATIONS PRESENTED IN THIS REPORT ARE BASED ON THE RESULTS OF ANALYSIS, INSPECTION, AND PERFORMANCE TESTING OF A SAMPLE OF COMPONENTS OF THE BUILDING SITE. ALTHOUGH CODE-RELATED ISSUES MAY BE NOTED, BSG-PMK AND SWA STAFF HAVE NOT COMPLETED A COMPREHENSIVE EVALUATION FOR CODE-COMPLIANCE OR HEALTH AND SAFETY ISSUES. THE OWNER(S) AND MANAGER(S) OF THE BUILDING(S) CONTAINED IN THIS REPORT ARE REMINDED THAT ANY IMPROVEMENTS SUGGESTED IN THIS SCOPE OF WORK MUST BE PERFORMED IN ACCORDANCE WITH ALL LOCAL, STATE, AND FEDERAL LAWS AND REGULATIONS THAT APPLY TO SAID WORK. PARTICULAR ATTENTION MUST BE PAID TO ANY WORK WHICH INVOLVES HEATING AND AIR MOVEMENT SYSTEMS, AND ANY WORK WHICH WILL INVOLVE THE DISTURBANCE OF PRODUCTS CONTAINING MOLD, ASBESTOS, OR LEAD.

LIGHTING ANALYSIS

Middletown Township
Library - Bayshore Branch
180 Main Street



Upgrade Code	Upgrade Description	Existing		Proposed		Lighting		
		Fixture	Watts	Fixture	Watts	Total # of Upgrades	Cost per Upgrade (\$)	SmartStart Rebate per Upgrade
1	150W Metal Halide Wall Pack Fixture / No Upgrade	150W MH/BALLAST	195	No Upgrade	195	1	\$0.00	\$0.00
2	(2) 34W T12 U-Tube Lamps, Magnetic Ballast / Retrofit with T8 U-Tube Lamps, Electronic Ballast	2L22" STD/STD	94	2L22"	62	3	\$60.00	\$15.00
3	LED Exit Sign	LED	2	No Upgrade	2	1	\$0.00	\$0.00
4	(4) 4' 34W T12 Lamps, Magnetic Ballasts / Retrofit with T8 Lamps, Electronic Ballast	4L4' EE/STD	160	4L4' T8/ELEC	110	44	\$90.00	\$15.00
5	40W Incandescent lamp / Replace with 13W Compact Fluorescent Lamps	40W INCANDESCENT	40	13W CF/SI	15	1	\$5.00	\$0.00
6	(1) 4' 34W T12 Lamps, Magnetic Ballasts / Retrofit with T8 Lamps, Electronic Ballast	1L4' EE/STD	50	1L4' T8/ELEC	31	1	\$50.00	\$15.00
7	60W Incandescent Lamp / Replace with 18W Compact Fluorescent	60W INCANDESCENT	60	18W CF/SI	21	2	\$6.00	\$0.00
8	Incandescent Exit Sign	15W Exit	15	LED	2	3	\$0.00	\$0.00
9	70W Metal Halide Wall Pack Fixture / No Upgrade	70W MH/BALLAST	95	No Upgrade	95	1	\$0.00	\$0.00
10						0	\$0.00	\$0.00
11						0	\$0.00	\$0.00
12						0	\$0.00	\$0.00

Summary

	Lighting (Only)	Sensors (Only)	Complete Lighting Upgrade
Cost	\$4,207.00	\$200.00	\$4,407.00
Rebate	\$720.00	\$20.00	\$740.00
Net Cost	\$3,487.00	\$180.00	\$3,667.00
Savings (kWh)	3,444	225	3,599
Savings (\$)	\$619.98	\$40.44	\$647.78
Payback	5.6	4.5	5.7

Variables:

\$0.18	Avg. Electric Rate (\$/kWh)
	Avg. Demand Rate (\$/kW)
1404	Operating Hours/Year
6	Operating Hours/Work Day

Assumptions:

25%	Occupancy Sensor Savings (Avg)
40%	Occupancy Sensor Savings(>Avg)

Notes:

Seq. #	Upgrade Code	Room/Area	Hrs/Work Day	Hrs/Year	Existing		Proposed			kW Reduction	Lighting				Occupancy Sensors (ONLY)				Lighting & Occupancy Sensors								
					Fixture	Qty.	Watts	Foot Candles	Fixture		Qty.	Watts	Energy Savings, kWh	Cost (\$)	Savings (\$)	Payback (yrs)	Controls Type	Qty.	Energy Savings, kWh	Cost (\$)	Savings (\$)	Payback (yrs)	SmartStart Rebate Lighting	Sensors	Energy Savings, kWh	Post-Rebate Cost (\$)	Savings (\$)
Totals:					7869		5412	2.457	3444	\$4,207.00	\$619.98	6.8	225	\$200.00	\$40.44	4.9	\$720.00	\$20.00	3599	\$3,667.00	\$647.78	5.7					
1	1	Outdoor Lighting	7	2555	150W MH/BALLAST	1	195	No Upgrade	1	195	0	0	\$0.00	\$0.00			0	\$0.00	\$0.00		\$0.00	\$0.00	0	\$0.00	\$0.00		
2	7	Outdoor Lighting	7	2555	60W INCANDESCENT	1	60	18W CF/SI	1	21	0.039	100	\$6.00	\$17.94	0.3		0	\$0.00	\$0.00		\$0.00	\$0.00	100	\$6.00	\$17.94	0.3	
3	9	Outdoor Lighting	7	2555	70W MH/BALLAST	1	95	No Upgrade	1	95	0	0	\$0.00	\$0.00			0	\$0.00	\$0.00		\$0.00	\$0.00	0	\$0.00	\$0.00		
4	2	Foyer	6	1404	2L22" STD/STD	1	94	2L22"	1	62	0.032	45	\$60.00	\$8.09	7.4		0	\$0.00	\$0.00		\$15.00	\$0.00	45	\$45.00	\$8.09	5.6	
5	3	Foyer	6	1404	LED	1	2	No Upgrade	1	2	0	0	\$0.00	\$0.00			0	\$0.00	\$0.00		\$0.00	\$0.00	0	\$0.00	\$0.00		
6	4	Main Room	6	1404	4L4' EE/STD	32	5120	4L4' T8/ELEC	32	3520	1.6	2246	\$2,880.00	\$404.35	7.1		0	\$0.00	\$0.00		\$480.00	\$0.00	2246	\$2,400.00	\$404.35	5.9	
7	2	Main Room	6	1404	2L22" STD/STD	2	188	2L22"	2	124	0.064	90	\$120.00	\$16.17	7.4		0	\$0.00	\$0.00		\$30.00	\$0.00	90	\$90.00	\$16.17	5.6	
8	8	Main Room	6	1404	15W Exit	3	45	LED	3	6	0.039	55	\$0.00	\$9.86	0.0		0	\$0.00	\$0.00		\$0.00	\$0.00	55	\$0.00	\$9.86	0.0	
9	4	Mens Room	6	1404	4L4' EE/STD	1	160	4L4' T8/ELEC	1	110	0.05	70	\$90.00	\$12.64	7.1		0	\$0.00	\$0.00		\$15.00	\$0.00	70	\$75.00	\$12.64	5.9	
10	4	Womens Room	6	1404	4L4' EE/STD	1	160	4L4' T8/ELEC	1	110	0.05	70	\$90.00	\$12.64	7.1		0	\$0.00	\$0.00		\$15.00	\$0.00	70	\$75.00	\$12.64	5.9	
11	4	Office	6	1404	4L4' EE/STD	4	640	4L4' T8/ELEC	4	440	0.2	281	\$360.00	\$50.54	7.1	OSW	1	225	\$200.00	\$40.44	4.9	\$60.00	\$20.00	435	\$480.00	\$78.34	6.1
12	5	Display Light	6	1404	40W INCANDESCENT	1	40	13W CF/SI	1	15	0.025	35	\$5.00	\$6.32	0.8		0	\$0.00	\$0.00		\$0.00	\$0.00	35	\$5.00	\$6.32	0.8	
13	6	Upstairs	6	1404	1L4' EE/STD	1	50	1L4' T8/ELEC	1	31	0.019	27	\$50.00	\$4.80	10.4		0	\$0.00	\$0.00		\$15.00	\$0.00	27	\$35.00	\$4.80	7.3	
14	4	Upstairs	6	1404	4L4' EE/STD	4	640	4L4' T8/ELEC	4	440	0.2	281	\$360.00	\$50.54	7.1		0	\$0.00	\$0.00		\$60.00	\$0.00	281	\$300.00	\$50.54	5.9	
15	4	Upstairs	6	1404	4L4' EE/STD	2	320	4L4' T8/ELEC	2	220	0.1	140	\$180.00	\$25.27	7.1		0	\$0.00	\$0.00		\$30.00	\$0.00	140	\$150.00	\$25.27	5.9	
16	7	Boiler Room	0.5	117	60W INCANDESCENT	1	60	18W CF/SI	1	21	0.039	5	\$6.00	\$0.82	7.3		0	\$0.00	\$0.00		\$0.00	\$0.00	5	\$6.00	\$0.82	7.3	

Appendix B: Third Party Energy Suppliers (ESCOs)

Supplier	Telephone & Web Site
American Powernet Management, LP 437 North Grove St. Berlin, NJ 08009 Attn: Brian Vayda	877-977-2636 bvayda@americanpowernet.com www.americanpowernet.com
Commerce Energy, Inc. 4400 Route 9 South, Suite 100 Freehold, NJ 07728	(800) 556-8457 www.commerceenergy.com
ConEdison Solutions Cherry Tree Corporate Center 535 State Highway 38 Cherry Hill, NJ 08002	(888) 665-0955 www.conedsolutions.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.newenergy.com
Credit Suisse, (USA) Inc. 700 College Road East Princeton, NJ 08450	212-538-3124 www.creditsuisse.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
FirstEnergy Solutions 300 Madison Avenue Morristown, NJ 07962	(800) 977-0500 Supply chain website www.firstenergycorp.com/supplierregistration www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	1-877-569-2841 www.glacialenergy.com
Hess Corporation 1 Hess Plaza Woodbridge, NJ 070956	(800) 437-7872 Tom Miller www.hess.com
Integrus Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	1-877-763-9977 Dole Janssen: 920-617-6029 Charles Kuntz: 614-844-4324 www.integrusenergy.com

Supplier	Telephone & Web Site
Liberty Power Delaware, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866)769-3799 www.libertypowercorp.com
Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com
Palmco Power NJ, LLC One Greentree Centre 10000 Lincoln Drive East, Suite 201 Marlton, NJ 08053	(877) 726-5862 www.PalmcoEnergy.com
Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	(800) ENERGY-9 (363-7499) www.pepco-services.com
PPL Energy Plan, LLC 811 Church Road Cherry Hill, NJ 08002	800-281-2000 www.pplenergyplus.com
Sempra Energy Solutions The Mac-Cali Building 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 732-596-6400-Tony Buck www.semprasolutions.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 Gary Bean gbean@sjindustries.com www.southjerseyenergy.com