



Steven Winter Associates, Inc.
Architects and Engineers

293 Route 18 South, Suite 330
East Brunswick, NJ 08816
www.swinter.com

Telephone: (866) 676-1972
E-mail: swinter@swinter.com

April 30, 2010

**Local Government Energy Program
Energy Audit Final Report**

South River War Memorial Building
South River, NJ 08882

Project Number: LGEA48

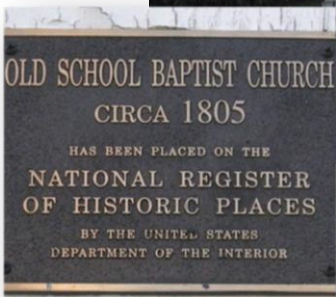


TABLE OF CONTENTS

INTRODUCTION	3
EXECUTIVE SUMMARY	4
1. HISTORIC ENERGY CONSUMPTION	7
1.1. ENERGY USAGE AND COST ANALYSIS	7
1.2. UTILITY RATE	9
1.3. ENERGY BENCHMARKING.....	10
2. FACILITY AND SYSTEMS DESCRIPTION	12
2.1. BUILDING CHARACTERISTICS.....	12
2.2. BUILDING OCCUPANCY PROFILES	12
2.3. BUILDING ENVELOPE	13
2.3.1. EXTERIOR WALLS.....	13
2.3.2. ROOF	14
2.3.3. BASE.....	15
2.3.4. WINDOWS.....	15
2.3.5. EXTERIOR DOORS	16
2.3.6. BUILDING AIR TIGHTNESS	17
2.4. HVAC SYSTEMS	17
2.4.1. HEATING.....	17
2.4.2. COOLING	18
2.4.3. VENTILATION	19
2.4.4. DOMESTIC HOT WATER	19
2.5. ELECTRICAL SYSTEMS.....	19
2.5.1. LIGHTING.....	19
2.5.2. APPLIANCES AND PROCESS	20
2.5.3. ELEVATORS	20
2.5.4. OTHERS ELECTRICAL SYSTEMS.....	20
3. EQUIPMENT LIST	21
4. ENERGY CONSERVATION MEASURES	21
5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES	27
5.1. EXISTING SYSTEMS.....	27
5.2. WIND.....	27
5.3. SOLAR PHOTOVOLTAIC	27
5.4. SOLAR THERMAL COLLECTORS	27
5.5. COMBINED HEAT AND POWER.....	27
5.6. GEOTHERMAL	27
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES	27
6.1. LOAD PROFILES	27
6.2. TARIFF ANALYSIS	29
6.3. ENERGY PROCUREMENT STRATEGIES	29
7. METHOD OF ANALYSIS	31
7.1. ASSUMPTIONS AND TOOLS.....	31
7.2. DISCLAIMER.....	31
APPENDIX A: LIGHTING STUDY	32
APPENDIX B: THIRD PARTY ENERGY SUPPLIERS (ESCOs)	33
APPENDIX C: GLOSSARY AND METHOD OF CALCULATIONS	34

INTRODUCTION

As an approved energy consulting firm under the Local Government Energy Audit Program (LGEA), Steven Winter Associates, Inc. (SWA) was selected to perform an energy audit and assessment for the Borough of South River municipal buildings. The audit, conducted on January 5th, 11th and 12th, included a review of the:

- Human Services Building
- Municipal Building
- Public Library
- Criminal Justice Building
- War Memorial Building
- Roads Department Building
- George Street Firehouse
- Rescue Squad Building
- Appleby Avenue Firehouse

The buildings are located in South River, NJ. A separate energy audit report is issued for each of the referenced buildings.

This report addresses the South River War Memorial Building located at 64 Main St., South River, NJ 08882. 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 South River Museum / South River War Memorial / Old School Baptist Church building was built as a church in 1805. In the middle of the nineteenth century, a major expansion and renovation was undertaken. The church was sold to the First Free Public Library in 1922. The Library moved to a new building in 1979, and the Borough Clerk moved his office into building. The property was placed on the New Jersey Register of Historic Places in 1991 and on the National Register of Historic Places in 1992. HVAC upgrades occurred in 2002. The building today consists of 5,450 square feet of conditioned space. Besides the historical showcases, the two-story building houses two bathrooms and an old council chamber table. The first floor is used by the Borough for small meetings and by the South River Historical & Preservation Society for exhibits and meetings. The museum building is open to the public to visit the first Sunday of each month 1:30 pm - 3:30 pm. Historical Society meetings are held twice a month (2nd and 4th Wednesday / month) with an average attendance of 10 members.

The goal of this Local Government Energy Audit (LGEA) is to provide sufficient information to the Borough of South River to make decisions regarding the implementation of the most appropriate and most cost effective energy conservation measures for the War Memorial Building.

Launched in 2008, the 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 that additional 25% will also be paid by the program. The Board of Public Utilities' (BPUs) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

EXECUTIVE SUMMARY

The energy audit performed by Steven Winter Associates (SWA) encompasses the War Memorial Building located at 64 Main St., South River, NJ 08882. The War Memorial Building is a two-story building with a furnace room attachment comprising of a total floor area of 5,450 square feet. The original structure was built in 1805, with additions and renovations, last HVAC upgrade occurring in 2002.

Based on the field visits performed by the SWA staff on January 5th, 11th and 12th 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.

From November 2008 through October 2009 the War Memorial Building consumed 14,357 kWh or \$1,866 worth of electricity at an approximate rate of \$0.130/kWh and 1,926 therms or \$2,428 worth of natural gas at an approximate rate of \$1.261/therm. The joint energy consumption for the building, including both electricity and natural gas, was 242 MMBtus of energy that cost a total of \$4,294.

SWA has entered energy information about the War Memorial Building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. This Public Assembly / Entertainment / Culture facility is comprised of non-eligible (Other) space type. SWA encourages the Borough of South River to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time. EPA is continually working to expand the available space types.

The Site Energy Use Intensity is 47.0 kBtu/ft²yr compared to the national average of Borough Public Assembly / Entertainment / Culture building consuming 95.0 kBtu/ft²yr. Implementing this report's recommendations will reduce use by approximately 9.6 kBtu/ft²yr, which when implemented would make the building energy consumption much better than the national average.

Based on the assessment of the War Memorial Building, SWA has separated the recommendations into three categories (See Section 4 for more details). These are summarized as follows:

Category I Recommendations: Capital Improvement Measures

- Select NEMA Premium motors when replacing motors at the end of their useful operating lives
- Replace all original / single glazed windows during the next major building renovation
- Replace doors and frames during the next major building renovation

Category II Recommendations: Operations and Maintenance

- Thoroughly and evenly insulate space above the ceiling
- Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly. Install soffit and ridge vent system for effective attic ventilation.
- Install cap flashing with drip edge on top of exposed footing
- Maintain downspouts and cap flashing - repair / install missing downspouts and cap flashing as needed
- Provide weather stripping / air sealing

- Repair / seal wall cracks and penetrations
- Provide water efficient fixtures and controls
- Use smart power electric strips
- Create an energy educational program

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

At this time, SWA highly recommends a total of **1** Energy Conservation Measure (ECM) for the War Memorial Building that is summarized in the following Table 1. The total investment cost for this ECM without incentives is **\$50**. SWA estimates a first year savings of **\$33** with a simple payback of **1.5 years**. SWA also recommends **2** more ECMs with a total first year savings of **\$1,223** that is summarized in Table 2. SWA estimates that implementing these recommended ECMs will reduce the carbon footprint of the War Memorial Building by **11,935 lbs of CO₂**, which is equivalent to removing approximately 1 car from the roads each year or avoiding the need of 29 trees to absorb the annual CO₂ generated.

There are various incentives available in New Jersey to lower the cost of installing the Energy Conservation Measures (ECMs), like NJ SmartStart program and Direct Install through the New Jersey Office of Clean Energy. These incentive programs can help provide technical assistance for the building in the implementation phase of any energy conservation project. The Borough of South River and 6 other nearby boroughs have a long term contract to purchase electricity as a consortium from the South River Electric Utility and do not pay the Societal Benefit Charges (SBCs) that fund NJCEP programs. Therefore, the Borough of South River is not eligible to receive any equipment incentives for energy conservation under the New Jersey Clean Energy Program (NJCEP) at the present time. SWA recommends the Borough of South River initiate a dialogue with the Board of Public Utilities (BPU) to gain access to these and other incentives in the future.

The following two tables summarize the proposed Energy Conservation Measures (ECMs) and their economic relevance. In order to clearly present the overall energy opportunities for the building and ease the decision and choice of which ECM to implement, SWA calculated each ECM independently and did not incorporate slight / potential overlaps between some of the summarized ECMs (i.e. lighting change influence on heating / cooling).

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 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
1.1	replace 1 exterior incandescent bulb with a CFL bulb	RS Means, Lit Search	50	0	50	175	0.0	0	0.1	11	33	5	166	1.5	233	47	60	98	313
Totals			50	0	50	175	0.0	0	0.1	11	33	-	166	1.5	233	-	60	98	313

Assumptions: Discount Rate: 3.2% per DOE FEMP; Energy Price Escalation Rate: 0% per DOE FEMP Guidelines
Note: A 0.0 electrical demand reduction / month indicates that it is very low / negligible

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 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	install climate controlled display case(s) - (~50 cu ft) and decrease bldg heating / cooling	Energy Star purchasing and procurement site, similar projects	11,000	0	11,000	3,890	0.8	374	9.3	200	1,177	15	17,657	9.3	61	4	7	2,763	11,086
1.2	install motion detectors for the exterior path bollard lights	RS Means, Lit Search	440	0	440	299	0.1	0	0.2	7	46	12	551	9.6	25	2	4	11	536
Totals			11,440	0	11,440	4,189	0.9	374	9.5	207	1,223	-	18,208	9.4	59	-	7	2,774	11,622

1. HISTORIC ENERGY CONSUMPTION

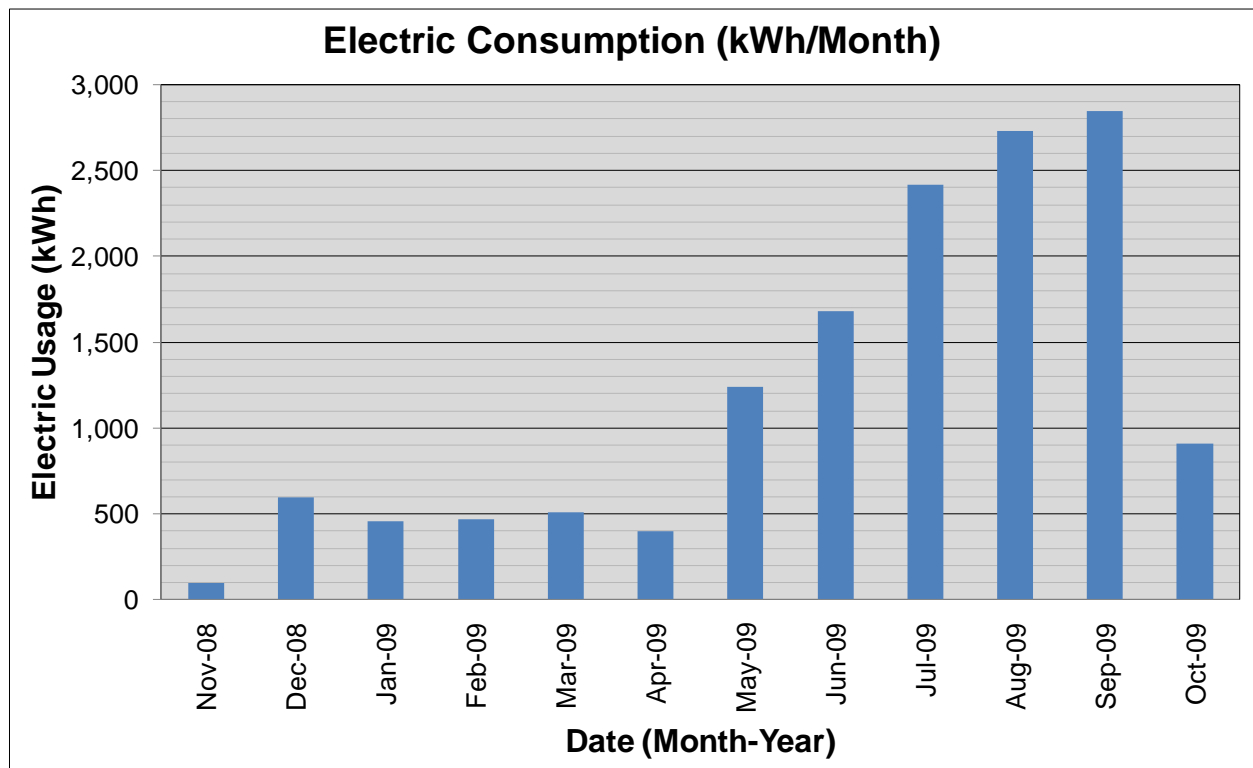
1.1. Energy Usage and Cost Analysis

SWA analyzed utility bills from December 2007 through October 2009 that were received from the utility companies supplying the South River War Memorial Building with electric and natural gas.

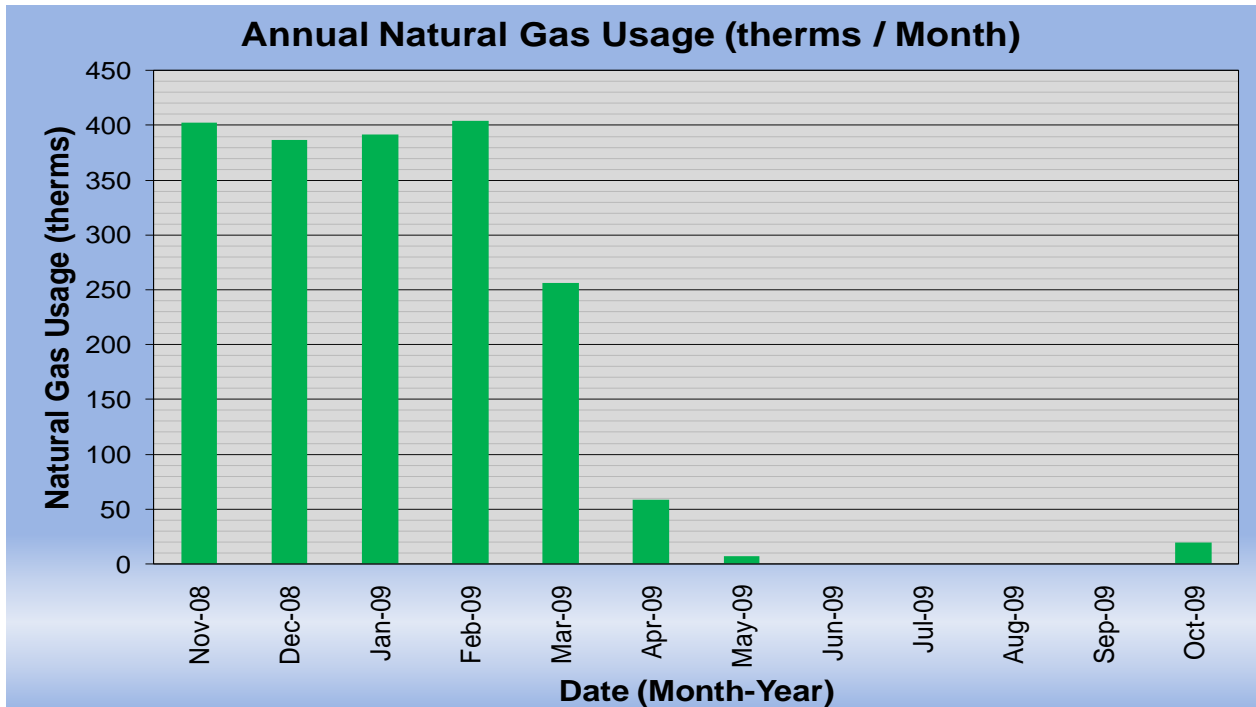
Electricity - The South River War Memorial Building is currently served by one electric meter. The War Memorial Building currently buys electricity from South River Electric Utility at **an average rate of \$0.130/kWh** based on 12 months of utility estimates from November 2008 through October 2009. The War Memorial Building purchased **approximately 14,357 kWh or \$1,866 worth of electricity** in the previous year. The average monthly demand was not recorded and is unavailable.

Natural gas - The South River War Memorial Building is currently served by one meter for natural gas. The South River War Memorial Building currently buys natural gas from PSE&G at **an average aggregated rate of \$1.261/therm** based on 12 months of utility bills for November 2008 through October 2009. The South River War Memorial Building purchased **approximately 1,926 therms or \$2,428 worth of natural gas** in the previous year at a very competitive rate.

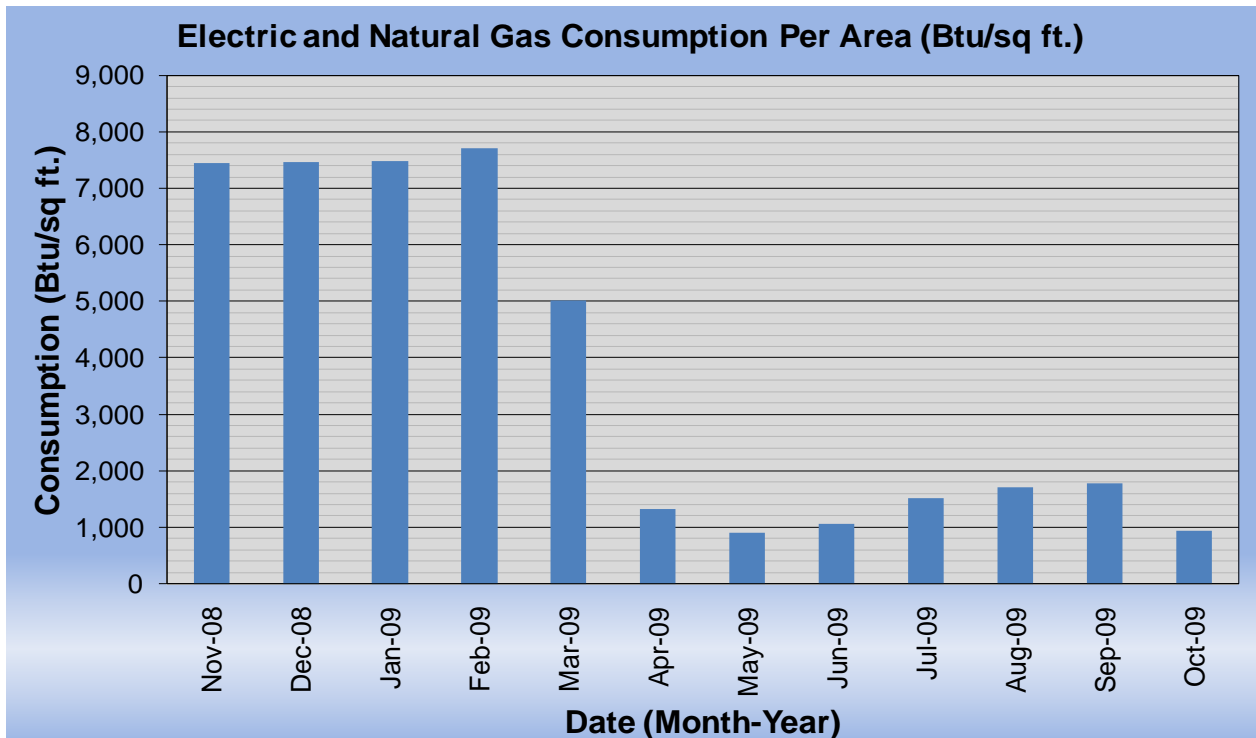
The following chart shows electricity use for the War Memorial Building based on estimates for the 12 month period of November 2008 through October 2009.



The following chart shows the natural gas consumption for the War Memorial Building based on natural gas bills for the 12 month period of November 2008 through October 2009.

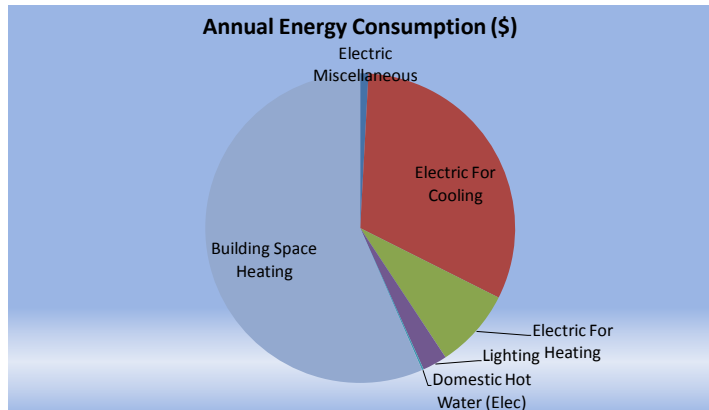
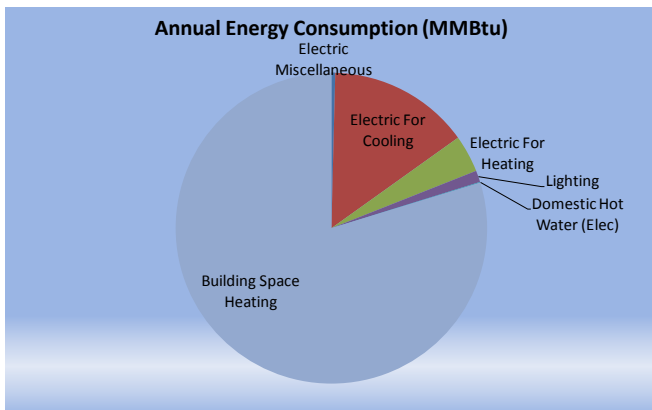


The following chart shows combined natural gas and electric consumption in Btu/sq ft for the War Memorial Building based on estimates and utility bills for the 12 month period of November 2008 through October 2009.



The following table and chart pies show energy use for the War Memorial Building based on utility bills for the 12 month period of November 2008 through October 2009. Note electrical cost at \$38/MMBtu of energy is 3 times as expensive to use as natural gas at \$13/MMBtu.

2009 Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	\$	% \$	\$/MMBtu
Electric Miscellaneous	1	0%	\$37	1%	38
Electric For Cooling	36	15%	\$1,355	32%	38
Electric For Heating	9	4%	\$357	8%	38
Lighting	3	1%	\$111	3%	38
Domestic Hot Water (Electric)	0.2	0%	\$8	0%	38
Building Space Heating	193	80%	\$2,428	57%	13
Totals	242	100%	\$4,294	100%	18
Total Electric Usage	49	20%	\$1,866	43%	38
Total Gas Usage	193	80%	\$2,428	57%	13
Totals	242	100%	\$4,294	100%	18



1.2. Utility Rate

The War Memorial Building currently purchases electricity from South River Electric Utility at a general service market rate for electricity use (kWh) with a separate (kW) demand charge. The War Memorial Building currently pays an average rate of approximately \$0.130/kWh based on the 12 months estimates of November 2008 through October 2009.

The War Memorial Building currently purchases natural gas supply from the PSE&G at a competitive general service market rate for natural gas (therms). PSE&G also acts as the transport company. There is one gas meter that provides natural gas service to the War Memorial Building currently. The average aggregated rate (supply and transport) for the meter is

approximately \$1.261/therm based on 12 months of utility bills for November 2008 through October 2009.

Some of the minor unusual utility fluctuations that showed up for a couple of months on the utility bills may be due to adjustments between estimated and actual meter readings.

1.3. Energy Benchmarking

SWA has entered energy information about the War Memorial Building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. This Public Assembly / Entertainment / Culture facility is comprised of non-eligible (Other) space type. A Public Assembly / Entertainment / Culture facility space or "Other" can be used to classify a facility or a portion of a facility where the primary activity does not fall into any of the available space types. Consequently, the War Memorial Building is not eligible to receive a national energy performance rating at this time.

The Site Energy Use Intensity is 47.0 kBtu/sq ft yr compared to the national average of a Borough Public Assembly / Entertainment / Culture building consuming 95.0 kBtu/sq ft yr. Implementing this report's highly recommended Energy Conservations Measures (ECMs) will reduce use by approximately 0.1 kBtu/sqft yr, with an additional 9.5 kBtu/sq ft yr from the recommended ECMs. These recommendations could account for at least 9.6 kBtu/sq ft yr reduction, which when implemented would make the building energy consumption much better than the national average.

Per the LGEA program requirements, SWA has assisted the Borough of South River to create an *Energy Star Portfolio Manager* account and share the War Memorial Building facilities information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager site information with the Borough of South River (user name of "sriverboro" with a password of "sriverboro") and TRC Energy Services (user name of TRC-LGEA).



STATEMENT OF ENERGY PERFORMANCE

Borough of South River - War Memorial Building

Building ID: 2019214
 For 12-month Period Ending: October 31, 2009¹
 Date SEP becomes ineligible: N/A

Date SEP Generated: January 26, 2010

Facility Borough of South River - War Memorial Building 64 Main Street South River, NJ 08882	Facility Owner N/A	Primary Contact for this Facility N/A
--	------------------------------	---

Year Built: 1905
 Gross Floor Area (ft²): 5,450

Energy Performance Rating² (1-100) N/A

Site Energy Use Summary³

Electricity - Grid Purchase (kBtu)	48,983
Natural Gas (kBtu) ⁴	206,312
Total Energy (kBtu)	255,295

Energy Intensity⁵

Site (kBtu/ft ² /yr)	47
Source (kBtu/ft ² /yr)	70

Emissions (based on site energy use)

Greenhouse Gas Emissions (MtCO ₂ e/year)	18
---	----

Electric Distribution Utility

Borough of South River

National Average Comparison

National Average Site EUI	95
National Average Source EUI	265
% Difference from National Average Source EUI	-74%
Building Type	Entertainment/Culture

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 this column (e.g. table fees) are converted to kBtu with adjustments made for equivalent 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 preparing the SEP) and we have suggestions for reducing this time/effort. Send comments (including OMB control number) to the Director, Collection Strategies Division, U.S. EPA (2022), 1200 Pennsylvania Ave., NW, Washington, DC 20460.

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

The South River Museum / South River War Memorial / Old School Baptist Church building was built as a church in 1805 when a small congregation of Baptists gathered in the village of Washington, now known as South River. It was the only church in this area until 1851. The Old School Baptist Church is one of the few remaining churches established by the First Baptist Church of Hightstown. The original front of the building was located on the east (river) side. It was a single story, three bay, clapboard sided facade with a central entrance. In the middle of the nineteenth century, a major expansion and renovation was undertaken. The structure was expanded vertically to include a second story gallery level of the worship space. The portico, supported by four 20 foot tall columns, was added to the north side facing Main Street. The church was sold to the First Free Public Library in 1922. In 1927 new floors on both levels were redone, windows and their trim and roofing replaced and a restroom added. In 1936, an oil-fired central heating system was installed to replace the old stove. Corner posts, foundation sills, and bottoms of some studs were replaced in 1950 and a false ceiling was installed to save heat. The Library moved to a new building on Appleby Avenue in 1979, and the Borough Clerk moved his office into the empty Old School Baptist Church building. Part of the second floor was occupied by cable TV35. In 1991 the large tree trunks encased within the portico columns were replaced with steel beams which were re-encased with the original cladding material. Through the efforts of the South River Historical & Preservation Society, local residents, and the support of the Mayor and Council, the property was placed on the New Jersey Register of Historic Places on November 19, 1991, and on the National Register of Historic Places on January 7, 1992. In 1995 a grant funded by the Historic Preservation Bond Program and administered by the New Jersey Historic Trust for restoration of the building was approved. More HVAC upgrades occurred in 2002. The building today consists of 5,450 square feet of conditioned space. The first floor includes historical showcases, a bathroom, an old council chamber table and chairs. The second floor includes historical showcases and a bathroom. The furnace room is attached to the back of building.



Front Façade



Partial Rear Façade



Partial Side Façade



2.2. Building Occupancy Profiles

The first floor of the restored building is used by the Borough for small meetings and by the South River Historical & Preservation Society for exhibits and meetings. The Historical

Society uses the second floor as office and storage space. The museum building is open to the public to visit the first Sunday of each month 1:30 pm - 3:30 pm. Historical Society meetings (averaging a couple of hours) are held twice a month (2nd and 4th Wednesday / month) with an average attendance of 10 members.

2.3. Building envelope

Due to favorable weather conditions (min. 20 deg F delta-T in / outside & no / low wind) some exterior envelope infrared (IR) images were taken during the field audit. Thermal imaging / infrared (IR) technology helps to identify energy compromising problem areas in a non-invasive way.

General Note: All findings and recommendations on the exterior envelope (base, walls, roofs, doors and windows) are based on the energy auditors' experience and expertise, on construction document reviews (if available) and on detailed visual and thermal analysis, as far as accessibility and weather conditions allowed at the time of the field audit.

2.3.1. Exterior Walls

The exterior wall envelope is mostly constructed of wood clapboard siding over wood framing with an unconfirmed level of insulation. The interior is presumed to be mostly plaster and painted gypsum wallboard.

Note: Wall insulation levels could not be verified in the field or on construction plans and are based upon similar wall types at time of construction.

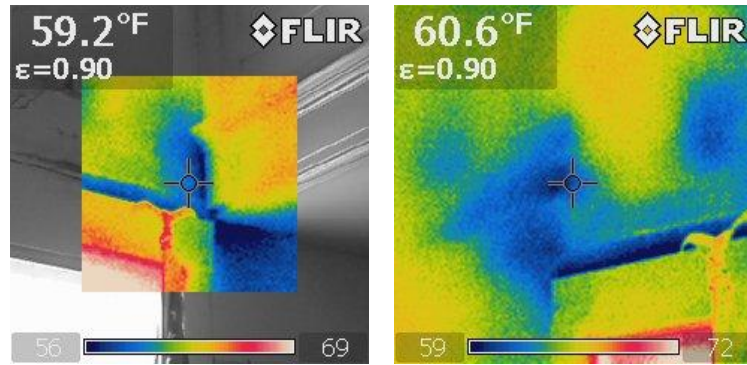
During the field audit exterior and interior wall surfaces were inspected. They were found / reported to be in overall acceptable / age appropriate condition with some signs of uncontrolled moisture, air-leakage and / or other energy-compromising issues located mostly at the rear of the building.

The following specific exterior wall problem spots and areas were identified:



Deteriorating interior and exterior wall finishes due to water / moisture presence inside the wall cavity.

The following IR images further visualize some of the exterior wall issues mentioned above:



Water / moisture issues within the exterior wall assembly.

In light of the exterior wall conditions mentioned above SWA has the following recommendation, which is further outlined and categorized in the *Executive Summary*:

1. Inspect and replace cracked / ineffective caulk and head flashing around all windows in the affected areas and also inspect roof finishes and flashing in the building's rear to prevent leaks.

2.3.2. Roof

The building's roof is predominantly a medium-pitch gable type over a wood structure with a asphalt shingle finish.. It was replaced approximately 8 years ago. 6 inches of fiberglass batt attic / ceiling and no detectable / assumed roof insulation were recorded.

Note: Roof insulation levels could visually be verified in the field by non-destructive methods.

During the field audit, roofs, related flashing, gutters and downspouts were inspected. They were found / reported to be in overall acceptable / age appropriate condition with only a few signs of uncontrolled moisture, air-leakage and / or other energy-compromising issues mostly in roof areas.

The following specific roof problem spots and areas were identified:



Missing soffit and ridge vent system



Uneven / ineffective attic insulation found.

In light of the roof conditions mentioned above SWA has the following recommendations, which are further outlined and categorized in the *Executive Summary*.

1. Add and distribute insulation into ineffectively and under-insulated ceiling sections.
2. Install soffit and ridge vent system for effective attic ventilation.

2.3.3. Base

The building's base is composed of a slab-on-grade floor with a foundation type and no detectable slab edge / perimeter insulation.

Slab / perimeter insulation levels could not be verified in the field or on construction plans and are based upon similar wall types and time of construction.

The building's base and its perimeter were inspected. Judging from signs of uncontrolled moisture or water presence and other energy compromising issues, overall the base was found / reported to be in acceptable / age appropriate condition with only a few signs of uncontrolled moisture, air-leakage and / or other energy-compromising issues.

The following specific base problem spot and area was identified:



Missing cap flashing for exposed foundation wall.

In light of the base condition mentioned above, SWA has the following recommendations, which are further outlined and categorized in the *Executive Summary*.

1. Install cap flashing with drip edge on top of exposed footing to deflect water away form foundation wall.

2.3.4. Windows

The building contains basically only one type of window.

1. Double-hung type windows with a wood frame, clear single glazing and no interior or exterior shading devices, except for UV film applied on the inside of the windows. They are located throughout the building and were replaced in 1927, according to the current owner.

Windows, shading devices, sills, related flashing and caulking were inspected from the exterior and interior as far as accessibility allowed. Based on signs of moisture, air-leakage and other energy compromising issues, overall the windows were found and / or reported to be in poor condition with some signs of uncontrolled moisture, air-leakage and / or other energy-compromising issues.

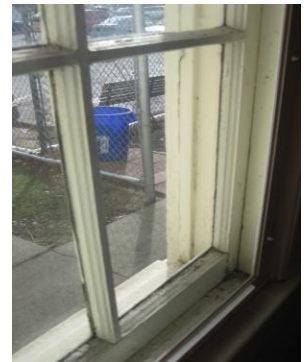
The following specific window problem spots and areas were identified:



Broken / missing glazing



Damaged / aged window frame



Single glazed window with ineffective frame

In light of the window conditions mentioned above, SWA has the following recommendation, which is further outlined and categorized in the *Executive Summary*:

1. Replace all original / single glazed windows and frames with historically / architecturally accurate low-E, double glazed type during the next major building renovation.

2.3.5. Exterior doors

The building contains basically only one type of exterior door.

1. Solid wood panel type exterior doors. They are located throughout the building and were replaced in the 1930s, according to the current owner.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected. Based on signs of moisture, air-leakage and other energy compromising issues, overall the doors were found / reported to be in poor condition with some signs of uncontrolled moisture, air-leakage and / or other energy-compromising issues.

The following specific door problem spots and areas were identified:



Damaged / warped / aged door frame



Missing / worn weather stripping

In light of the door conditions mentioned above, SWA has the following recommendations, which are further outlined and categorized in the *Executive Summary*.

1. Replace doors and frames with historically / architecturally accurate units during the next major building renovation. Should the doors be original then SWA suggests only replacement of the frames and restoration of doors as necessary to minimize air-leakage.

2.3.6. Building Air Tightness

Overall, the field auditors found the building to be reasonably air-tight, considering the building's use, age, historical value and sporadic occupancy, as described in more detail in the previous sections under 2.3. *Building Envelope*

In addition to all the above mentioned findings SWA recommends air sealing, caulking and/or insulating around all structural members, recessed lighting fixtures, electrical boxes that are part of or penetrate the exterior envelope and where air-leakage can occur.

The air tightness of buildings helps maximize all other implemented energy measures and investments and minimizes potentially costly long term maintenance/ repair / replacement expenses.

2.4. HVAC Systems

The War Memorial building heating is provided by two hot air furnaces, located in an enclosure attached to the back of the building, with the cooling provided by evaporators located in the furnace discharge ductwork. The split system fan-cooled condenser associated with the evaporator coils is located at the back of the building.

2.4.1. Heating

Heating to the building is provided by a couple of Lennox hot air furnaces, 80% efficient. They were installed during the 2002 building upgrade. They have approximately 50% useful life left on them. All forced air heat is distributed via ducts and diffusers to the War Memorial building. There isn't any wall perimeter heating. There is a programmable thermostat that maintains the building at a constant temperature of 67 deg F at all times and a separate humidity controller that maintains 30% humidity. Dehumidification is adjusted via an Aprilaire

system that works in conjunction with the blown air into the building sensing / adjusting to the desired humidity levels. Installed as part of the heating and cooling system, a central dehumidifier pulls air from every room in the building through the return ducts. It removes the moisture and then sends dry air back throughout the building. It works in conjunction with the air conditioner to efficiently balance the humidity levels in the building, but can also work independently on days when air conditioning is not needed. SWA recommends that the temperature and humidity sensitive artifacts be enclosed in a small showcase or room with appropriate heating / cooling / humidity controls so that the total building energy expenditure can be lowered, since the building is generally unoccupied.



War Memorial building wall mounted programmable thermostat and humidity controller

2.4.2. Cooling

The War Memorial Building cooling is provided by Lennox evaporator coils (located in the furnace discharge ductwork). The Lennox fan cooled condenser matched to the evaporator coils is located behind the building, at ground level. The unit is 8 years old and has approximately 50% useful life left on it. It uses R-22 Freon refrigerant for cooling. The thermostat control is the same described in the above 2.4.1 Heating section.



Condenser in back of the furnace / evaporator attached enclosure

2.4.3. Ventilation

The various spaces of the building are ventilated by air infiltration and by the furnace units that serve the space as described in the “Heating / Cooling” sections above.

2.4.4. Domestic Hot Water

The domestic hot water (DHW) for the War Memorial building, serving the two bathrooms, is provided by an A. O. Smith electric heater with 4 gal storage. This heater was installed in 2002 and has a 40% estimated useful operating life left.

2.5. Electrical systems

2.5.1. Lighting

Interior Lighting - The interior lighting in the War Memorial Building consists of T8 fluorescent fixtures with electronic ballasts, T12 fluorescent fixtures with magnetic ballasts, halogens and screw-in incandescent light fixtures. Based on measurements of lighting levels for each space, there are not any vastly over-illuminated areas. Due to the very infrequent use of the building, SWA does not recommend at this time replacing the T12, Halogen and Incandescent fixtures mentioned above with more efficient types because the simple

payback period is over 10 years. SWA does not recommend installing occupancy sensors either since payback on savings are not justified. See attached lighting schedule in Appendix A for a complete inventory of lighting throughout the building and estimated power consumption.

Exit Lights - Exit signs were found to be efficient LED type.

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be a mix of Incandescent and Metal Halide lamp fixtures. Exterior lighting is controlled by automatic timers. SWA recommends replacing the Incandescent light lamp with a CFL lamp. SWA is not recommending at this time any upgrades to the exterior photocells.

2.5.2. Appliances and Process

Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. For example, Energy Star refrigerators use as little as 315 kWh / yr. When compared to the average electrical consumption of older equipment, Energy Star equipment results in a large savings. Building management should select Energy Star label appliances and equipment when replacing: refrigerators, printers, computers, copy machines, etc. More information can be found in the "Products" section of the Energy Star website at: <http://www.energystar.gov>. Also, energy vending miser devices are now available for conserving energy usage by Drinks and Snacks vending machines. When equipped with the vending miser devices, vending machines use less energy and are comparable in daily energy performance to new ENERGY STAR qualified machines.

Computers left on in the building consume a lot of energy. A typical desk top computer uses 65 to 250 watts and uses the same amount of energy when the screen saver is left on. Televisions (DVDs, stereos, computers, and kitchen appliances which now have internal memories or clocks which always require a trickle of power) in meeting areas use approximately 3-5 watts of electricity when turned off. SWA recommends all computers and all appliances (i.e. fridges, coffee makers, televisions, etc) be plugged in to power strips and turned off each evening just as the lights are turned off.

2.5.3. Elevators

The War Memorial building is a two-story building without an elevator. One may be considered for ADA purposes and access to the balcony floor displays.

2.5.4. Others Electrical Systems

Besides a few small transformers, there are not currently any other significant energy impacting electrical systems installed at the War Memorial building.

3. EQUIPMENT LIST

Inventory

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	2 hot air furnaces (200 MBH input, 160 MBH output) - 80% est. htg. eff. with evaporator coils to maintain bldg warm in winter and cool in summer at all times	back of bldg, in utility bldg	Lennox, furnace Model: G24-200A-1, evap LSA120C-1Y; Serial #: furnace: 6398L 19467 ; evap: 5698G 04537	Natural Gas / Electric - blower	War Memorial Bldg.	2002	50%
Dehumidifier	one central unit (90 pints/day) working in conjunction with furnace and evaporator	back of bldg, in utility bldg	Aprilaire 1700; Serial #: 3004AA104042	Electric	War Memorial Bldg.	2002	50%
Cooling	condenser, 2 fan unit with an est. eff. of 9.0 EER	outside and back of bldg	Lennox, Model: L Series LSA 120C; Catalog #89 T00; Serial #: 5698604537	Electric	War Memorial Bldg.	2002	50%
Domestic Hot Water	1 DHW unit, 4 gal tank - bronze tank, 1,500 Watt heating element - 90% est. htg. eff.	upstairs bathroom	A. O. Smith ELC-4-100; Serial #: MJ98-0010523-100	Electric	War Memorial Bldg. bathrooms	2002	40%
Lighting	See details - Appendix A	See details - Appendix A	See details - Appendix A	Electric	War Memorial Bldg.	varies	on the average, 20%

Note: The remaining useful life of a system (in %) is an estimate based on the system date of built and existing conditions derived from visual inspection.

4. ENERGY CONSERVATION MEASURES

Based on the assessment of the South River War Memorial Building, SWA 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 Improvements

- Install NEMA Premium motors when replacements are required - Select NEMA Premium motors when replacing motors that have reached the end of their useful operating lives.
- Replace all original / single glazed windows and frames with historically / architecturally accurate low-E, double glazed type during the next major building renovation.
- Replace doors and frames with historically / architecturally accurate units during the next major building renovation. Should the doors be original then SWA suggests only replacement of the frames and restoration of doors as necessary to minimize air-leakage.

Category II Recommendations: Operations and Maintenance

- Thoroughly and evenly insulate space above the ceiling and plug all ceiling penetration. Add and distribute insulation into ineffectively and under-insulated ceiling sections.
- Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly. Install soffit and ridge vent system for effective attic ventilation.
- Install cap flashing with drip edge on top of exposed footing to deflect water away from foundation wall.
- Maintain downspouts and cap flashing - Repair / install missing downspouts and cap flashing as needed to prevent water / moisture infiltration and insulation damage.
- Provide weather stripping / air sealing - SWA observed that exterior door weather-stripping in places was beginning to deteriorate. Doors and vestibules should be observed annually for deficient weather-stripping and replaced as needed. The perimeter of all window frames should also be regularly inspected and any missing or deteriorated caulking should be re-caulked to provide an unbroken seal around the window frames. Any other accessible gaps or penetrations in the thermal envelope penetrations should also be sealed with caulk or spray foam.
- Repair / seal wall cracks and penetrations - SWA recommends as part of the maintenance program to install proper flashing, seal wall cracks and penetrations wherever necessary in order to keep insulation dry and effective. Inspect and replace cracked / ineffective caulk and head flashing around all windows in the affected areas and also inspect roof finishes and flashing in the building's rear to prevent leaks.
- Provide water efficient fixtures and controls - Adding controlled on / off timers on all lavatory faucets is a cost-effective way to reduce domestic hot water demand and save water. Building staff can also easily install faucet aerators and / or low-flow fixtures to reduce water consumption. There are many retrofit options, which can be installed now or incorporated as equipment is replaced. Routine maintenance practices that identify and quickly address water leaks are a low-cost way to save water and energy. Retrofitting with more efficient water-consumption fixtures / appliances will save both energy and money through reduced energy consumption for water heating, while also decreasing water / sewer bills.
- Create an energy educational program - that teaches how to minimize their energy use. The US Department of Energy offers free information for hosting energy efficiency educational programs and plans, for more information please visit: <http://www1.eere.energy.gov/education/> .

Category III Recommendations: Energy Conservation Measures - Summary Table

ECM#	Description of Highly Recommended 0-5 Year Payback ECMs
1.1 & 1.2	replace an exterior incandescent lamp with a CFL lamp; install motion detectors for exterior bollard lights
Description of Recommended 5-10 Year Payback ECMs	
2	install a climate controlled display case to reduce the building's energy use

ECM#1: *Building Lighting Upgrades*

Description:

On the days of the site visits, SWA completed a lighting inventory of the War Memorial Building (see Appendix A). The interior lighting in the War Memorial Building consists of T8 fluorescent fixtures with electronic ballasts, T12 fluorescent fixtures with magnetic ballasts, halogens and screw-in incandescent light fixtures. Due to the very infrequent use of the building, SWA does not recommend at this time replacing the T12, Halogen and Incandescent fixtures mentioned above with more efficient types because the simple payback period is over 10 years. The exterior lighting surveyed during the building audit was found to be a mix of Incandescent and Metal Halide lamp fixtures. Exterior lighting is controlled by automatic timers. SWA recommends replacing the exterior Incandescent light bulb with a CFL bulb. SWA is also recommending installation of motion detectors for the exterior path bollard lights. The labor in all these installations was evaluated using prevailing electrical contractor wages. The Borough of South River may decide to perform this work with in-house resources from its Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor, to obtain savings.

Installation cost:

Estimated installed cost: \$490 (includes \$263 of labor)

Source of cost estimate: *RS Means; Published and established costs*

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 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
1.1	replace 1 exterior incandescent bulb with a CFL	RS Means, Lit Search	50	0	50	175	0.0	0	0.1	11	33	5	166	1.5	233	47	60	98	313
1.2	install motion detectors for the exterior path bollard lights	RS Means, Lit Search	440	0	440	299	0.1	0	0.2	7	46	12	551	9.6	25	2	4	11	536
	Totals		490	0	490	474	0.1	0	0.3	18	79	-	717	6.2	46	-	7	109	849

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA also assumed an aggregated 1/2 hr/yr to replace aging burnt out lamps vs. newly installed.

Rebates / Financial Incentives:

NJ Clean Energy - There aren't any incentives at this time offered by the state of NJ for this energy conservation measure.

Options for Funding ECM:

This project may benefit from applying for a grant from the State of New Jersey - American Recovery and Reinvestment Act Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.

http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html

ECM#2: *Install Climate Controlled Display Case*

Description:

The South River War Memorial Building has a number of artifacts that require temperature and humidity control for future preservation. However, there are many more artifacts that can withstand a cooler or warmer environment than the 67+ deg F present constant building temperature setting with a slightly higher setting during the summer. SWA recommends that those few temperature and humidity sensitive artifacts be stored in a climate controlled museum display case and that the building temperature be allowed to drop to the upper 50s - low 60s deg F during winter and high 70s - low 80s during the summer, thus conserving energy on heating and air conditioning since the Museum is so seldom occupied (only a few hours a month). The proposed museum showcase or cabinet is connected to the display case constant humidity device, forming an airtight recirculation system. Air is extracted from the case into the constant humidity device where it is conditioned before being fed back into the cabinet. By default, the whole process takes place without mixing system air with ambient air. The sensor monitors both temperature and relative humidity and is mounted discreetly inside the display case. Once set in operation, the constant humidity device continuously monitors the condition inside the showcase. If the measured relative humidity value deviates from the required value (set point), the appropriate action is immediately initiated ie: dehumidification by condensing or humidification by evaporation. Condensate from the dehumidification process is added to the unit's integral water bottle which also provides the reservoir for the humidification process. The modes of operation "humidification" and "dehumidification" are indicated on the control panel visual display. Should the set value not be reached within a pre-set time, an alarm is activated. In addition to the integral alarm display on the panel, external remote alarm signaling is available using the potential free contact, thus providing the user with the possibility to install external alarming notification. There is also a small heating / air conditioning unit to maintain display case temperature as desired.

Installation cost:

Estimated installed cost: \$11,000 (includes \$2,200 of labor)

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 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	install climate controlled display case(s) - (~50 cu ft) and decrease bldg heating / cooling	Energy Star purchasing and procurement site, similar projects	11,000	0	11,000	3,890	0.8	374	9.3	200	1,177	15	17,657	9.3	61	4	7	2,763	11,086

Assumptions: SWA estimated the cost and savings of the system based on past projects, utility estimates and bills. Annual operation maintenance costs will decrease with less strain on the building heating / air conditioning systems.

Rebates / Financial Incentives:

NJ Clean Energy - There aren't any incentives at this time offered by the state of NJ for this energy conservation measure.

Options for Funding ECM:

This project may benefit from applying for a grant from the State of New Jersey - American Recovery and Reinvestment Act Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.

http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html

5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES

5.1. Existing Systems

There aren't currently any existing renewable energy systems.

5.2. Wind

Description:

A Wind system is not applicable for this building because the area does not have winds of sufficient velocity to justify installing a wind turbine system.

5.3. Solar Photovoltaic

Description:

A Solar PV System is not applicable because of the building's low electric usage, shading from surrounding buildings and trees and insufficient financial incentives and a simple payback greater than 40 years.

5.4. Solar Thermal Collectors

Description:

Solar thermal collectors are not cost effective for this building and would not be recommended due to the insufficient and not constant use of domestic hot water throughout the building to justify the expenditure.

5.5. Combined Heat and Power

Description:

CHP is not applicable for this building because of several existing split system cooling and insufficient domestic hot water use.

5.6. Geothermal

Description:

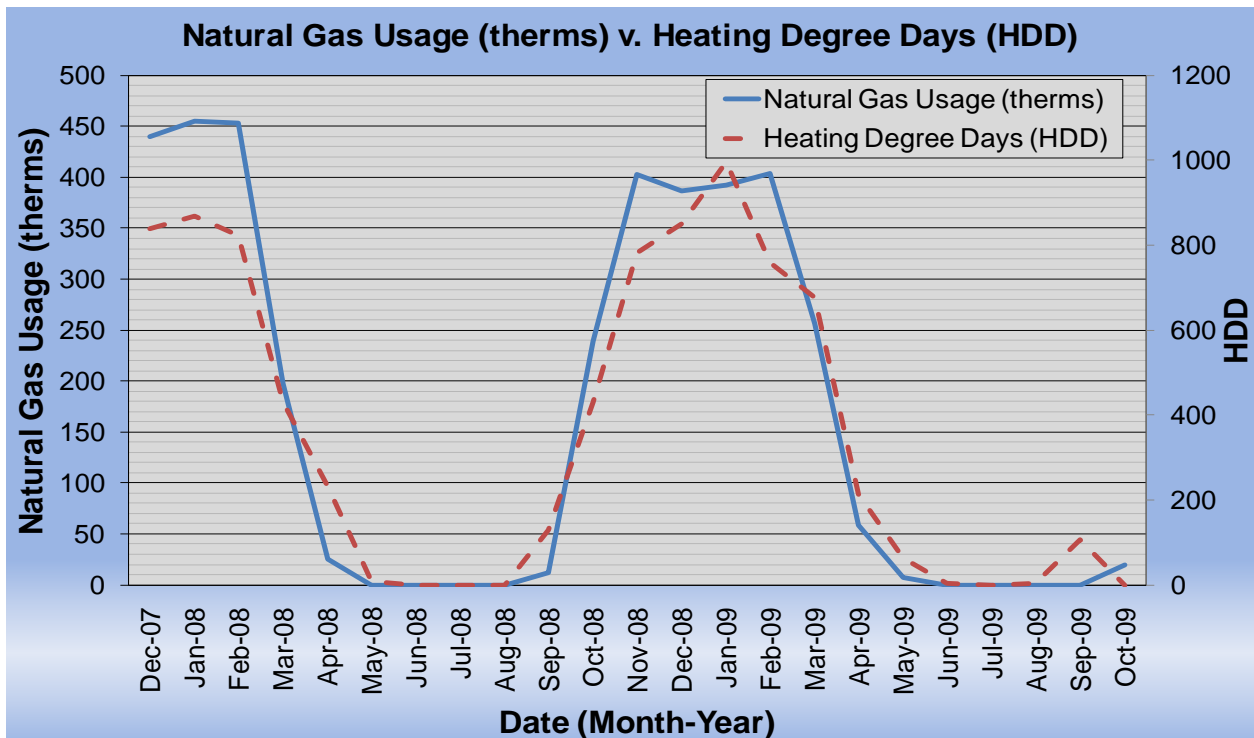
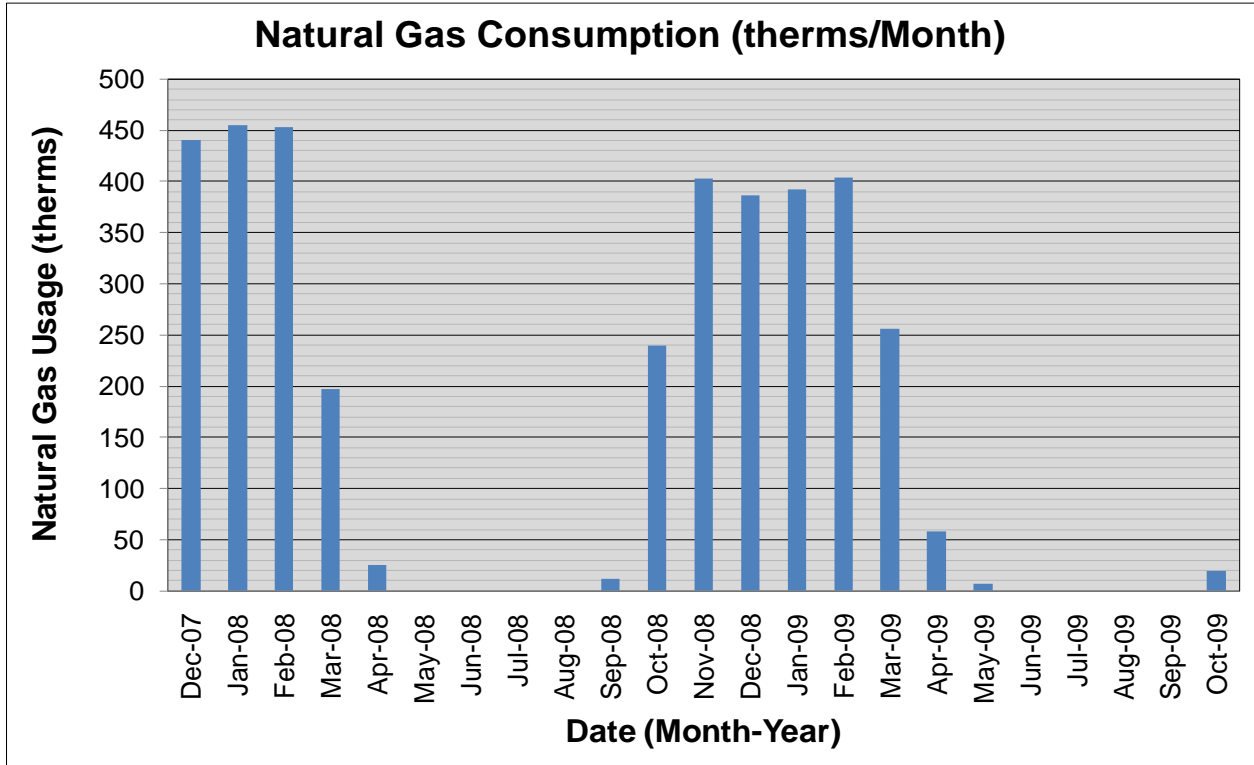
Geothermal is not applicable for this building because it would not be cost effective, since it would require replacement of the existing HVAC system, of which major components still have as a whole a number of useful operating years.

6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Load Profiles

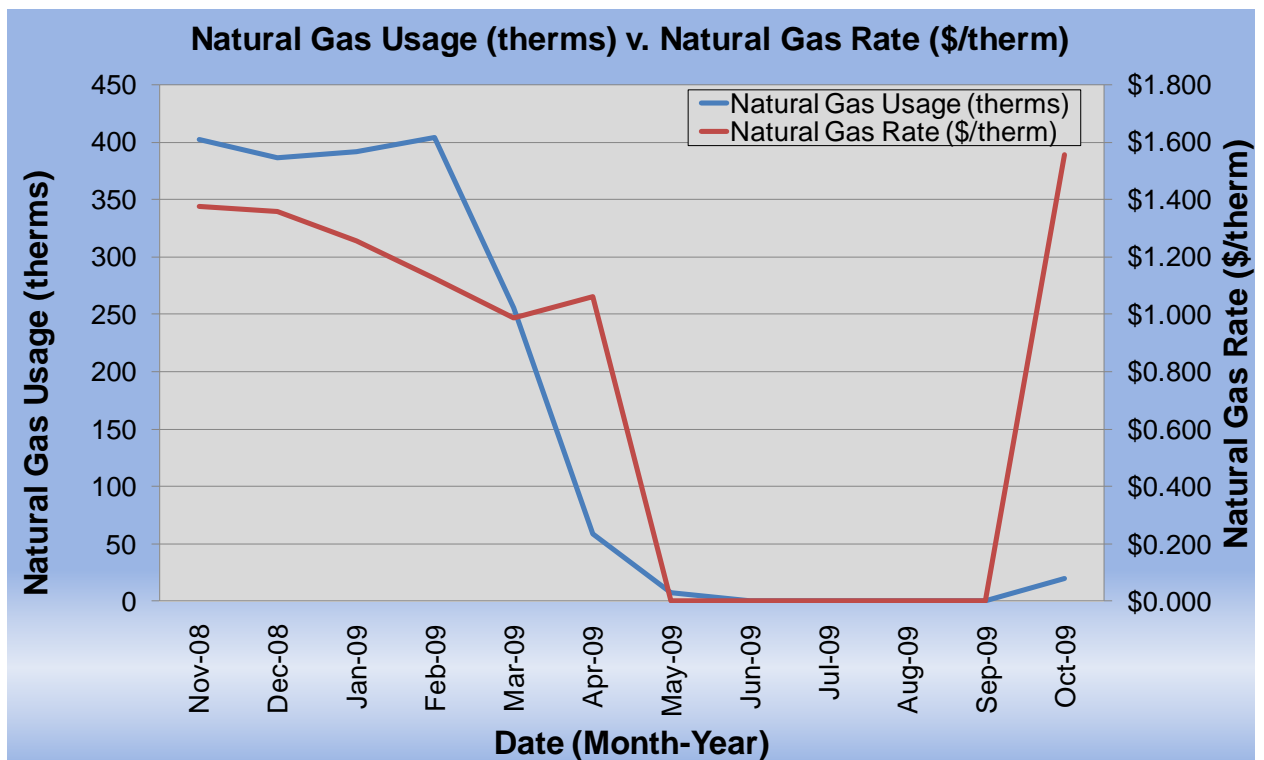
The following are charts that show the annual natural gas load profiles for the South River War Memorial Building. For annual electric and natural gas usage please also see Section 1. Historic Energy Consumption.

The following is a chart of the natural gas load profile for the building, peaking in the coldest months of the year and a chart showing natural gas consumption following the “heating degree days” curve. Some utility bills have more than one month estimated and combined.



6.2. Tariff Analysis

Currently, natural gas is provided to the War Memorial Building via one gas meter with the PSE&G acting as the supply and also the transport company. Gas is provided by PSE&G at a general and very competitive service rate. The suppliers' general service rate for natural gas charges a market-rate price based on use and the War Memorial Building billing does not breakdown demand costs for all periods. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Typically, the natural gas prices increase during the heating months when natural gas is used by the furnace units. Some high gas price per therm fluctuations in the summer may be due to high energy costs that recently occurred and low use caps for the non-heating months. Thus the building pays for fixed costs such as meter reading charges during the summer months. Some of the cap payments are excluded from the following chart.

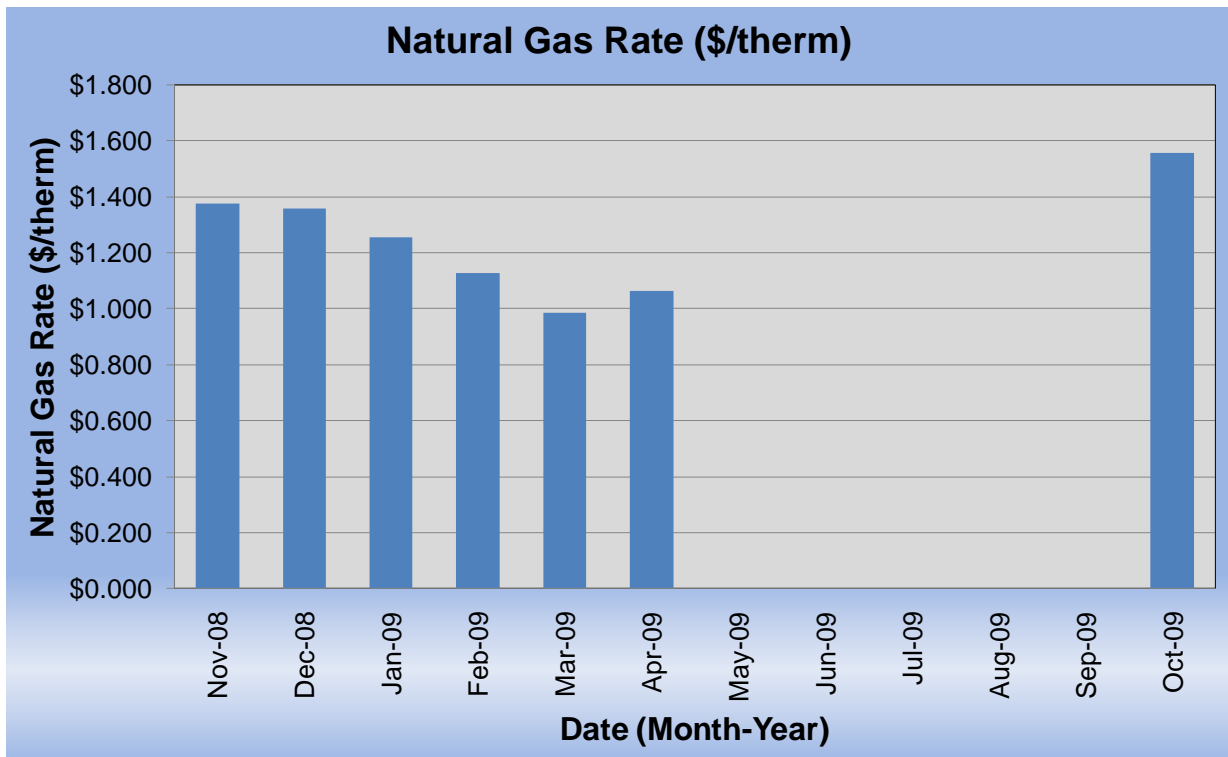


The War Memorial Building is direct-metered and currently purchases electricity from the South River Electric Utility at a general service rate. The general service rate for electric charges is market-rate based on use and the War Memorial Building does not track a breakdown of demand costs. Demand prices are generally reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Typically, the electricity prices increase during the cooling months when electricity is used by the HVAC condensing units and air handlers.

6.3. Energy Procurement strategies

The War Memorial Building receives natural gas via one incoming meter. PSE&G supplies the gas and transports it. There is not an ESCO engaged in the process. An Energy Services

Company (ESCO) is a consultancy group that engages in a performance based contract with a client firm to implement measures which reduce energy consumption and costs in a technically and financially viable manner. Electricity is also purchased via one incoming meter directly for the main War Memorial Building from South River Electricity Company without an ESCO. SWA analyzed the utility rate for natural gas and electricity supply over an extended period. Electric usage was estimated over the most recent 12 month period since meter readings are not recorded. Natural gas bill analysis shows fluctuations up to 24% over the most recent 12 month period. Some of these fluctuations may have been caused by adjustments between estimated and actual meter readings; others may be due to unusual high and recent escalating energy costs. The average estimated NJ commercial utility rates for electric and gas are \$0.150/kWh and \$1.550/therm respectively. The War Memorial Building annual utility costs are competitive when compared to the average estimated NJ commercial utility rates. SWA recommends that the Borough of South River further explore opportunities of purchasing both natural gas and electricity from ESCOs in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the War Memorial Building. Appendix B contains a complete list of third party energy suppliers for the Borough of South River service area. The Borough of South River may want to consider partnering with other school districts, municipalities, boroughs and communities to aggregate a substantial electric and natural gas use for better leveraging in negotiations with ESCOs and of improving the pricing structures. This sort of activity is happening in many parts of the country and in New Jersey. Also, the War Memorial Building would not be eligible for enrollment in a Demand Response Program, because there isn't the capability at this time to shed a minimum of 150 kW electric demand when requested by the utility during peak demand periods, which is the typical threshold for considering this option. The following chart show the War Memorial Building monthly natural gas spending per unit of energy in 2009. Electric rates were estimated at a constant rate of \$0.130/kWh.



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 & established specialized equipment material & 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, 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.

Appendix A: Lighting Study

Location			Existing Fixture Information												Retrofit Information										Annual Savings						
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)	
1	1	Auditorium (100)	Recessed	N	Hal	10	1	50	S	3	18	13	630	34	N/A	Recessed	Hal	N	S	10	1	50	3	18	13	630	34	0	0	0	
2	1	Auditorium (100)	Recessed	E	CFL	6	1	13	S	3	18	0	78	4	N/A	Recessed	CFL	E	S	6	1	13	3	18	0	78	4	0	0	0	
3	1	Auditorium (100)	Recessed	N	hal	2	1	50	S	3	18	13	126	7	N/A	Recessed	Hal	N	S	2	1	50	3	18	13	126	7	0	0	0	
4	1	Auditorium (100)	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0	
5	1	Hallway (101)	Screw-in	N	Inc	1	1	60	S	3	18	0	60	3	N/A	Screw-in	Inc	N	S	1	1	60	3	18	0	60	3	0	0	0	
6	1	Mechanical Rm (102)	Parabolic	M	4'T12	2	2	40	S	3	18	15	190	10	N/A	Parabolic	4T12	M	S	2	2	40	3	18	15	190	10	0	0	0	
7	1	mezanine (200)	Parabolic	E	4'T8	2	2	32	S	3	18	6	140	8	N/A	Parabolic	4'T8	E	S	2	2	32	3	18	6	140	8	0	0	0	
8	1	Bathroom (201)	Screw-in	N	Inc	2	3	40	S	3	18	0	240	13	N/A	Screw-in	Inc	N	S	2	3	40	3	18	0	240	13	0	0	0	
9	1	mezanine (200)	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0	
10	1	mezanine (200)	Recessed	N	Inc	1	1	75	S	3	18	0	75	4	N/A	Recessed	Inc	N	S	1	1	75	3	18	0	75	4	0	0	0	
11	Ext	Exterior ()	Screw-in	N	Inc	1	1	60	T	12	365	0	60	263	CFL	Screw-in	CFL	N	T	1	1	20	12	365	0	20	88	175	0	175	
12	Ext	Exterior ()	Pin	E	CFL	7	1	13	T	12	365	0	91	399	N/A	Pin	CFL	E	MS	7	1	13	9	365	0	91	100	0	299	299	
Totals:						36	16	443				49	1,702	850							36	16	403			49	1,662	376	175	299	474
Rows Highlighted Yellow Indicate an Energy Conservation Measure is recommended for that space																															
TO USERS: ONCE ALL ROOMS ARE ADDED, DELETE ROWS NOT USED. MAKE SURE TO DELETE ENTIRE ROW, DO NOT SHIFT CELLS!																															

Legend:	
<u>Fixture Type</u>	<u>Lamp Type</u>
Exit Sign	LED
Screw-in	Inc (Incandescent)
Pin	1T5
Parabolic	2T5
Recessed	3T5
2'U-shape	4T5
Circiline	2T8
Exterior	3T8
HID (High Intensity Discharge)	4T8
	6T8
	8T8
	2T12
	3T12
	4T12
	6T12
	8T12
	CFL (Compact Fluorescent Lightbulb)
	MR16
	Halogen
	MV (Mercury Vapor)
	MH (Metal Halide)
	HPS (High Pressure Sodium)
	LPS (Low Pressure Sodium)
<u>Control Type</u>	<u>Ballast Type</u>
N (None)	N/A (None)
S (Switch)	E (Electronic)
OS (Occupancy Sensor)	M (Magnetic)
T (Timer)	
PC (Photocell)	
D (Dimming)	
DL (Daylight Sensor)	
M (Microphonic Sensor)	
<u>Retrofit Category</u>	
N/A (None)	
T8 (Install new T8)	
T5 (Install new T5)	
CFL (Install new CFL)	
LEDex (Install new LED Exit)	
LED (Install new LED)	
D (Delamping)	
C (Controls Only)	

Appendix B: Third Party Energy Suppliers (ESCOs)
<http://www.state.nj.us/bpu/commercial/shopping.html>

PSE&G NATURAL GAS SERVICE TERRITORY		
Last Updated: 06/15/09		
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109 800-6BUYGAS (6-289427) www.cooperativenet.com	Direct Energy Services, LLP 120 Wood Avenue, Suite 611 Iselin, NJ 08830 866-547-2722 www.directenergy.com	Dominion Retail, Inc. 395 Highway 170 - Suite 125 Lakewood, NJ 08701 866-275-4240 http://retail.dom.com
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701 800-805-8586 www.gesc.com	UGI Energy Services, Inc. d/b/a GASMARK 704 East Main Street, Suite 1 Moorestown, NJ 080111 856-273-9995 www.ugienergyservices.com	Great Eastern Energy 116 Village Riva, Suite 200 Princeton, NJ 08540 888-651-4121 www.greateastern.com
Hess Energy, Inc. One Hess Plaza Woodbridge, NJ 07095 800-437-7872 www.hess.com	Hudson Energy Services, LLC 920 Route 17 South Ridgewood, NJ 07450 877- Hudson 9 www.hudsonenergyservices.com	Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024 800-724-1880 www.intelligentenergy.org
Keil & Sons 1 Bergen Blvd. Fairview, NJ 07002 1-877-Systrum www.systrumenergy@aol.com	Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724 877-750-7046 www.metromediaenergy.com	Metro Energy Group, LLC 14 Washington Place Hackensack, NJ 07601 888-111-Metro www.metroenergy.com
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 088327 800-375-1277 www.mxenergy.com	NATGASCO (Mitchell Supreme) 1112 Freeman Street Orange, NJ 07050 800-840-4GAS www.natgasco.com	Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833 800-363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road - Office 105 Cherry Hill, NJ 08002 800-281-2000 www.pplenergyplus.com	Sempra Energy Solutions The Mac-Cali Building 581 Main Street, 8th fl. Woodbridge, NJ 07095 877-273-6772 800-2 SEMPRA www.semprasolutions.com	South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037 800-756-3749 www.sjindustries.com/sje.htm
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 011128 800-225-1560 www.spragueenergy.com	Stuyvesant Energy LLC 10 West Ivy Lane, Suite 4 Englewood, NJ 07631 800-646-64111 www.stuyfuel.com	Woodruff Energy 73 Water Street Bridgeton, NJ 08302 800-5111-1121 www.woodruffenergy.com

Appendix C

Glossary and Method of Calculations

Glossary of ECM Terms

Net ECM Cost: The net ECM cost is the cost experienced by the customer, which is typically the total cost (materials + labor) of installing the measure minus any available incentives. Both the total cost and the incentive amounts are expressed in the summary for each ECM.

Annual Energy Cost Savings (AECS): This value is determined by the audit firm based on the calculated energy savings (kWh or Therm) of each ECM and the calculated energy costs of the building.

Lifetime Energy Cost Savings (LECS): This measure estimates the energy cost savings over the lifetime of the ECM. It can be a simple estimation based on fixed energy costs. If desired, this value can factor in an annual increase in energy costs as long as the source is provided.

Simple Payback: This is a simple measure that displays how long the ECM will take to break-even based on the annual energy and maintenance savings of the measure.

ECM Lifetime: This is included with each ECM so that the owner can see how long the ECM will be in place and whether or not it will exceed the simple payback period. Additional guidance for calculating ECM lifetimes can be found below. This value can come from manufacturer's rated lifetime or warranty, the ASHRAE rated lifetime, or any other valid source.

Operating Cost Savings (OCS): This calculation is an annual operating savings for the ECM. It is the difference in the operating, maintenance, and / or equipment replacement costs of the existing case versus the ECM. In the case where an ECM lifetime will be longer than the existing measure (such as LED lighting versus fluorescent) the operating savings will factor in the cost of replacing the units to match the lifetime of the ECM. In this case or in one where one-time repairs are made, the total replacement / repair sum is averaged over the lifetime of the ECM.

Return on Investment (ROI): The ROI is expressed as the percentage return of the investment based on the lifetime cost savings of the ECM. This value can be included as an annual or lifetime value, or both.

Net Present Value (NPV): The NPV calculates the present value of an investment's future cash flows based on the time value of money, which is accounted for by a discount rate (assumes bond rate of 3.2%).

Internal Rate of Return (IRR): The IRR expresses an annual rate that results in a break-even point for the investment. If the owner is currently experiencing a lower return on their capital than the IRR, the project is financially advantageous. This measure also allows the owner to compare ECMs against each other to determine the most appealing choices.

Calculation References

ECM = Energy Conservation Measure
AOCS = Annual Operating Cost Savings
AECS = Annual Energy Cost Savings
LOCS = Lifetime Operating Cost Savings
LECS = Lifetime Energy Cost Savings
LCS = Lifetime Cost Savings

NPV = Net Present Value
IRR = Internal Rate of Return
DR = Discount Rate

Net ECM Cost = Total ECM Cost – Incentive
LECS = AECS X ECM Lifetime
AOCS = LOCS / ECM Lifetime
LCS = LOCS+LECS

Note: The lifetime operating cost savings are all avoided operating, maintenance, and / or component replacement costs over the lifetime of the ECM. This can be the sum of any annual operating savings, recurring or bulk (i.e. one-time repairs) maintenance savings, or the savings that comes from avoiding equipment replacement needed for the existing measure to meet the lifetime of the ECM (e.g. lighting change outs).

Simple Payback = Net ECM Cost / (AECS + AOCS)
Lifetime ROI = (LECS + LOCS – Net ECM Cost) / Net ECM Cost
Annual ROI = (Lifetime ROI / Lifetime) = (AECS + OCS) / Net ECM Cost – 1 / Lifetime
It is easiest to calculate the NPV and IRR using a spreadsheet program like Excel.

Excel NPV and IRR Calculation

In Excel, function =IRR(values) and =NPV(rate, values) are used to quickly calculate the IRR and NPV of a series of annual cash flows. The investment cost will typically be a negative cash flow at year 0 (total cost - incentive) with years 1 through the lifetime receiving a positive cash flow from the annual energy cost savings and annual maintenance savings. The calculations in the example below are for an ECM that saves \$850 annually in energy and maintenance costs (over a 10 year lifetime) and takes \$5,000 to purchase and install after incentives:

	A	B	C	D	E	F	G	H	I
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									

Year	Cash Flow
0	\$ (5,000.00)
1	\$ 850.00
2	\$ 850.00
3	\$ 850.00
4	\$ 850.00
5	\$ 850.00
6	\$ 850.00
7	\$ 850.00
8	\$ 850.00
9	\$ 850.00
10	\$ 850.00

IRR	11.03%
NPV	\$2,250.67

Investment Cost

Cash Flow: Annual Energy Cost Savings + Annual Maintenance Savings

Formula:
 =IRR(F4:F14)
 =NPV(0.03,F5:F14)+F4

ECM Lifetime

ECM and Equipment Lifetimes

Determining a lifetime for equipment and ECM's can sometimes be difficult. The following table contains a list of lifetimes that the NJCEP uses in its commercial and industrial programs. Other valid sources are also used to determine lifetimes, such as the DOE, ASHRAE, or the manufacturer's warranty.

Lighting is typically the most difficult lifetime to calculate because the fixture, ballast, and bulb can all have different lifetimes. Essentially the ECM analysis will have different operating cost savings (avoided equipment replacement) depending on which lifetime is used.

When the bulb lifetime is used (rated burn hours / annual burn hours), the operating cost savings is just reflecting the theoretical cost of replacing the existing case bulb and ballast over the life of the recommended bulb. Dividing by the bulb lifetime will give an annual operating cost savings.

When a fixture lifetime is used (e.g. 15 years) the operating cost savings reflects the avoided bulb and ballast replacement cost of the existing case over 15 years minus the projected bulb and ballast replacement cost of the proposed case over 15 years. This will give the difference of the equipment replacement costs between the proposed and existing cases and when divided by 15 years will give the annual operating cost savings.

NJCEP C & I Lifetimes

Measure	Measure Life
Commercial Lighting — New	15
Commercial Lighting — Remodel/Replacement	15
Commercial Custom — New	18
Commercial Chiller Optimization	18
Commercial Unitary HVAC — New - Tier 1	15
Commercial Unitary HVAC — Replacement - Tier 1	15
Commercial Unitary HVAC — New - Tier 2	15
Commercial Unitary HVAC — Replacement Tier 2	15
Commercial Chillers — New	25
Commercial Chillers — Replacement	25
Commercial Small Motors (1-10 HP) — New or Replacement	20
Commercial Medium Motors (11-75 HP) — New or Replacement	20
Commercial Large Motors (76-200 HP) — New or Replacement	20
Commercial VSDs — New	15
Commercial VSDs — Retrofit	15
Commercial Comprehensive New Construction Design	18
Commercial Custom — Replacement	18
Industrial Lighting — New	15
Industrial Lighting — Remodel/Replacement	15
Industrial Unitary HVAC — New - Tier 1	15
Industrial Unitary HVAC — Replacement - Tier 1	15
Industrial Unitary HVAC — New - Tier 2	15
Industrial Unitary HVAC — Replacement Tier 2	15
Industrial Chillers — New	25
Industrial Chillers — Replacement	25
Industrial Small Motors (1-10 HP) — New or Replacement	20
Industrial Medium Motors (11-75 HP) — New or Replacement	20
Industrial Large Motors (76-200 HP) — New or Replacement	20
Industrial VSDs — New	15
Industrial VSDs — Retrofit	15
Industrial Custom — Non-Process	18
Industrial Custom — Process	10
Small Commercial Gas Furnace — New or Replacement	20
Small Commercial Gas Boiler — New or Replacement	20
Small Commercial Gas DHW — New or Replacement	10
C&I Gas Absorption Chiller — New or Replacement	25
C&I Gas Custom — New or Replacement (Engine Driven Chiller)	25
C&I Gas Custom — New or Replacement (Gas Efficiency Measures)	18
O&M savings	3
Compressed Air (GWh participant)	8