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June 28, 2010

Local Government Energy Program
Energy Audit Final Report

Palmyra Borough Hall
Palmyra, NJ 08065

Project Number: LGEA49

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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 Palmyra municipal buildings. The audit, conducted on March 2, 2010 included a review of the:

- Borough Hall
- Palmyra Firehouse

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

This report addresses the Palmyra Borough Hall located at 20 West Broad Street, Palmyra, NJ 08065. 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 two-story (including a partial basement),16,100 square feet Borough Hall was constructed circa 1940 with additions/alterations performed since then, the latest occurring in 1994. The older part of the building with the clock tower served as a church prior to being relocated to the present site. The building's partial basement is on level with the back lot. The basement houses the Police Department evidence room, interrogation room, training room, locker rooms, a kitchenette, two cells, offices, an ID room, a lobby, an elevator room, a boiler room, a pump room, closets, storage spaces and two Nextel rooms. The first floor houses the Construction and Zoning Department and offices, the Fire Inspector's office, the Tax Assessor's office, the Maintenance office, the Tax office, the Payroll office, the CFO/Administration office, the Clerk's office, the Mayor's office, the Council's office, the Court's office, storage areas, a kitchen and bathrooms. The second floor houses the Court room, a waiting area, the Judge's and Council chambers, storage rooms, bathroom and ladder to the clock tower. The occupancy of the Borough Hall is approximately 55-60 hours per week for the 20 employees, including 6 police officers working the day shift. The Borough Hall is open on weekdays from 8:30 AM - 4:30 PM with Court in day session last Monday of every month and some periodic night meetings. The Police Department operates 24 hrs / 7 days. There isn't an assigned overnight dispatcher.

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

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 Borough Hall located at 20 West Broad Street, Palmyra, NJ 08065. The Borough Hall is a two-story (including a partial basement) building, comprising of a total conditioned floor area of 16,100 square feet. The original structure was built circa 1940 with additions/alterations performed since then, the latest occurring in 1994.

Based on the field visits performed by the SWA staff on March 2, 2010 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, natural gas and electric usage.

From January 2009 through December 2009 the Borough Hall consumed 316,581 kWh or $50,828 worth of electricity at an approximate rate of $0.161/kWh and 4,185 therms or $4,892 worth of natural gas at an approximate rate of $1.169/therm. The joint energy consumption for the building, including both electricity and natural gas, was 1,499 MMBtu of energy that cost a total of $55,720.

SWA has entered energy information about the Borough Hall in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, a benchmark score could not be generated for the building since it is mixed-use and contains areas that operated at different hours. This building is comprised of non-eligible (Other) space type, and national comparisons are yet unavailable for rating. SWA encourages the Borough of Palmyra 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 93.0 kBtu/ft2yr compared to the national average of (Other) space type buildings consuming an average of 104.0 kBtu/ft^{2}yr. Implementing this report's recommendations will reduce use approximately 29.3 kBtu/ft2yr. Due to the nature of its calculation that is based upon a survey or existing buildings of varying usage, the national average for "Other" space types is very subjective and is not an absolute bellwether for gauging performance. The Borough Hall annual natural gas costs are competitive and the electric costs are $3,341 higher when compared to the average estimated NJ commercial utility rates.

Based on the assessment of the Borough Hall, 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

- Replace water source heat pump units
- Replace supply and exhaust fans and ductwork
- Consider replacing existing water source heat pump system with chilled water cooling system along with terminal equipment upgrades
- In lieu of chilled water cooling systems recommended above, add geothermal cooling and heating system
- Install premium motors when replacements are required - Select NEMA Premium motors
- At the next major renovation replace older windows with newer advanced insulated windows
- Add insulation to ineffectively/under-insulated exterior wall with the next major renovation
- Insulate original and un-insulated roof/ceiling sections with the next major renovation

Category II Recommendations: Operations and Maintenance

- Water levels in the expansion tanks and the integrity of the tank bladder should be checked on a regular basis
- Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly
- Maintain downspouts and cap flashing
- Provide weather stripping/air sealing
- Repair/seal wall cracks and penetrations
- Slope perimeter grade away from building to maximize site drainage
- Expand/provide water efficient fixtures and controls
- Use Energy Star labeled appliances
- Use smart power electric strips
- Create an energy educational program for the Maintenance staff

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

At this time, SWA highly recommends a total of **8** Energy Conservation Measures (ECMs) for the Borough Hall as summarized in the following Table 1. The total investment cost for these ECMs with incentives is **$42,743**. SWA estimates a first year savings of **$10,694** with a simple payback of **4.0 years**. SWA also recommends **5** more ECMs with a total first year savings of **$19,525** as summarized in Table 2. SWA estimates that implementing these recommended ECMs will reduce the carbon footprint of the Borough Hall by **182,095 lbs of CO_2**, which is equivalent to removing approximately 15 cars from the roads each year or avoiding the need of 443 trees to absorb the annual CO_2 generated.

There are various incentives that the Borough of Palmyra could apply for that could also help lower the cost of installing the ECMs, such as enroll in the NJ SmartStart program through the New Jersey Office of Clean Energy. This incentive program 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, has been rolled out recently and could also assist to cover up to 60% of the capital investment. SWA also recommends that the Borough of Palmyra investigate the benefits of the Pay for Performance and Energy Efficiency and Conservation Block Grant programs, briefly described in Appendix D Incentive Programs.

Renewable ECMs require application approval and negotiations with the utility and proof of performance. There is also a utility-sponsored loan program through PSE&G that would allow the building to pay for the installation of the PV system through a loan issued by PSE&G.

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	Install (1) beverage vending machine energy miser	www.usatech.com and established costs	279	0	279	1,456	0.3	0	0.3	0	234	12	2,813	1.2	908	76	84	1,964	2,607
2	replace (2) 1 HP water loop circulator pump motors with Premium Efficiency	DOE International Motor Master	554	90	464	1,566	0.3	0	0.3	0	252	20	5,043	1.8	987	49	54	3,119	2,804
3.1	Install (30) occupancy sensors in offices and meeting room	RS Means, Lit Search	6,600	600	6,000	13,323	2.6	0	2.8	0	2,145	12	25,740	2.8	329	27	35	14,631	23,855
4	install VFDs on (2) 1 HP building water loop pumps	Honeywell VFD Quick Savings Estimator	4,500	none at this time	4,500	7,750	1.5	0	1.6	0	1,248	15	18,716	3.6	316	21	27	9,867	13,876
3.2	Replace (12) incandescent with CFLs	RS Means, Lit Search	420	none at this time	420	463	0.1	0	0.1	35	110	5	548	3.8	30	6	10	76	829
3.3	replace (19) incandescent Exit sign fixtures with LED Exit sign type	RS Means, Lit Search	3,515	380	3,135	3,995	0.8	0	0.8	70	713	15	10,698	4.4	241	16	22	5,094	7,153
5	Retro-commissioning	Similar projects	20,125	none at this time	20,125	13,727	2.6	419	5.5	1,820	4,519	12	54,231	4.5	169	14	20	23,573	29,191
6	Replace Boiler with High Efficiency Condensing Boiler(s)	Similar projects	8,500	680	7,820	0	0.0	1,260	7.8	0	1,473	25	36,824	5.3	371	15	19	16,731	13,889
	Totals		**44,493**	**1,750**	**42,743**	**42,280**	**8.1**	**1,679**	**19.4**	**1,925**	**10,694**	**-**	**154,612**	**4.0**	**262**	**-**	**23**	**75,054**	**94,204**

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
7	Replace (1) electric DHW Heater with a Natural Gas Direct Vent Model	Similar projects	2,150	50	2,100	3,050	0.6	-104	0.0	0	370	12	4,435	5.7	111	9	14	1,487	4,315
8	replace (3) old (PD and Court) refrigerators with 18 cu ft Energy Star models	Energy Star purchasing and procurement site, similar projects	2,250	0	2,250	1,050	0.2	0	0.2	150	319	12	3,829	7.1	70	6	9	861	1,880
9	Install 14.4 kW PV with Incentives	Similar Projects	108,000	14,400	93,600	16,998	14.4	0	3.6	0	12,937	25	221,416	7.2	1	0	11	70,768	30,434
3.4	Replace (250) T12 fixtures throughout the bldg with new T8 fixtures	RS Means, Lit Search	53,750	6,250	47,500	26,816	5.1	0	5.7	1,050	5,367	15	80,511	8.8	69	5	7	15,173	48,014
3.5	Replace (9) exterior Metal Halide fixtures with pulse start MH type	RS Means, Lit Search	5,850	225	5,625	1,813	0.3	0	0.4	240	532	15	7,978	10.6	42	3	5	614	3,246
	Totals		**172,000**	**20,925**	**151,075**	**49,727**	**20.7**	**-104**	**9.9**	**1,440**	**19,525**	**-**	**318,168**	**7.7**	**111**	**-**	**10**	**88,903**	**87,890**

Note: ECM#7: -104 represents additional natural gas usage when traded off against saving more expansive electric usage.

1. HISTORIC ENERGY CONSUMPTION

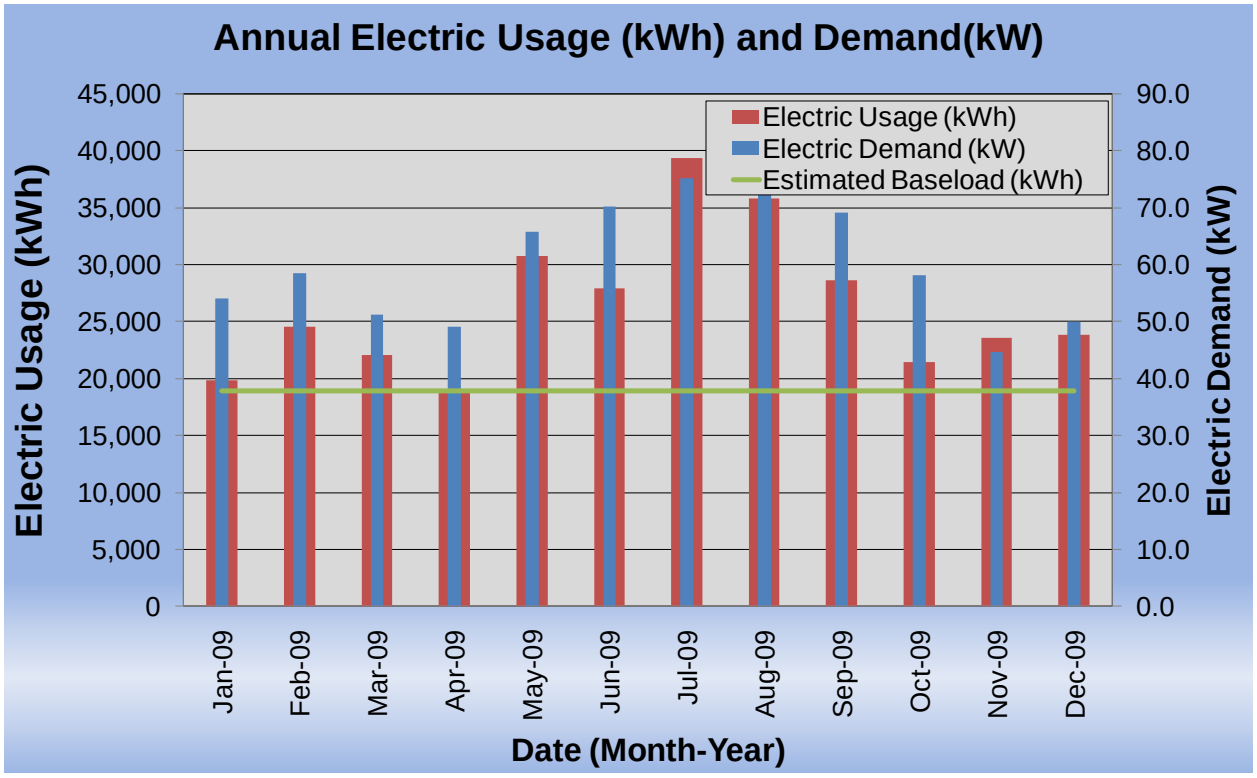
1.1. Energy Usage and Cost Analysis

SWA analyzed utility bills from April 2007 through December 2009 that were received from the utility companies supplying the Palmyra Borough Hall with electric and natural gas.

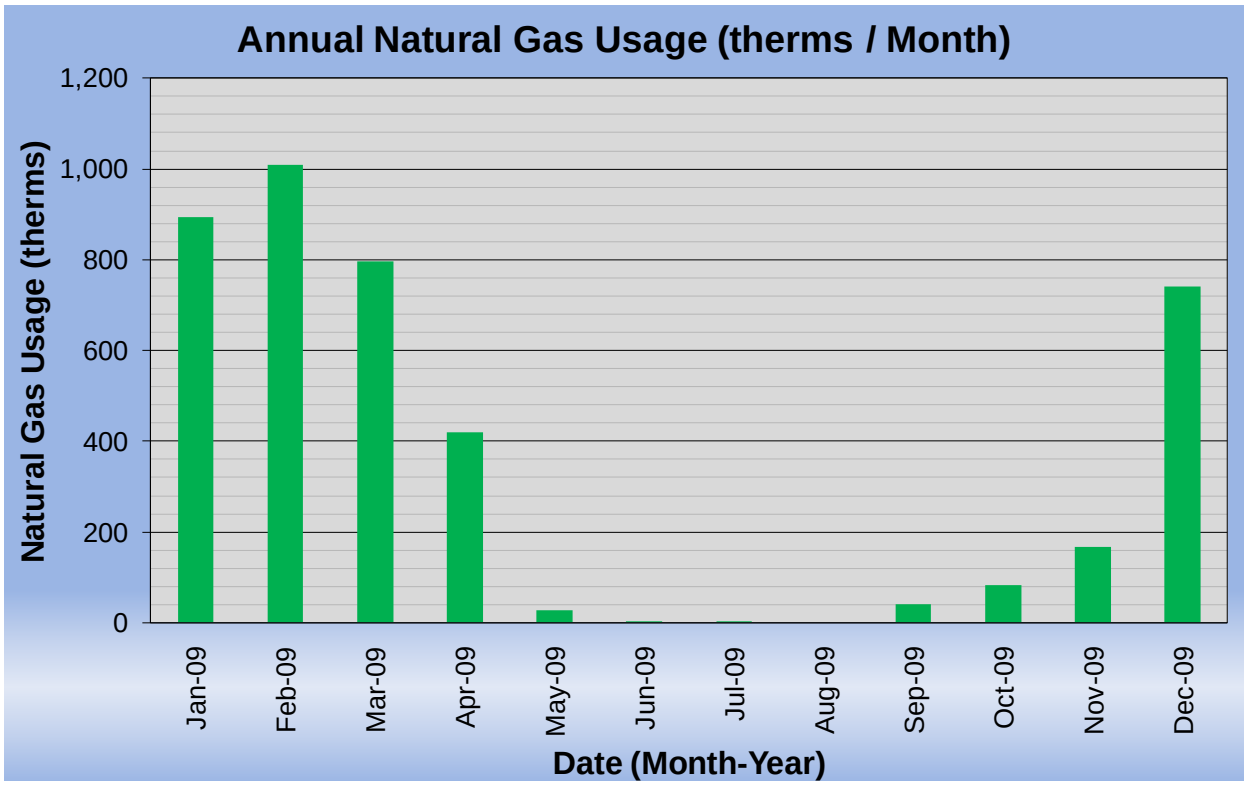
Electricity - The Palmyra Borough Hall is currently served by one electric meter. The Borough Hall currently buys electricity from PSE&G at **an average rate of $0.161/kWh** based on 12 months of utility estimates from January 2009 through December 2009. The Borough Hall purchased **approximately 316,581 kWh or $50,828 worth of electricity** in the previous year. The average monthly demand was 60 kW, peaking at 80 kW during the analyzed period.

Natural gas - The Palmyra Borough Hall is currently served by one meter for natural gas. The Palmyra Borough Hall currently buys natural gas from PSE&G at **an average aggregated rate of $1.169/therm** based on 12 months of utility bills for January 2009 through December 2009. The Palmyra Borough Hall purchased **approximately 4,185 therms or $4,892 worth of natural gas** in the previous year at a very competitive rate.

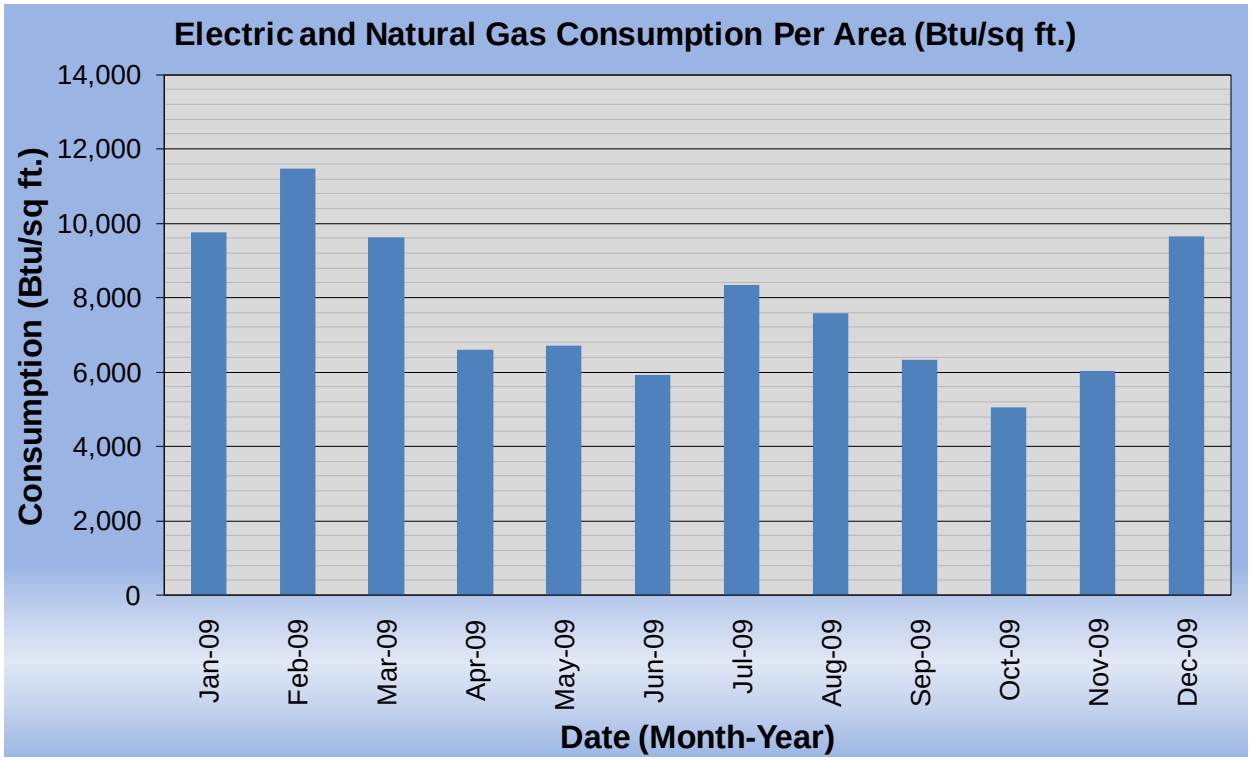
The following chart shows electricity consumption for the Borough Hall based on electric bills for the 12 month period of January 2009 through December 2009. It is assumed that the Air Handling Unit (AHU) blowers and heat pumps are operating at all times to circulate the conditioned air.



The following chart shows the natural gas consumption for the Borough Hall based on natural gas bills for the 12 month period of January 2009 through December 2009.

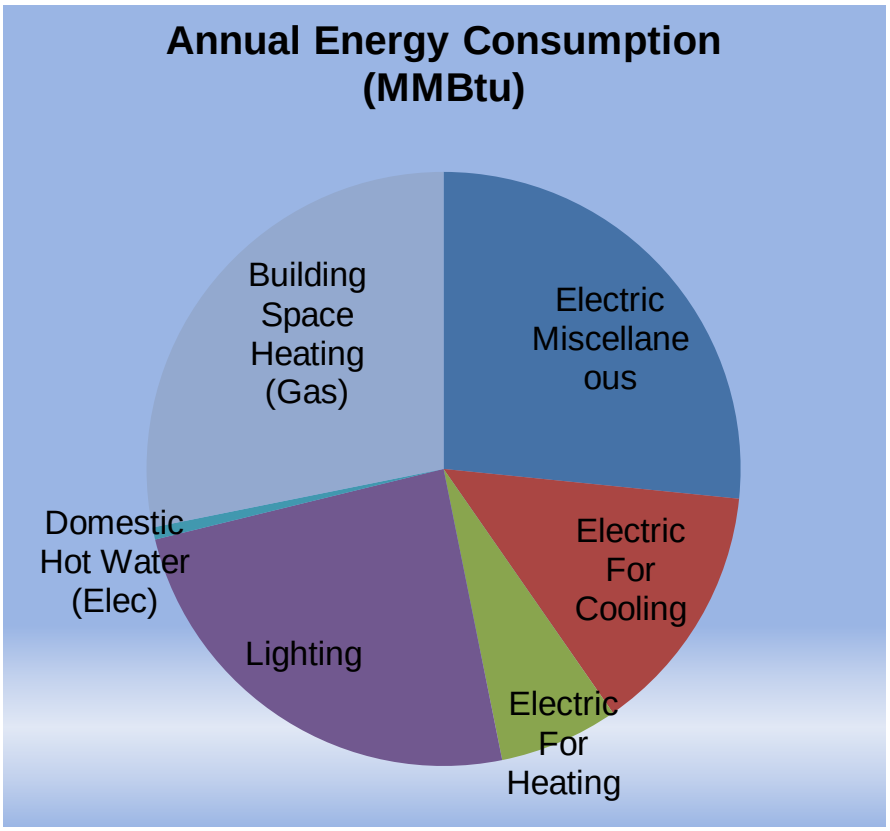


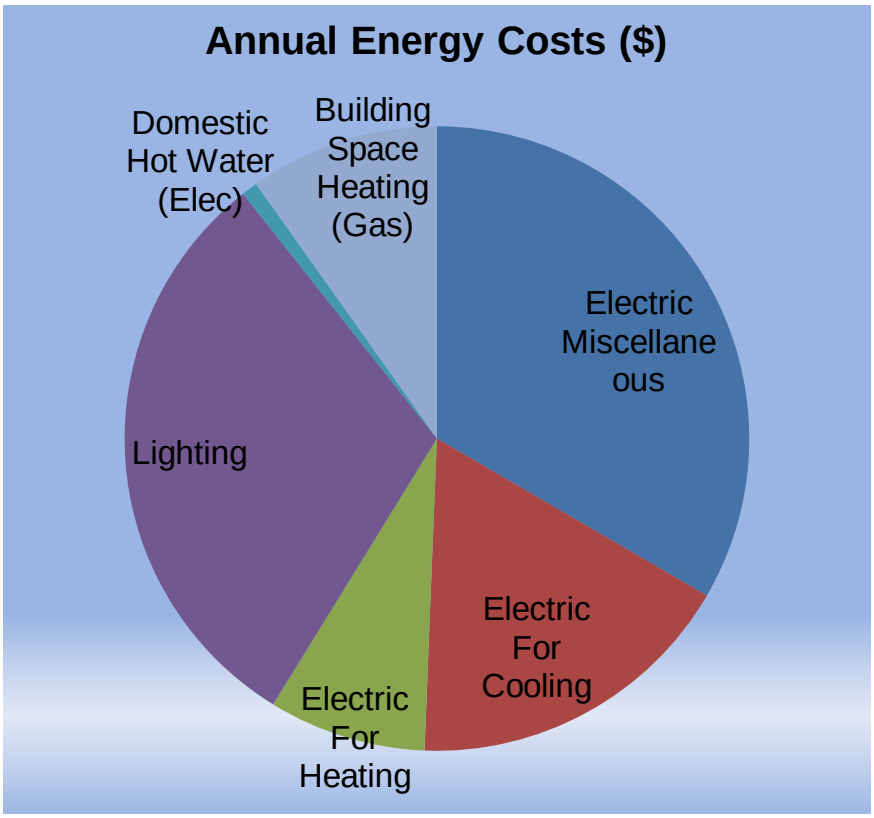
The following chart shows combined natural gas and electric consumption in Btu/sq ft for the Borough Hall based on estimates and utility bills for the 12 month period of January 2009 through December 2009.



The following table and pie charts show energy use for the Borough Hall based on utility bills for the 12 month period of January 2009 through December 2009. Note electrical cost at $47/MMBtu of energy is more than 4 times as expensive to use as natural gas at $12/MMBtu. Air Handling Unit (AHU) blower and heat pump usage is included in the electric miscellaneous usage below.

2009 Annual Energy Consumption/Costs					
	MMBtu	**% MMBtu**	**$**	**% $**	**$/MMBtu**
Electric Miscellaneous	347	23%	$16,313	29%	47
Electric For Cooling	232	15%	$10,911	20%	47
Electric For Heating	74	5%	$3,504	6%	47
Lighting	417	28%	$19,611	35%	47
Domestic Hot Water (Elec)	10	1%	$490	1%	47
Building Space Heating (Gas)	419	28%	$4,892	9%	12
Totals	1,499	100%	$55,720	100%	37
Total Electric Usage	1,080	72%	$50,828	91%	47
Total Gas Usage	419	28%	$4,892	9%	12
Totals	1,499	100%	$55,720	100%	37





1.2. Utility Rate

The Borough Hall currently purchases electricity from PSE&G at a general service market rate for electricity use (kWh) with a separate (kW) demand charge. The Borough Hall currently pays an average rate of approximately $0.161/kWh based on the 12 months estimates of January 2009 through December 2009.

The Borough Hall currently purchases natural gas 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 Borough Hall currently. The average aggregated rate (supply and transport) for the meter is approximately $1.169/therm based on 12 months of utility bills for January 2009 through December 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 Borough Hall in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, a benchmark score could not be generated for the building since it is mixed-use and contains areas that operated at different hours. This building is comprised of non-eligible (Other) space type, and national comparisons are yet unavailable for rating. SWA encourages the Borough of Palmyra 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 93.0 kBtu/ft2yr compared to the national average of (Other) space type buildings consuming an average of 104.0 kBtu/ft^{2}yr. Implementing this report's highly recommended Energy Conservations Measures (ECMs) will reduce use by approximately 19.4 kBtu/sq ft yr, with an additional 9.9 kBtu/sq ft yr from the recommended ECMs. Implementing this report's recommendations will reduce use approximately 29.3 kBtu/ft2yr. Due to the nature of its calculation based upon a survey or existing buildings of varying usage, the national average for "Other" space types is very subjective and is not an absolute bellwether for gauging performance.

Per the LGEA program requirements, SWA has assisted the Borough of Palmyra to create an *Energy Star Portfolio Manager* account and share the Borough Hall 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 Palmyra (user name of "boropalmyra" with a password of "palmyraboro") and TRC Energy Services (user name of TRC-LGEA).

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Borough of Palmyra - Borough Hall

Building ID: 2043657
For 12-month Period Ending: November 30, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: April 15, 2010

Facility
Borough of Palmyra - Borough Hall
20 West Broad Street
Palmyra, NJ 08065

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1940
Gross Floor Area (ft²): 16,100

Energy Performance Rating[2] (1-100) N/A

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	1,078,275
Natural Gas (kBtu)[4]	421,991
Total Energy (kBtu)	1,500,266

Energy Intensity[5]

Site (kBtu/ft²/yr)	93
Source (kBtu/ft²/yr)	251

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	187

Electric Distribution Utility
Public Service Elec & Gas Co

National Average Comparison

National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	18%
Building Type	Other

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.

Certifying Professional
N/A

Meets Industry Standards[6] **for Indoor Environmental Conditions:**

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

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

The two-story (including a partial basement),16,100 square feet Borough Hall building was originally constructed circa 1940 with additions/alterations performed since then, the latest occurring in 1994. The older part of the building with the clock tower served as a church prior to being relocated to the present site. The building's partial basement is on level with the back lot. The basement houses the Police Department records room, evidence room, interrogation room, training room, locker rooms, a kitchenette, two cells, a detective's office, an ID room, two Sergeants' offices, a Chief's office, a Lieutenant's office, a Secretary's room, a lobby, an elevator room, a boiler room, a pump room, closets, storage spaces and two Nextel rooms. The first floor houses the Construction and Zoning Department and offices, the Fire Inspector's office, the Tax Assessor's office, the Maintenance office, the Tax office, the Payroll office, the CFO/Administration office, the Clerk's office, the Mayor's office, the Council's office, the Court's office, storage areas, a kitchen and bathrooms. The second floor houses the Court room, a waiting area, the Judge's and Council chambers, storage rooms, bathroom and ladder to the clock tower.

Front Façade and Partial Side Views

2.2. Building Occupancy Profiles

The occupancy of the Borough Hall is approximately 55-60 hours per week for the 20 employees, including 6 police officers working the day shift. The Borough Hall is open on weekdays from 8:30 AM - 4:30 PM with Court in day session last Monday of every month and some periodic night meetings. The Police Department operates 24 hrs/7 days (mostly in and out of the building). There isn't an assigned overnight dispatcher.

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 analysis, as far as accessibility and weather conditions allowed at the time of the field audit.

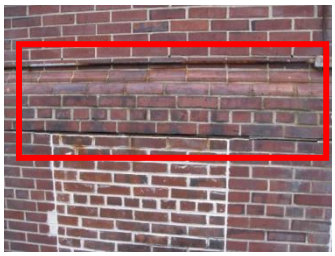
2.3.1. Exterior Walls

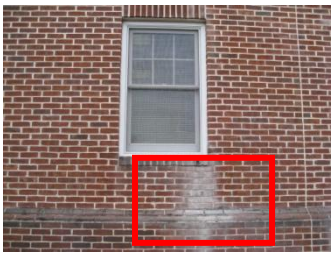
The exterior wall envelope is mostly constructed of 4” brick veneer and some wood/vinyl/aluminum clapboard siding and Fypon accents over 12” and 8” CMU and 5-1/2" light gauge steel framing with 1” air space and R-19 Kraft faced fiberglass batt cavity insulation. Other older areas are constructed of 4” brick veneer and some wood/vinyl/aluminum clapboard siding accents over 5-1/2" wood stud framing with an unconfirmed level of detectable/assumed insulation. The interior is mostly painted gypsum wallboard.

Note: Wall insulation levels could not be totally 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 only a few signs of uncontrolled moisture, air-leakage and/or other energy-compromising issues located mostly at the side(s) of the building.

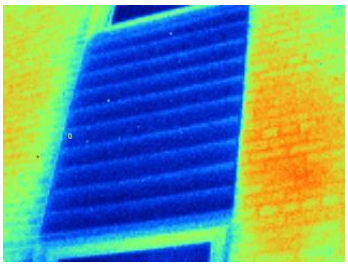
The following specific exterior wall problem spots and areas were identified:



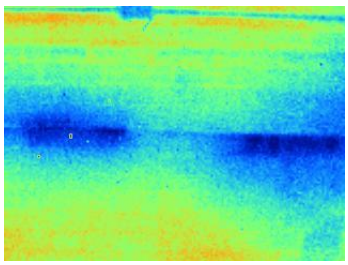


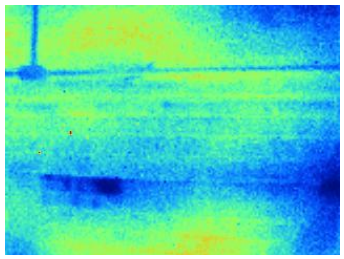
Efflorescence on brick and masonry walls indicate moisture presence within the wall cavity

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



Cold spots in exterior walls due to water/moisture or missing/ineffective insulation





In light of the exterior wall conditions mentioned above SWA has the following recommendation which may be described, quantified and categorized further in the *Executive Summary*:

1. Add insulation to ineffectively or under-insulated exterior wall sections. SWA suggests applying 2" XPS rigid foam boards to the interior and cover with gypsum wallboard or other preferred interior finish with the next major renovation.

2. Inspect and replace cracked/ineffective caulk.

3. Efflorescence coated brick and masonry materials need to dry out and possible cause of water infiltration into wall cavities should be investigated.

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 16 years ago. 6 inches of R-30 Kraft faced fiberglass batt attic/ceiling and no detectable/assumed roof insulation were recorded. In some places, such as over the Court waiting area there is little/no insulation detected. Many areas have uneven/loose insulation cover with spaces barely covered.

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

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 detected on a few roof areas.

The following specific roof/ceiling problem spots and areas were identified:

Uneven/ineffective attic insulation found

In light of the exterior wall conditions mentioned above SWA has the following recommendation which may be described, quantified and categorized further in the *Executive Summary*:

1. Insulate original and un-insulated roof/ceiling sections. SWA suggests applying spray-foam and/or rigid foam board insulation (R-30 min.) under and/or on top of the wood decking surface.

2. Install/repair and maintain roof flashing.

3. Maintain/inspect all roof surfaces on a regular basis.

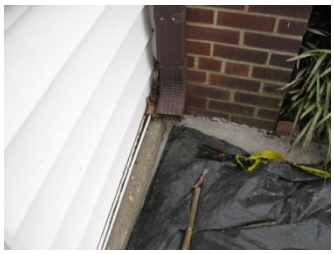
2.3.3. Base

The building's base is composed of a 4" slab-on-grade floor with a perimeter footing and concrete block foundation walls and a slab 1" by 24" rigid edge/perimeter insulation in the 1994 addition. Documents/drawings could not be located for the older foundation and section of the building with the clock tower.

Slab/perimeter insulation levels could not be totally verified in the field or on construction plans and are based upon similar wall types at 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 visible form the exterior only.

The following specific base problem spots and areas were identified:



Water/moisture seepage through foundation due to missing downspout splash block

In light of the exterior wall conditions mentioned above SWA has the following recommendation which may be described, quantified and categorized further in the *Executive Summary*:

1. Apply appropriate air/water-sealing strategies around all slab penetrations (incl. electrical, plumbing and HVAC).

2. Slope perimeter grade away from building to maximize site drainage.

2.3.4. Windows

The building contains several different types of windows.

1. The 1994 addition has a number of Marvin double-hung low-E type windows with vinyl clad frames, clear, double glazing and with interior blinds. The windows are located throughout the building and are original/have not been replaced since 1994.

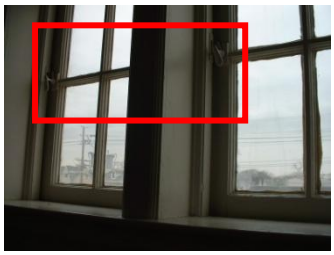
2. The 1994 addition also has a number of Marvin awning low-E type windows with vinyl clad frames, security, double glazing and with interior blinds. The windows are

located mainly on the lower Police Department floor and are original/have not been replaced since 1994.

3. The older clock tower building has double-hung type windows with wood frames, clear single glazing with aluminum storm single glazed windows on the outside and interior blinds. The windows are located throughout the clock tower building and are original/have not been replaced since the building was relocated.

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 acceptable/age appropriate condition with only a few signs of uncontrolled moisture, air-leakage and/or other energy-compromising issues.

The following specific window problem spots and areas were identified:



Single glazed window with ineffective frame. The window latches cannot be closed.

In light of the exterior wall conditions mentioned above SWA has the following recommendation which may be described, quantified and categorized further in the *Executive Summary*:

1. Replace all original/single glazed windows with a low-E, double glazed type with the next major renovation.

2.3.5. Exterior Doors

The building contains several different types of exterior doors.

1. There are a number of wood type exterior doors in the older section of the building. They are located on the basement floor and are original/have never been replaced. The frames are starting to rot and SWA recommends replacement.

2. Other doors in the 1994 addition are Fenestra and Folger Adam 12 gauge hollow metal type exterior doors (some with vision panels). They are located throughout the building and are original/have not been replaced.

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 acceptable/age appropriate condition with only a few signs of uncontrolled moisture, air-leakage and/or other energy-compromising issues.

The following specific door problem spots and areas were identified:

Doors with missing/worn weather stripping; other wood doors with rotting frames

In light of the exterior wall conditions mentioned above SWA has the following recommendation which may be described, quantified and categorized further in the *Executive Summary*:

1. Replace/repair and maintain broken/non-closing/damaged door units.

2. Install/replace/maintain weather stripping around all exterior doors and roof hatches.

3. Replace doors and frames with historically/architecturally accurate units. Should the doors be original, than 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 with only a few areas of suggested improvements, as described in more detail earlier in this chapter.

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 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 Palmyra Borough Hall is heated and cooled by a water source heat pump system. The heating is provided by one (1) cast iron sectional boiler located in the Boiler Room. The fluid cooler used for cooling heat rejection is located on grade behind the building. The majority of the visible heating and cooling system piping in the Boiler Room was not insulated, but it is not required for this type of system.

2.4.1 Heating

The building has a system of water source heat pumps that was installed during the 1995 renovation and addition. These units are either floor-mounted or ceiling-mounted and are located in each of the rooms as well as the corridors, vestibules and lobbies. Each water source heat pump contains a combination heating/cooling coil, compressor, fan assembly, damper, filter and controls within a metal cabinet. These units are not ducted and draw in air directly from the room, condition the air and discharge it back into the room via a small supply fan. Each unit responds to a thermostat located in the room that it serves. When the unit is in cooling mode, it uses an internal DX compressor and rejects heat to the building water loop, cooling the room air that is drawn through it by the fan. When the unit is in heating mode, the compressor rejects heat to the room air by operating in the reverse of the cooling mode, extracting heat from the building-wide water loop.

In total, the building contains approximately twenty-six (26) Climatemaster water source heat pumps. This equipment is in fair to good condition and is at the end of its service life of 15 years, as published in the 2007 ASHRAE HVAC Applications Handbook. In addition, it was reported that these units are noisy and that the system as a whole has poor temperature control. SWA recommends that these units are replaced as part of a total system replacement desired by the Borough.

Typical Water Source Heat Pump

The heating hot water is produced by one (1) gas-fired, cast iron sectional hot water boiler located in the boiler room. The boiler was manufactured by HB Smith and has a rated capacity of 998 MBH. The boiler was installed in the year 1982. According to its age, the boiler has 2 years remaining on its expected service life of 30 years, as published in the 2007 ASHRAE HVAC Applications Handbook. The burner was also installed in 1982 and is beyond its expected service life of 20 years.

Hot Water Boiler

The heating/cooling system piping is set up in a modified primary-secondary loop system. A portion of the piping system for the original building was salvaged from the previous steam heating system. This approach may have been taken to save money or to minimize demolition within the original building. As such, it appears that the piping is oversized for the new system, which may be the cause of some operational problems. Also, it appears that the water loop is constantly pumped through all terminal units and through the fluid cooler. This scheme may be contributing to the temperature control issues reported, and also may be leading to loss of system heat to the outside during the heating season via the fluid cooler.

Performance of the existing system could be improved by installing a zone control valve at each water source heat pump and isolating the building loop from the terminal units. In addition, modifying the existing loop to only pump water through the fluid cooler when the loop needs heat rejection would save energy. Should the Borough not elect to replace the entire system, SWA recommends that the existing piping system and controls are modified to achieve a more energy-efficient operation. These modifications will not address the acoustic issues reported by the Borough personnel.

There is one pair (main and backup) of base-mounted water circulating supply pumps located in the boiler room. The supply pumps were installed in 1995. The pumps are driven by standard efficiency motors and are 75% of the way through their expected service life of 20 years. In this type of system, one system pump will run all year long. According to maintenance personnel, the pumps are intended to operate in a lead-lag fashion. However, on the day of the field visit, both pumps were observed to be operating simultaneously and over the entire period of the visit. Should the Borough not elect to replace the entire system, SWA recommends that the pump motors are replaced with premium efficiency motors and the controls are re-commissioned.

There is a Barber Colman Loop Temperature Controller in the Pump Room adjacent to the Boiler Room to regulate the water loop temperature. There is no central Automatic Temperature Control (ATC) system for the building. Each of the water source heat pumps responds to a local, wall-mounted thermostat located in the room that the unit serves.

There were complaints about the ability of the heating system to provide adequate heating to the building occupants. Based on the condition of the existing equipment and control systems, SWA recommends replacement of heating equipment.

2.4.2 Cooling

The building is cooled by the water source heat pumps mentioned above. Each unit contains a compressor that rejects heat into the overall building water loop when the local thermostat calls for cooling.

The heat is rejected from the building water loop via the fluid cooler located on grade behind the building. The fluid cooler was installed in 1997, and according to its age it is a little over half way through its expected service life of 20 years, as published in the 2007 ASHRAE HVAC Applications Handbook.

Fluid Cooler at Rear of Building

There were complaints about the ability of the cooling system to provide adequate cooling to the building occupants. Based on the age and condition of the existing equipment and control systems, SWA recommends a total system replacement.

2.4.3 Ventilation

It is the intent of the floor-mounted water source heat pumps on the perimeter should introduce outdoor air via a grille and damper located on the outside wall. The horizontal, ceiling-mounted units above the interior rooms receive ventilation air from a series of small, fractional horsepower supply fans located in the attic via ductwork. Both types of units are designed to mix room air with outside air, condition the air as required, and deliver it to the occupied space. There are also fractional horsepower exhaust fans in the attic that are ducted from these spaces to aid in moving the ventilation air through the spaces. Each fan as its intake or exhaust ducted through the roof.

Typical Fan in Attic Used for Supply or Exhaust Air

Measurement or verification of the code compliance for ventilation was not part of this energy study. However, should any retro-commissioning or system upgrades be made part of some capital improvement project, the scope should include readjustment of outside air rates at the fans to provide a code-compliant level of outside air to the spaces.

2.4.4 Domestic Hot Water

There is one domestic hot water heater located in the Boiler Room. This heater is a Bradford White tank type electric water heater that was installed in 1995. This heater serves nearby toilet rooms as well as the adjacent kitchen sink. The heater is in fair condition and is at the end of its expected service life of 15 years, according to the 2007 ASHRAE Applications Handbook.

Domestic *Water Heater*

In addition to the domestic water heaters, there are also two (2) electric, instantaneous water heaters that each serves a sink in the 1995 addition.

2.5 Electrical Systems

2.5.1 Lighting

Interior Lighting - The interior lighting of the Borough Hall consists of mainly T12 fixtures with magnetic ballasts, a few T8 fixtures with electronic ballasts and a few incandescent bulbs. Based on measurements of lighting levels for each space, there are not any vastly over-illuminated areas. SWA recommends replacing T12 with T8 fixtures and incandescent bulbs with CFLs. CFL bulbs produce the same lumen output with less wattage than incandescent bulbs and last up to five times longer. All replacements should meet local code requirements, such as shielding for safety hazards. SWA also recommends installing occupancy sensors in areas that are occupied only part of the day and the payback on savings is justified. Typically, occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion is detected within a set time period. Advance micro-phonic lighting sensors include sound detection as a mean to control lighting operation. See the 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 inefficient incandescent type. SWA recommends replacing incandescent with LED type Exit signs.

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be a mix of Metal Halide (MH) lamp fixtures, one incandescent and one T12 fixture. Exterior lighting is controlled mainly by photocells. SWA recommends replacing MH fixtures of high wattage with pulse-start MH lamps which offer the advantages of standard (probe-start) MH lamps, but minimize the disadvantages. They produce higher light output both initially and over time, operate more efficiently, produce whiter light, and turn on and re-strike faster. SWA is not recommending at this time any upgrades to the exterior light 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 Beverage 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. See section 4, Energy Conservation Measures for details on replacing refrigerators and installing energy misers on vending machines.

Computers left on inside 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 often have internal memories or clocks which consume approximately 3-5 watts of electricity when turned off. SWA recommends all computers and all appliances, (other than refrigerators and freezers), be plugged into power strips and turned off each evening just as the lights are turned off.

The building's computers are generally NOT programmed for the power save mode, to shut down after a period of time that they have not been used.

Sewage Pumps

There is a duplex sewage ejector located in the Pump Room on the Basement level. The pumps are in fair condition. One pump is 15 years old and is at the end of its expected service life of 15 years, according to the 2007 ASHRAE Applications Handbook. The other pump was replaced 4 years ago.

2.5.3 Elevators

The Palmyra Borough Hall is a two-story building (with a basement) and a Schindler type EO1874 hydraulic elevator. The hydraulic system driving the elevator piston is located on the basement level and has a 20 HP motor with an estimated 50% left of its expected useful operating life. There have been electrical/electronic problems with the system. SWA recommends that an elevator specialist completely re-commission the system. This will not save energy however it will greatly improve the reliability of the elevator.

2.5.4 Other Electrical Systems

Besides an emergency 125 kW Generac generator used for emergency back-up (which has an estimated 30% left of its expected useful operating life) and a few small transformers in satisfactory condition, there are not currently any other significant energy impacting electrical systems installed at the Borough Hall. The generator serves emergency lighting, the boiler, the hot water circulating pumps, the sewage pumps, the elevator and the Police Area radios, lighting and HVAC. This generator was installed in 1995 and is in fair to good condition. The Borough has expressed interest in replacing this unit with a 200 kW natural gas driven generator and sharing its use with the adjacent Community Center that is currently under construction.

Emergency *Generator at Rear of Building*

SWA was told that the Borough Hall experiences frequent power outages, electrical phase imbalances, as well as go through relatively more than the norm of motor replacements throughout the year. SWA recommends that the Borough Hall record incoming power

phases to the building. Perhaps, ask the utility company, PSE&G, to megger feeds to the main transformer buses. On the whole, megger testing is non destructive. What happens is a DC voltage is applied to the cable under test. It is an insulation test to see if the insulation has been compromised in any way to cause a short circuit when normal power is applied to it. There may be some phase imbalance and/or grounding. Also the Borough of Palmyra should determine if weekly generator tests are shortening the lives of motors and transformers in the building or damaging any motor drives. The Township may also want to investigate surge suppressors for the main transformer.

3. EQUIPMENT LIST

Inventory

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	Natural Gas Boiler - Est. 65% efficiency	Basement Boiler Room	HB Smith Model 2500L 1,500 MBH Input, 998 MBH Net Output, Approx. 65% efficient current operation	Natural Gas	Building	1982	0%
Heating	Boiler Burner - Est. 70% efficiency	Basement Boiler Room	Iron Fireman Whirlpower 1500 MBH Input	Natural Gas	Building	1982	0%
Heating	(2) 1 HP Circulating Hot Water Pumps - Est. 75% efficiency	Basement Pump Rm (Adj. to Boiler Rm)	Taco VT2506EZHAB605D	Electric	Building	1995	0%
Cooling	Air Cooled Fluid Cooler - Est. 75% efficiency	Exterior Rear of Building On Grade	Witt Model #FDS 621 VE Serial # 243429G97 30% Ethylene Glycol; 120 gpm	Electric	Building	1997	10%
Heating/ Cooling	(26) Heat Pumps,1-3 tons ea. - Est. 1.6 COP and 6 EER	Throughout Building	Several models in building; Two typical are: Climatemaster Model # VS036HSZMRTPCSA; Serial # 95A033544; Climatemaster Model # CS019GROSADFSA Serial # 95C038044	Electric	Building	1995	0%
Domestic Hot Water	Domestic Water Heater, 95+% eff.	Boiler Room	Bradford White Model # M-I-40S5DS-12 40 gal DHW, 4.5 kW Dual Element Serial # JG0376561	Electric	Toilet Rooms & Kitchen Sink	1992	0%
Ventilation	3 Exhaust Fans - Est.80% efficiency	Attic	Loren Cook - Various Models, Sim. To Model #DB-13, 1/3 HP	Electric	Building	1995	0%
Ventilation	3 Supply Fans - Est.80% efficiency	Attic	Loren Cook - Various Models, Sim. To Model #DB-10, 1/4 HP	Electric	Building	1995	0%
Sewer Pumps	3 Grinder Pumps - Est.80% efficiency	Sewage Pump Room	No Visible Nameplate	Electric	Building	1994	20%
Elevators	Elevator	Machine Room on Lower Level	Schindler Type EO1874 20HP	Electric	Building	1995	50%
Generator	125 KW Diesel Generator	Exterior Rear of Building On Grade	Generac Model # 9JA01554S	Diesel	Building	1995	30%
Lighting	See details - Appendix A	See details - Appendix A	See details - Appendix A	Electric	Borough Hall	Varies	On the avg. 20%

Note: The remaining useful life of a system (in %) is an estimate based on the system's manufacturing date and existing conditions derived from visual inspections

4. ENERGY CONSERVATION MEASURES

Based on the assessment of the Palmyra Borough Hall, 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

- Replace water source heat pump units - This equipment is in fair condition and is at the end of its expected service life. Age and wear have reduced the heat transfer capacity. This equipment should be replaced with more modern equipment suited for the intended use. These changes cannot be justified based on energy savings alone. However replacement is strongly recommended to improve the overall efficiency of the heating system. This is a replacement in kind recommendation which offers negligible energy savings. The estimated cost for this equipment replacement is $85,700. The estimated energy savings are $2,135/yr, resulting in a greater than 40 year simple payback.

- Replace supply and exhaust fans and ductwork - This equipment is run by fractional horsepower motors, so the replacements cannot be justified by energy savings alone and there are no NJ Clean Energy rebates available. However due to the age and condition of the equipment, replacement is recommended. The estimated cost for this equipment replacement is $1,800. The estimated energy savings are $60/yr, resulting in a 30 year simple payback.

- Consider replacing existing water source heat pump system with chilled water cooling system along with terminal equipment upgrades - The existing water source heat pump system does not provide adequate temperature control and present noise issues in the building, especially in the Court Room. The noise is primarily caused by the compressors inside the terminal units. One method of dealing with the noise issue is to utilize terminal equipment where the cooling compressor is located elsewhere, as with fan coil units in a chilled water system. An air-cooled chiller or packaged water-cooled chiller with cooling tower could be located in the current location of the fluid cooler. The estimated budget installed cost for the addition of a chiller/cooling tower, pumps, piping and required terminal equipment is $320,000. The estimated energy savings are $1,600/yr, resulting in a 200 year simple payback.

- In lieu of chilled water cooling systems recommended above, add geothermal cooling and heating system - Note that the boiler could be replaced but would have limited use. There is a possibility that the Borough could make use of a portion of the geothermal well field currently under construction for the adjacent Community Center to dedicate wells for a geothermal system for the Borough Hall. However it should be noted that since the terminal equipment would contain a compressor, this type of system would not reduce the noise issues without construction of additional features, such as storage spaces or closets in which to locate the terminal equipment, and additional ductwork to ceiling diffusers. The estimated budget installed cost for the addition of geothermal wells, pumps, and electric heat pump terminal equipment is $525,000. The estimated energy savings are $2,930/yr resulting in a 179 year simple payback.

- Install premium motors when replacements are required - Select NEMA Premium motors when replacing motors that have reached the end of their useful operating lives.

- At the next major renovation replace older windows with newer advanced insulated windows with low-E, argon filled double (or triple) glazed type with thermally broken frames, made of wood, vinyl or fiber glass frame which are less conductive than aluminum.

- Add insulation to ineffectively or under-insulated exterior wall sections. SWA suggests applying 2" XPS rigid foam boards to the interior and cover with gypsum wallboard or other preferred interior finish with the next major renovation.

- Insulate original and un-insulated roof/ceiling sections. SWA suggests applying spray-foam and/or rigid foam board insulation (R-30 min.) under and/or on top of the wood decking surface with the next major renovation.

Category II Recommendations: Operations and Maintenance

- Water levels in the expansion tanks and the integrity of the tank bladder should be checked on a regular basis to confirm proper operation.

- Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly. Add insulation to ineffectively and under-insulated roof/ceiling sections.

- 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 - 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. The perimeter of all window frames should be regularly inspected and any missing or deteriorated caulked areas should be re-caulked to provide an unbroken seal around the window frames. Efflorescence coated brick and masonry materials need to dry out and possible cause of water infiltration into wall cavities should be investigated.

- Slope perimeter grade away from building to maximize site drainage.

- Expand/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. Maintenance 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.

- Use Energy Star labeled appliances - such as Energy Star refrigerators that should replace older energy inefficient equipment.

- Use smart power electric strips - in conjunction with occupancy sensors to power down computer equipment when left unattended for extended periods of time.

- Create an energy educational program for the Maintenance staff - 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	Install beverage vending machine miser
2	Replace water loop circulator pump motors with Premium efficiency motors
3.1, 3.2 & 3.3	Install occupancy sensors, CFLs in place of incandescent lamps and LED Exit signs in place of incandescent Exit signs
4	Install VFDs on building water loop pumps
5	Retro-commission heating and cooling mechanical equipment
6	Replace boiler with high efficiency condensing boiler(s)
	Description of Recommended 5-10 Year Payback ECMs
7	Replace electric DHW heater with Energy Star natural gas fired and vent model
8	Replace old refrigerators with Energy Star models
9	Install 14.4 kW Photo-Voltaic system
3.4 & 3.5	Install T8 in place of T12 fixtures and Metal halide with pulse start Metal Halide pictures

ECM#1: *Install Vending Miser*

Description:

The Borough Hall has one beverage vending machine serving the building occupants and visitors. Energy vending miser devices are now available for conserving energy with these vending machines and coolers. There isn't a need to purchase new machines to reduce operating costs and greenhouse gas emissions. When equipped with the vending miser devices, refrigerated beverage vending machines use less energy and are comparable in daily energy performance to new ENERGY STAR qualified machines. Vending miser devices incorporate innovative energy-saving technology into small plug-and-play devices that installs in minutes, either on the wall or on the vending machine. Vending miser devices use a Passive Infrared Sensor (PIR) to: Power down the machine when the surrounding area is vacant; Monitor the room's temperature; Automatically repower the cooling system at one- to three-hour intervals, independent of sales; Ensure the product stays cold.

Snack vending miser devices can be used on snack vending machines to achieve maximum energy savings that result in reduced operating costs and decreased greenhouse gas emissions with existing machines. Snack vending miser devices also use a Passive Infrared Sensor (PIR) to determine if there is anyone within 25 feet of the machine. It waits for 15 minutes of vacancy, then powers down the machine. If a customer approaches the machine while powered down, the snacks vending miser will sense the presence and immediately power up.

Installation cost:

Estimated installed cost: $279 (includes $100 of labor)
Source of cost estimate: www.usatech.com *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	Install (1) beverage vending machine energy miser	www.usatech.com and established costs	279	0	279	1,456	0.3	0	0.3	0	234	12	2,813	1.2	908	76	84	1,964	2,607

Assumptions: SWA assumes energy savings based modeling calculator found at www.usatech.com or http://www.usatech.com/energy_management/energy_calculator.php

Rebates/financial incentives:

This measure does not qualify for a rebate or other financial incentive at this time.

Options for funding ECM:

This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#2: *Install Premium Efficiency Motors on Building Loop Water Circulators*

Description:

The boiler/pump room houses one set of two (2) pipe-mounted circulator supply pumps as part of the building water loop system to serve the water source heat pumps listed in this report. The pumps are in relatively good condition. Each pump is rated at 1 HP, and the two pumps operate simultaneously for 8,760 hours per year. The pump motors are standard efficiency. Assuming the system is retained, The Palmyra Borough Hall will realize energy savings by utilizing premium efficiency motors for the pumps.

Installation cost:

Estimated installed cost: $554 (includes $139 of labor)
Source of cost estimate: Similar projects and DOE Motor Master International selection & savings analysis

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	replace (2) 1 HP water loop circulator pump motors with Premium Efficiency	similar projects, DOE International Motor Master selection & savings analysis	554	90	464	1,566	0.3	0	0.3	0	252	20	5,043	1.8	987	49	54	3,119	2,804

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. The DOE Motor Master International selection and calculator was used with the assumption that both building water pumps operate simultaneously. According to the system operation, both pumps operate for 8,760 hours per year.

Rebates/financial incentives:

NJ Clean Energy - Premium three-phase motors ($45-$700 per motor)
Maximum incentive amount is $90.

Options for funding ECM:

This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#3: *Building Lighting Upgrades*

Description:

On the day of the site visit, SWA completed a lighting inventory of the Borough Hall (see Appendix A). The interior lighting of the Borough Hall consists mainly of T12 fixtures with magnetic ballasts, a few T8 fixtures with electronic ballasts and a few incandescent bulbs. SWA recommends replacing T12 with T8 fixtures and incandescent bulbs with CFLs. CFL bulbs produce the same lumen output with less wattage than incandescent bulbs and last up to five times longer. All replacements should meet local code requirements, such as shielding for safety hazards. SWA also recommends installing occupancy sensors in areas that are occupied only part of the day and the payback on savings is justified. Typically, occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion is detected within a set time period. Advance micro-phonic lighting sensors include sound detection as a mean to control lighting operation. Exit signs were found to be inefficient incandescent type. SWA recommends replacing incandescent with LED type Exit signs. The exterior lighting surveyed during the building audit was found to be a mix of Metal Halide (MH) lamp fixtures, one incandescent and one T12 fixture. SWA recommends replacing MH fixtures of high wattage with pulse-start MH lamps which offer the advantages of standard (probe-start) MH lamps, but minimize the disadvantages. They produce higher light output both initially and over time, operate more efficiently, produce whiter light, and turn on and re-strike faster. See the attached lighting schedule in Appendix A for a complete inventory of lighting throughout the building and estimated power consumption. The labor in all these installations was evaluated using prevailing electrical contractor wages. The Borough of Palmyra 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.

Installation cost:

Estimated installed cost: $62,680 (includes $44,547 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
3.1	Install (30) occupancy sensors in offices and meeting room	RS Means, Lit Search	6,600	600	6,000	13,323	2.6	0	2.8	0	2,145	12	25,740	2.8	329	27	35	14,631	23,855
3.2	Replace (12) incandescent with CFLs	RS Means, Lit Search	420	None at this time	420	463	0.1	0	0.1	35	110	5	548	3.8	30	6	10	76	829
3.3	replace (19) incandescent Exit sign fixtures with LED Exit sign type	RS Means, Lit Search	3,515	380	3,135	3,995	0.8	0	0.8	70	713	15	10,698	4.4	241	16	22	5,094	7,153
3.4	Replace (250) T12 fixtures throughout the bldg with new T8 fixtures	RS Means, Lit Search	53,750	6,250	47,500	26,816	5.1	0	5.7	1,050	5,367	15	80,511	8.8	69	5	7	15,173	48,014
3.5	Replace (9) exterior Metal Halide fixtures with pulse start MH type	RS Means, Lit Search	5,850	225	5,625	1,813	0.3	0	0.4	240	532	15	7,978	10.6	42	3	5	614	3,246
	Totals		**70,135**	**7,455**	**62,680**	**46,410**	**8.9**	**0**	**9.8**	**1,395**	**8,867**	**-**	**125,475**	**7.1**	**100**	**-**	**11**	**35,588**	**83,097**

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 36 hrs/yr to replace aging burnt out lamps vs. newly installed.

Rebates/financial incentives:

- *NJ Clean Energy - Wall Mounted occupancy sensors ($20 per control) - Maximum incentive amount is $600.*
- *NJ Clean Energy - LED Exit Signs ($20 per fixture) - Maximum incentive amount is $380.*
  NJ Clean Energy - T8 lamps with electronic ballast in existing facilities ($10-30 per fixture, depending on quantity and lamps) Maximum incentive amount is $6,250.
- *NJ Clean Energy - Metal Halide with pulse start ($25 per fixture) - Maximum incentive amount is $225.*

Options for funding the Lighting ECM: *This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.* *http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings*

ECM#4: *Install Variable Frequency Drives on Motors of Building Loop Water Circulators*

Description:

The boiler room houses one set of two (2) pipe-mounted circulator supply pumps as part of as part of the building water loop system to serve the water source heat pumps listed in this report. Adding variable frequency drives (VFDs) to these two pumps will vary the flow according to the required heating and cooling requirements to better meet the load of the building. This recommendation will ensure that the retro-commissioning estimated savings (per ECM#5) are maintained and reproducible. Each supply pump is rated at 1 HP, and the two pumps operate simultaneously for 8,760 hours per year. The Palmyra Borough Hall will realize energy savings by utilizing variable frequency drives for the pump motors, and updating the Loop Temperature Controller programming to accommodate this new motor control method.

Installation cost:

Estimated installed cost: $4,500 (includes $1,575 of labor)
Source of cost estimate: RS Means Cost Data and Honeywell VFD Quick Savings Estimator

Economics (without incentives):

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
4	install VFDs on (2) 1 HP building water loop pumps	RS Means Cost Data & Honeywell VFD Quick Savings Estimator	4,500	none at this time	4,500	7,750	1.5	0	1.6	0	1,248	15	18,716	3.6	316	21	27	9,867	13,876

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. The Honeywell VFD Quick Savings Estimator was used with the assumption that both building water pumps operate simultaneously. According to the system operation, both pumps operate for 8,760 hours per year.

Rebates/financial incentives:

NJ Clean Energy rebates are not available for pump motors of less than 2 horsepower.

Options for funding ECM:

This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#5: *Retro-Commissioning*

Description:

Retro-commissioning is a process that seeks to improve how building equipment and systems function together. Depending on the age of the building, retro-commissioning can often resolve problems that occurred during design or construction and/or address problems that have developed throughout the building's life. Owners often undertake retro-commissioning to optimize building systems, reduce operating costs, and address comfort complaints from building occupants.

Since the systems at the Borough Hall have undergone some renovations in recent years, and the building continues to have concerns with thermal comfort control, SWA recommends undertaking retro-commissioning to optimize system operation as a follow-up to completion of the upgrades. The retro-commissioning process should include a review of existing operational parameters for both newer and older installed equipment. During retro-commissioning, the individual loop temperatures and (setback) schedules should also be reviewed to identify opportunities for optimizing system performance, besides air balancing and dampers' proper operation.

Installation cost:

Estimated installed cost: $20,125 (includes $17,106 of labor)
Source of cost estimate: Similar projects

Economics (without incentives):

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
5	Retro-commissioning	Similar projects	20,125	none at this time	20,125	13,727	2.6	419	5.5	1,820	4,519	12	54,231	4.5	169	14	20	23,573	29,191

Assumptions: Since the utility bills have some accounting fluctuations, it is difficult to determine the amount of energy used for heating and cooling the Borough Hall. Based on experience with similar buildings, SWA estimated the heating and cooling energy consumption. Typical savings for retro-commissioning range from 5-20%, as a percentage of the total space conditioning

consumption. SWA assumed 10% savings. Estimated costs for retro-commissioning range from $0.50-$2.00 per square foot. SWA assumed $1.25 per square foot of a total square footage of 16,100. SWA also assumed on the average 1 hr/wk operational savings when systems are operating per design vs. the need to make more frequent adjustments.

Rebates/financial incentives:

There aren't any current incentives for this measure at this time.

Options for funding ECM:

This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#6: Replace Boiler with Condensing Boiler(s)

Description:

The existing boiler is at the end of its useful life and is relatively inefficient as compared to modern condensing boilers. In addition, it is oversized compared to the needs of a water source heat pump system for this size building. This boiler should be replaced to achieve energy savings. The initial efficiency of the existing boiler is approximately 75%, but it can be assumed that in the time since its installation, it has degraded to an efficiency of about 65%. An upgrade to a condensing boiler of minimum 85% combustion efficiency can be justified by energy savings, and replacement should be considered along with upgrades to other portions of the heating system.

The new high efficiency condensing boilers should have a guaranteed minimum thermal efficiency of 85% at the worst case boiler operating conditions, such as mid-fire or high-fire conditions with a return water temperature in the range of 140-160 degrees Fahrenheit, and efficiencies of up to 95% achievable with lower return water temperatures. The boiler should be Low NOx certified with a 5:1 turndown burner, PVC direct venting and direct exhaust, hydronic safety controls and interface systems. The boiler shall have compact design for easy retrofit installation, with sectional aluminum block, ASME relief valve, stainless steel burner as a minimum. The air blower should be variable speed combustion with easily removable access panels.

Installation cost:

Estimated installed cost: $8,500 (includes $3,519 of labor)
Source of cost estimate: Manufacturer's data and 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
6	Replace Boiler with High Efficiency Condensing Boiler(s)	Similar projects	8,500	680	7,820	0	0.0	1,260	7.8	0	1,473	25	36,824	5.3	371	15	19	16,731	13,889

Assumptions: SWA calculated the savings for this measure using nameplate data taken on the days of the field visits and using the billing analysis. It was assumed that the existing boiler will be replaced with two (2) boilers of approximately 170 MBH each.

Rebates/financial incentives:

NJ Clean Energy – Gas-fired boilers <300 MBH ($2.00 per MBH but not less than $300 per unit)
Maximum incentive amount is $680.

Options for funding ECM:

This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#7: Replace Electric Domestic Water Heater with Direct Vent Gas Fired Unit

Description:

There is one (1) electric floor-mounted domestic water heater located in the Boiler Room that produces the domestic hot water for the nearby toilet rooms as well as the adjacent kitchen sink. The water heater utilizes a 40 gallon storage tank and. was installed in 1995 and is in fair condition. Based on the age and expected service life of 10-15 years, the Borough of Palmyra may wish to replace this heater with a more efficient gas fired heater and tank as part of a capital improvement plan.

Installation cost:

Estimated installed cost: $2,100 (includes $630 of labor)
Source of cost estimate: Manufacturer's data and similar projects

Economics (with incentives):

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
7	Replace (1) electric DHW Heater with a Natural Gas Direct Vent Model	Similar projects	2,150	50	2,100	3,050	0.6	-104	0.0	0	370	12	4,435	5.7	111	9	14	1,487	4,315

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. SWA estimated that the annual electric usage for the domestic water heating system approximately 3,050 kWh. The new high efficiency gas fired water heater would operate with an efficiency of approximately 95%.

Rebates/financial incentives:

NJ Clean Energy - Gas Water Heaters <50 Gal ($50 per water heater) - Maximum incentive amount is $50.

Options for funding ECM:

This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#8: *Replace Old Refrigerators with Energy Star Models*

Description:

On the day of the site visit, SWA observed that there (3) old refrigerators in the Police Department and Court office areas which were not Energy Star rated (using approximately 773 kWh/yr). Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. SWA recommends the replacement of the existing refrigerators with 18.2 cu. ft. top freezer refrigerators ENERGY STAR®, Mfr. model #6897, 407 kWh / yr, or equivalent. Besides saving energy, the replacement will also keep the surrounding area cooler. When compared to the average electrical consumption of older equipment, Energy Star equipment results in large savings. Look for the Energy Star label when replacing appliances and equipment, including: window air conditioners, 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.

Installation cost:

Estimated installed cost: $2,250 (includes $210 of labor)
Source of cost estimate: *Manufacturer and Store 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
8a	replace (3) old (PD and Court) refrigerators with 18 cu ft models in kind	Energy Star purchasing and procurement site, similar projects	2,100	0	2,100	150	0.0	0	0.0	150	174	12	2,090	12.1	0	0	0	-375	269
8b	incremental difference to replace (3) old (PD and Court) refrigerators with 18 cu ft Energy Star models	Energy Star purchasing and procurement site, similar projects	150	0	150	900	0.2	0	0.2	0	145	12	1,739	1.0	1059	88	97	1,236	1,611
8 (a+b)	replace (3) old (PD and Court) refrigerators with 18 cu ft Energy Star models	Energy Star purchasing and procurement site, similar projects	2,250	0	2,250	1,050	0.2	0	0.2	150	319	12	3,829	7.1	70	6	9	861	1,880

Assumptions: SWA calculated the savings for this measure using measurements taken the day of the field visit and using the billing analysis.

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 enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#9: *Install 14.4 kW PV System*

Description:

Currently the Borough Hall does not use any renewable energy systems. Renewable energy systems such as photovoltaic panels, can be mounted on the building roofs, and can offset a portion of the purchased electricity for the building. Power stations generally have two separate electrical charges: usage and demand. Usage is the amount of electricity in kilowatt-hours that a building uses from month to month. Demand is the amount of electrical power that a building uses at any given instance in a month's period. During the summer periods, when electric demand at a power station is high due to the amount of air conditioners, lights, equipment, etc… being used within the region, demand charges go up to offset the utility's cost to provide enough electricity at that given time. Photovoltaic systems not only offset the amount of electricity use by a building, but also reduce the building's electrical demand, resulting in a higher cost savings as well. It is recommended at this time that the Borough Hall further review installing a 14.4 kW PV system to offset electrical demand and reduce the annual net electric consumption for the building, and review guaranteed incentives from NJ rebates to justify the investment. The Borough Hall may consider applying for a grant and/or engage a PV generator/leaser who would install the PV system and then sell the power at a reduced rate. PSE&G provides the ability to buy SREC's at $600/MWh or best market offer.

The building has a flat roof which can accommodate a 14.4 kW PV installation. A commercial crystalline 230 watt panel has 17.5 square feet of surface area (13.1 watts per square foot). A 14.4 kW system needs approximately 63 panels which would take up 1,096 square feet. The installation of a renewable Solar Photovoltaic power generating system could serve as a good educational tool and exhibit for the community.

Installation cost:

Estimated installed cost: $93,600 (including $37,440 total labor cost)
Source of cost estimate: Similar projects

Economics (with incentives):

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
9	Install 14.4 kW PV with Incentives	Similar Projects	108,000	14,400	93,600	16,998	14.4	0	3.6	0	12,937	25	221,416	7.2	1	0	11	70,768	30,434

Assumptions: SWA estimated the cost and savings of the system based on past PV projects. SWA projected physical dimensions based on a typical Polycrystalline Solar Panel (230 Watts, model #ND-U230C1). PV systems are sized based on Watts and physical dimensions for an array will differ with the efficiency of a given solar panel (W/sq ft).

Rebates/financial incentives:

NJ Clean Energy - Renewable Energy Incentive Program, Incentive based on $1.00 / watt Solar PV application for systems 50 kW or less. Incentive amount for this application is $14,400 for the proposed option.

http://www.njcleanenergy.com/renewable-energy/programs/renewable-energy-incentive-program

NJ Clean Energy - Solar Renewable Energy Certificate Program. Each time a solar electric system generates 1,000kWh (1MWh) of electricity, a SREC is issued which can then be sold or traded separately from the power. The buildings must also become net-metered in order to earn SRECs as well as sell power back to the electric grid. A total annual SREC credit of $10,200 has been incorporated in the above costs, however it requires proof of performance, application approval and negotiations with the utility.

Options for funding ECM:

This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

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:

Pleases see the above recommended ECM#9.

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 cooling systems and insufficient domestic hot water use.

5.6. Geothermal

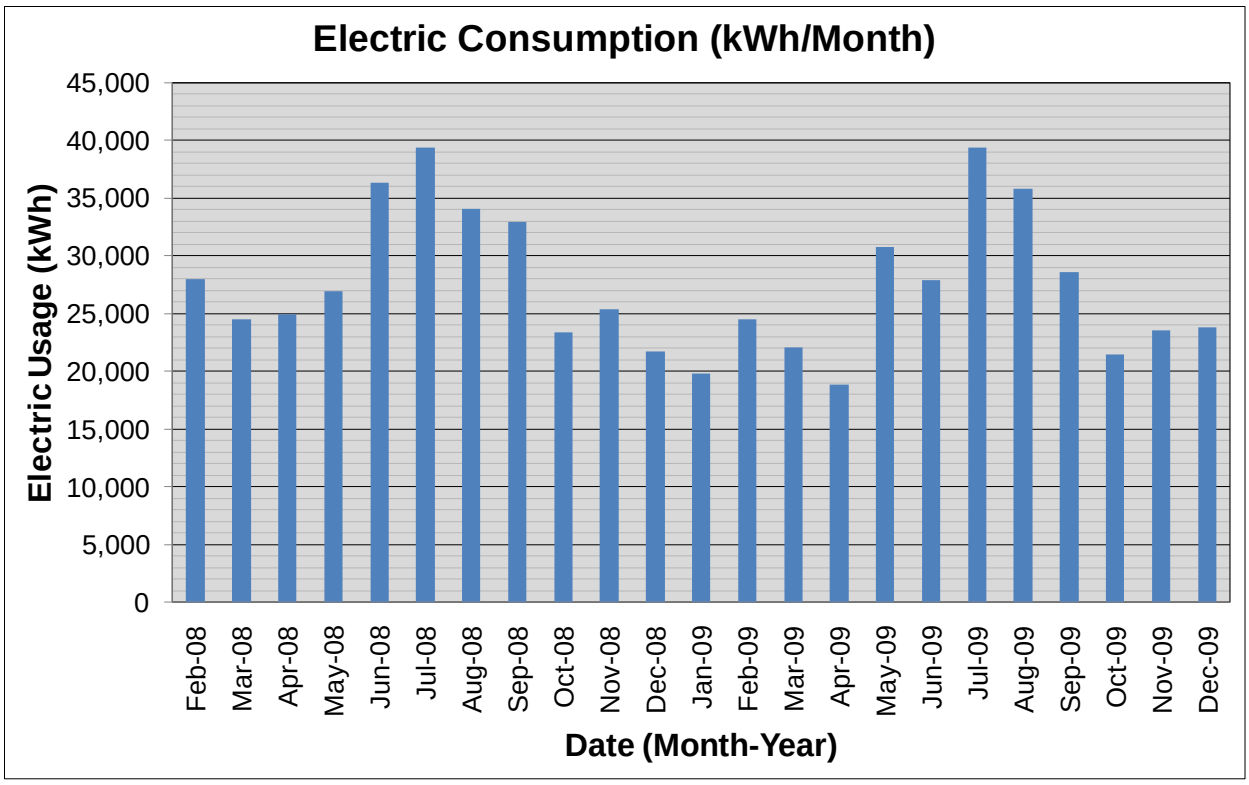
Description:

Geothermal is not applicable for this building due to the significant service life remaining on the fluid coolers and the noise issues associated with this type of system, being similar to the existing water source heat pump system in the building. A geothermal project would entail the expenses of new wells for the geothermal loops, pumps and new electric heat pump terminal equipment. See Capital Improvements section above.

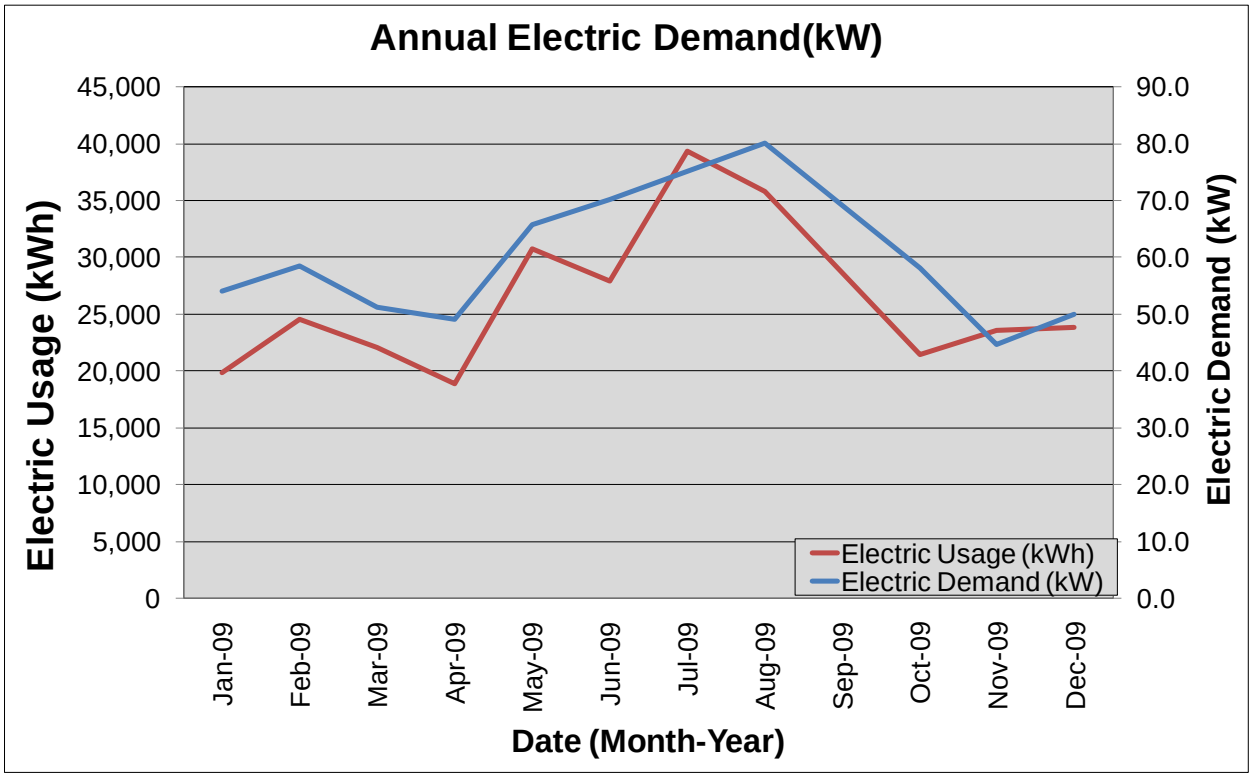
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Load Profiles

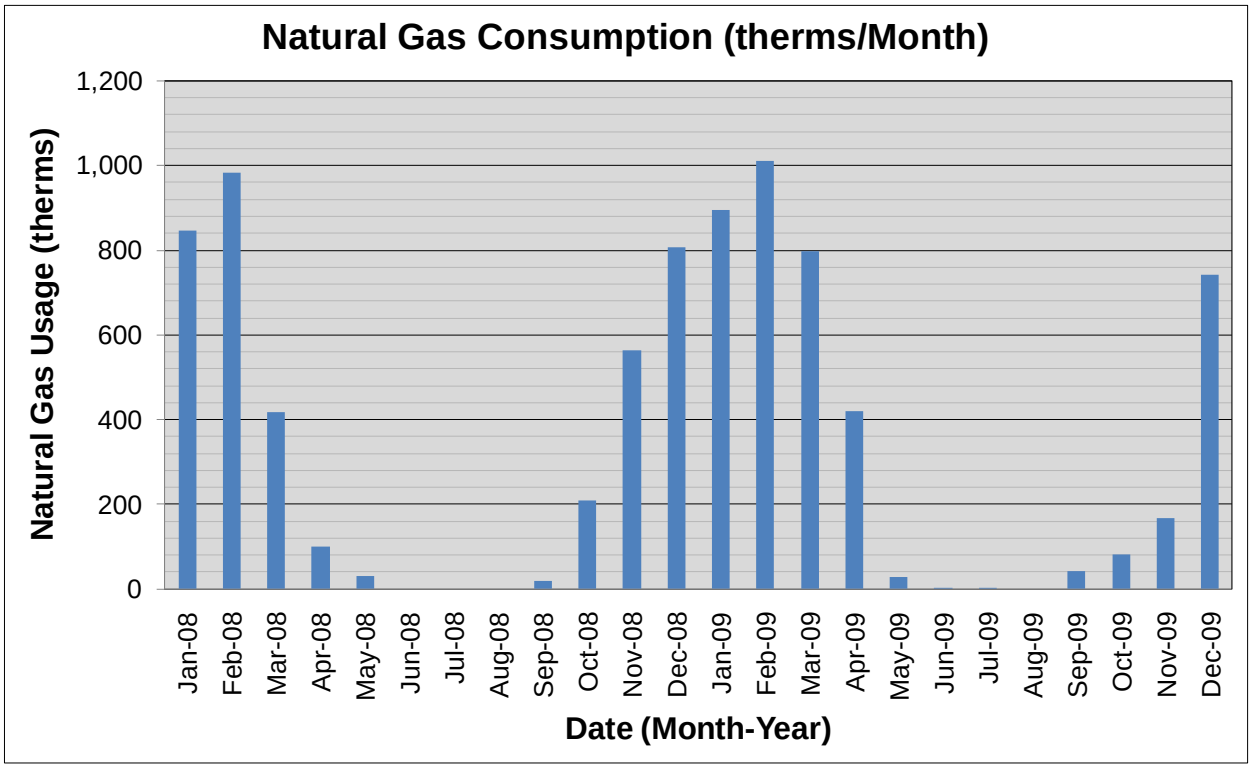
The following are charts that show the annual electric and natural gas load profiles for the Palmyra Borough Hall. For annual electric and natural gas usage please also see Section 1 Historic Energy Consumption.

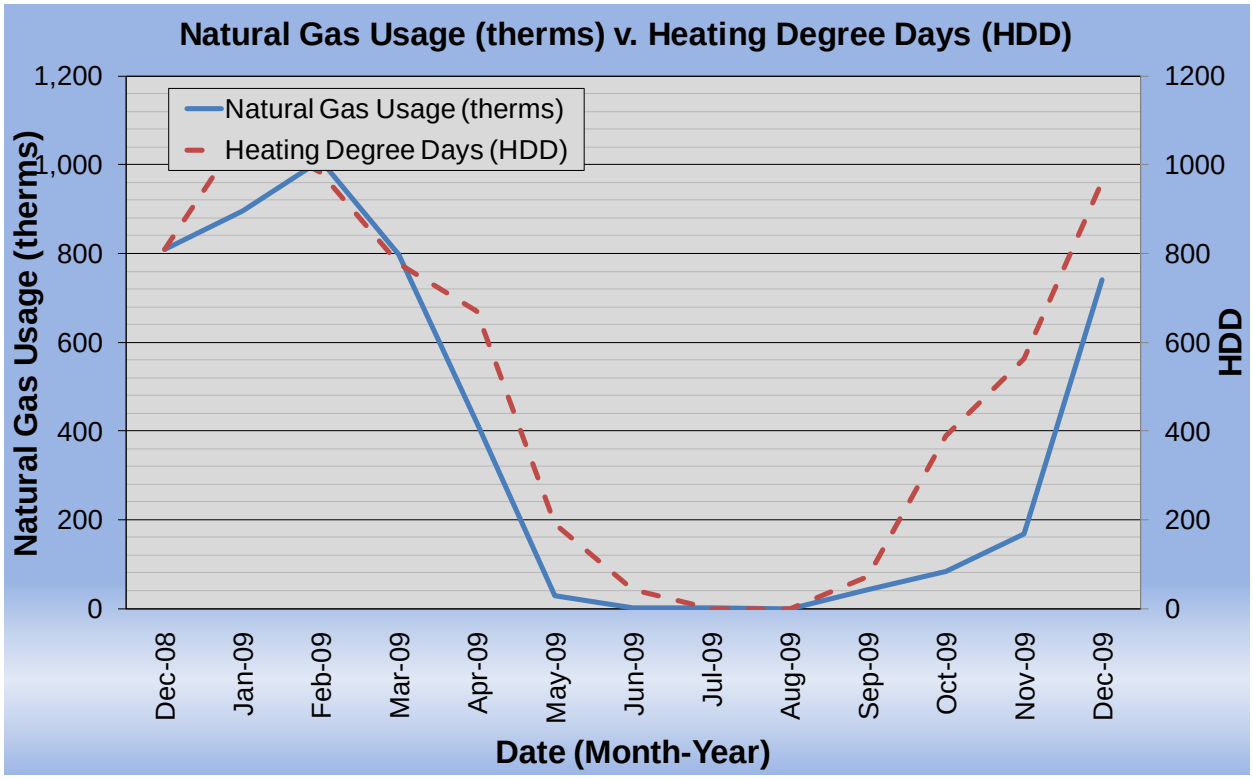


Some minor unusual electric fluctuations shown may be due to adjustments between estimated and actual meter readings. Also, note on the following chart how the electrical Demand peaks (except for a few unusual fluctuation anomalies) follow the electrical consumption peaks.



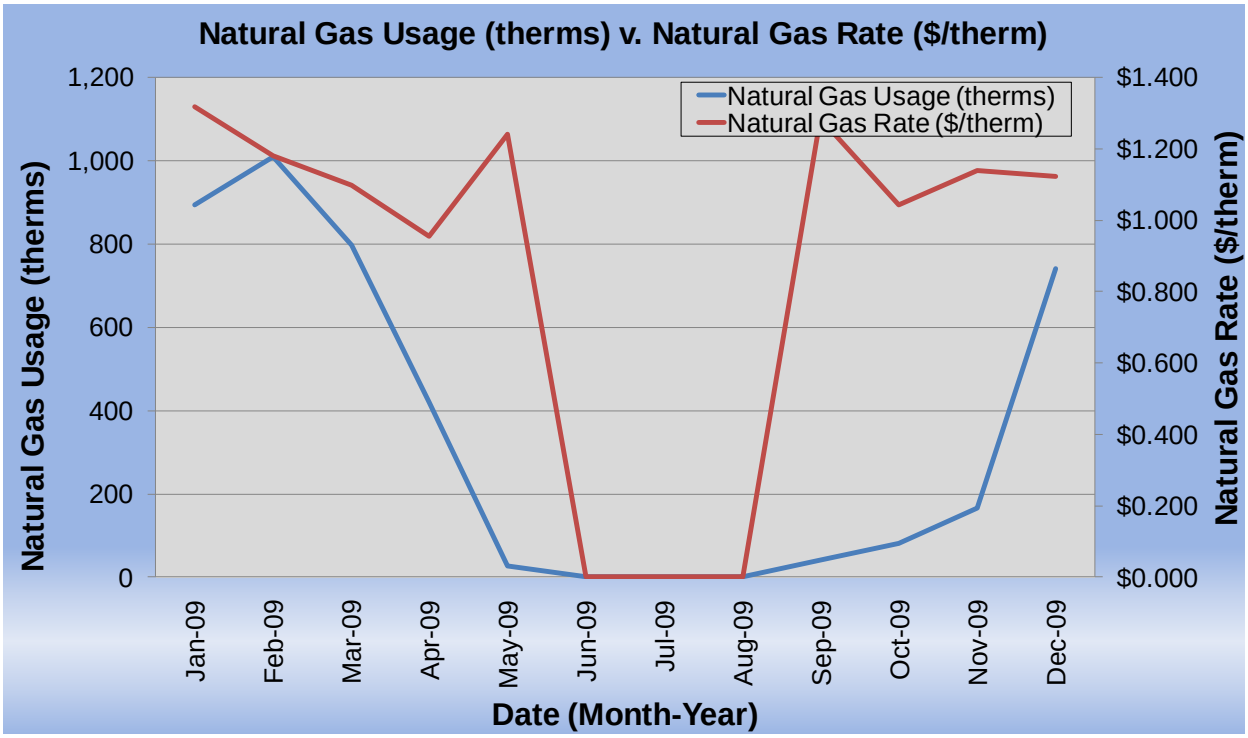
The following is a chart of the natural gas load profile for the building, peaking in the coldest months of the year and a chart showing natural gas consumption following the “heating degree days” curve. Some utility bills have more than one month estimated and combined.



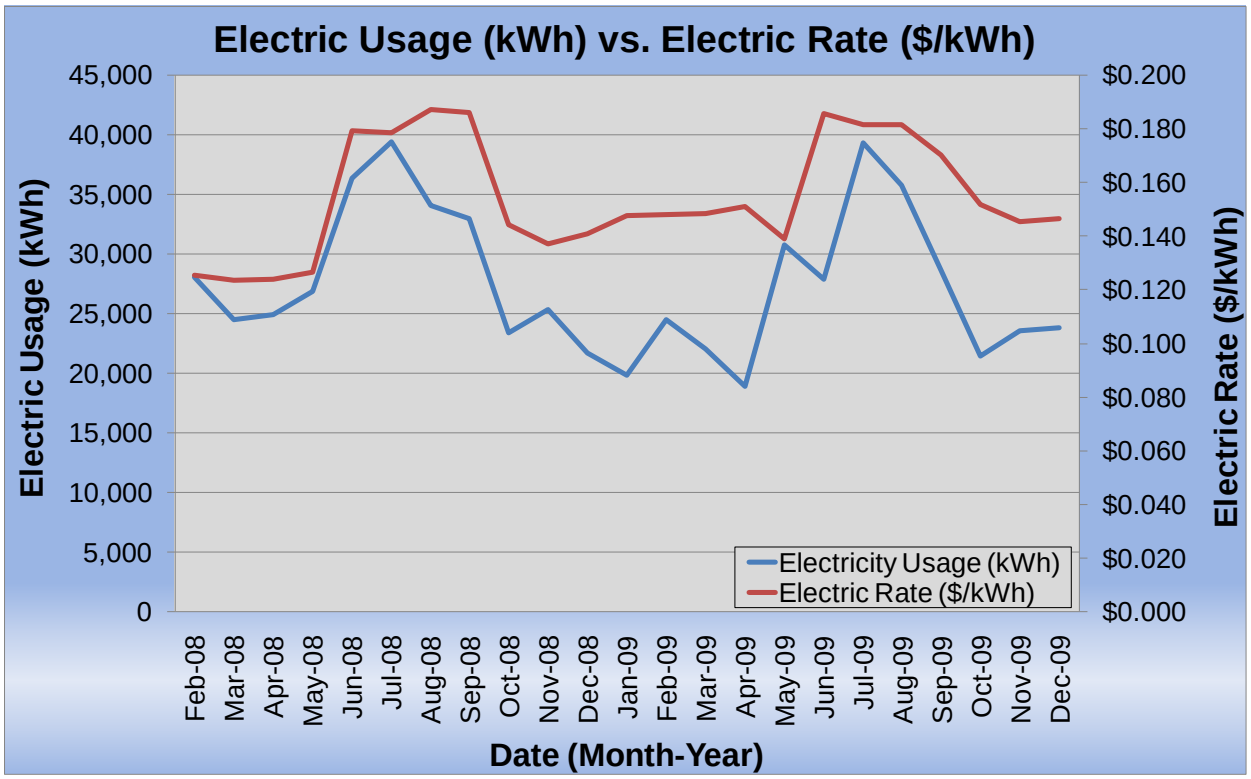


6.2. Tariff Analysis

Currently, natural gas is provided to the Borough Hall via one gas meter with the PSE&G acting as the supply and also the transport company. Gas is provided by the 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 Borough Hall 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 boiler. Some high gas price per therm fluctuations in the summer may be due to high energy costs that recently occurred and low use minimum payments 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 Borough Hall is direct-metered and currently purchases electricity from the PSE&G at a general service rate. The general service rate for electric charges is market-rate based on use and the Borough Hall 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 air conditioning systems.

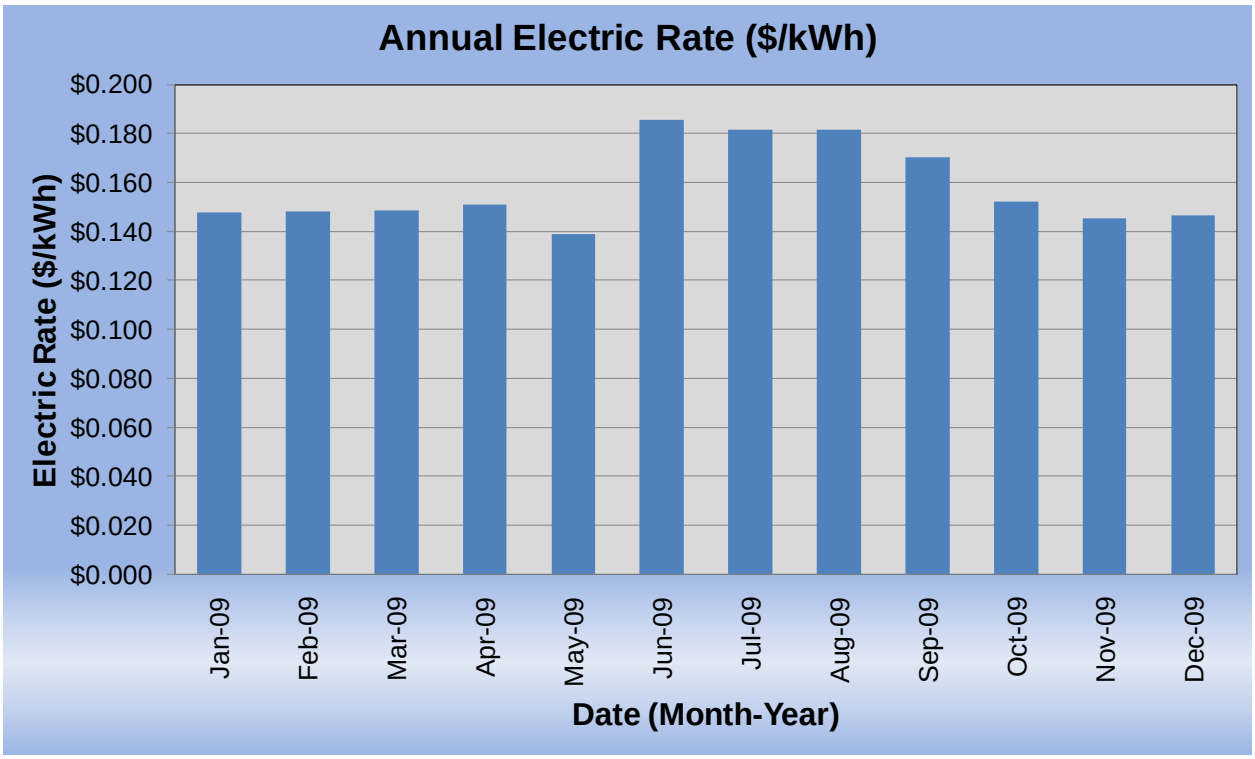


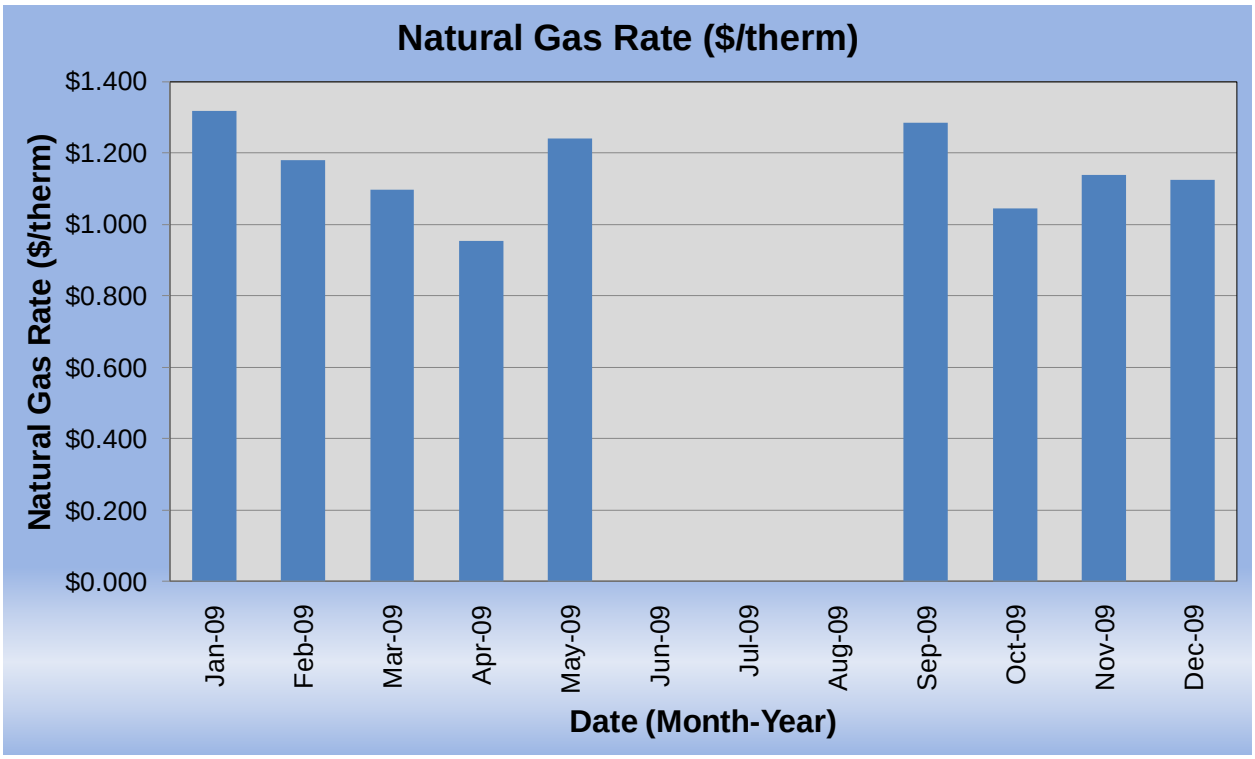
6.3. Energy Procurement strategies

The Borough Hall 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 Borough Hall from PSE&G without an ESCO. SWA analyzed the utility rate for natural gas and electricity supply over an extended period. Electric bill analysis shows fluctuations up to 34% over the most recent 12 month period. Natural gas bill analysis shows fluctuations up to 32% 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 have been 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 Borough Hall annual natural gas costs are competitive and the electric costs are $3,341 higher when compared to the average estimated NJ commercial utility rates. SWA recommends that the Borough of Palmyra 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 Borough Hall. Appendix B contains a complete list of third party energy suppliers for the Borough of Palmyra service area. The Borough of Palmyra 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 Borough Hall 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. There is however a plan to install a bigger natural gas driven generator to be shared with the future Community Center. The following chart show the Borough Hall monthly electric and natural gas spending per unit of energy in 2009.





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	B	Boiler Rm	Recessed	M	4'T12	5	2	40	S	1	260	15	475	124	T8	Recessed	4'T8	E	S	5	2	32	1	260	6	350	91	33	0	33
2	B	Staircase	Recessed	M	2'T12	1	2	20	S	1	260	16	56	15	T8	Recessed	2'T8	E	S	1	2	17	1	260	3	37	10	5	0	5
3	B	Staircase	Screw-in	M	Inc	1	1	60	S	1	260	0	60	16	CFL	Screw-in	CFL	M	S	1	1	20	1	260	0	20	5	10	0	10
4	B	Boiler Rm	Recessed	M	4'T12	1	3	40	S	24	365	20	140	1,226	T8	Recessed	4'T8	E	OS	1	3	32	18	365	10	106	696	298	232	530
5	B	Kitchen	Recessed	M	4'T12	4	4	40	S	24	365	24	736	6,447	T8	Recessed	4'T8	E	OS	4	4	32	18	365	13	564	3705	1507	1235	2742
6	B	Hallway	Exit Sign	N	Inc	1	2	15	N	24	365	0	30	263	LEDex	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	210	0	210
7	B	Storage Rm	Recessed	M	4'T12	1	2	40	S	1	260	15	95	25	T8	Recessed	4'T8	E	S	1	2	32	1	260	6	70	18	7	0	7
8	B	Records Rm	Recessed	M	4'T12	3	4	40	S	16	365	24	552	3,224	T8	Recessed	4'T8	E	OS	3	4	32	12	365	13	423	1853	753	618	1371
9	B	Evidence Rm	Recessed	M	4'T12	5	2	40	S	1	260	15	475	124	T8	Recessed	4'T8	E	S	5	2	32	1	260	6	350	91	33	0	33
10	B	Training Rm	Recessed	M	4'T12	3	3	40	S	1	260	20	420	109	T8	Recessed	4'T8	E	S	3	3	32	1	260	10	318	83	27	0	27
11	B	Amo Closet	Screw-in	M	Inc	1	1	65	S	1	260	0	65	17	CFL	Screw-in	CFL	M	S	1	1	20	1	260	0	20	5	12	0	12
12	B	Hallway	Recessed	M	4'T12	1	3	40	S	24	365	20	140	1,226	T8	Recessed	4'T8	E	S	1	3	32	24	365	10	106	929	298	0	298
13	B	Hallway	2'U-shape	M	4'T12	17	2	40	S	24	365	15	1,615	14,147	T8	2'U-Shape	4'T8	E	S	17	2	32	24	365	6	1190	10424	3723	0	3723
14	B	Hallway	Exit Sign	N	Inc	5	2	15	N	24	365	0	150	1,314	LEDex	Exit Sign	LED	N	N	5	1	5	24	365	1	30	263	1051	0	1051
15	B	Sally Port	Recessed	M	8'T12	1	2	80	S	1	260	35	195	51	T8	Recessed	8'T8	E	S	1	2	59	1	260	13	131	34	17	0	17
16	B	Men's Locker Room	Recessed	M	4'T12	3	3	40	S	24	365	20	420	3,679	T8	Recessed	4'T8	E	OS	3	3	32	18	365	10	318	2089	894	696	1590
17	B	Men's Locker Room	Recessed	E	2'T8	2	2	17	S	24	365	3	74	648	C	Recessed	2'T8	E	OS	2	2	17	18	365	3	74	486	0	162	162
18	B	Women's Locker Room	Recessed	E	2'T8	1	2	17	S	24	365	3	37	324	C	Recessed	2'T8	E	OS	1	2	17	18	365	3	37	243	0	81	81
19	B	Women's Locker Room	Recessed	M	4'T12	1	3	40	S	24	365	20	140	1,226	T8	Recessed	4'T8	E	OS	1	3	32	18	365	10	106	696	298	232	530
20	B	Men's Locker Room	Screw-in	M	Inc	1	1	60	S	1	260	0	60	16	CFL	Screw-in	CFL	M	S	1	1	20	1	260	0	20	5	10	0	10
21	B	Women's Locker Room	Screw-in	M	Inc	1	1	60	S	8	260	0	60	125	CFL	Screw-in	CFL	M	S	1	1	20	8	260	0	20	42	83	0	83
22	B	Interogation Rm	Recessed	M	4'T12	2	4	40	S	2	260	24	368	191	T8	Recessed	4'T8	E	S	2	4	32	2	260	13	282	147	45	0	45
23	B	Women's Locker Room	2'U-shape	M	4'T12	1	2	40	S	24	365	15	95	832	T8	2'U-Shape	4'T8	E	OS	1	2	32	18	365	6	70	460	219	153	372
24	B	Cell #1	Recessed	M	4'T12	1	1	40	S	1	260	12	52	14	T8	Recessed	4'T8	E	S	1	1	32	1	260	3	35	9	4	0	4
25	B	Cell #2	Recessed	M	4'T12	1	1	40	S	1	260	12	52	14	T8	Recessed	4'T8	E	S	1	1	32	1	260	3	35	9	4	0	4
26	B	Cell Hallway	Recessed	M	4'T12	2	1	40	S	1	260	12	104	27	T8	Recessed	4'T8	E	S	2	1	32	1	260	3	70	18	9	0	9
27	B	Detective's Office	Recessed	M	4'T12	4	4	40	S	16	365	24	736	4,298	T8	Recessed	4'T8	E	OS	4	4	32	12	365	13	564	2470	1004	823	1828
28	B	ID Rm	Recessed	M	4'T12	4	4	40	S	20	365	24	736	5,373	T8	Recessed	4'T8	E	OS	4	4	32	15	365	13	564	3088	1256	1029	2285
29	B	ID Rm	Recessed	M	4'T12	1	2	40	S	20	365	15	95	694	T8	Recessed	4'T8	E	S	1	2	32	20	365	6	70	511	183	0	183
30	B	Computer Rm	Recessed	M	4'T12	4	4	40	S	24	365	24	736	6,447	T8	Recessed	4'T8	E	OS	4	4	32	18	365	13	564	3705	1507	1235	2742
31	B	Sergeant Off #1	Recessed	M	4'T12	2	4	40	S	12	365	24	368	1,612	T8	Recessed	4'T8	E	OS	2	4	32	9	365	13	282	926	377	309	685
32	B	Sergeant Off #2	Recessed	M	4'T12	2	4	40	S	12	365	24	368	1,612	T8	Recessed	4'T8	E	OS	2	4	32	9	365	13	282	926	377	309	685
33	B	Chief	Recessed	M	4'T12	4	4	40	S	12	365	24	736	3,224	T8	Recessed	4'T8	E	OS	4	4	32	9	365	13	564	1853	753	618	1371
34	B	Lieutenant	Recessed	M	4'T12	2	4	40	S	12	365	24	368	1,612	T8	Recessed	4'T8	E	OS	2	4	32	9	365	13	282	926	377	309	685
35	B	Secretary	Recessed	M	4'T12	2	4	40	S	12	365	24	368	1,612	T8	Recessed	4'T8	E	OS	2	4	32	9	365	13	282	926	377	309	685
36	B	Radio Rm	Recessed	M	4'T12	3	4	40	S	12	365	24	552	2,418	T8	Recessed	4'T8	E	OS	3	4	32	9	365	13	423	1390	565	463	1028
37	B	Rear Stairway	2'U-shape	M	4'T12	2	2	40	S	24	365	15	190	1,664	T8	2'U-Shape	4'T8	E	S	2	2	32	24	365	6	140	1226	438	0	438
38	B	Police lobby	2'U-shape	M	4'T12	5	2	40	S	24	365	15	475	4,161	T8	2'U-Shape	4'T8	E	S	5	2	32	24	365	6	350	3066	1095	0	1095
39	B	Elevator	Recessed	M	4'T12	2	2	40	S	2	365	15	190	139	T8	Recessed	4'T8	E	S	2	2	32	2	365	6	140	102	37	0	37
40	B	Elevator Mech. Rm	Recessed	M	4'T12	1	3	40	S	1	365	20	140	51	T8	Recessed	4'T8	E	S	1	3	32	1	365	10	106	39	12	0	12
41	B	Restroom	Recessed	E	2'T8	2	2	17	S	12	365	3	74	324	N/A	Recessed	2'T8	E	S	2	2	17	12	365	3	74	324	0	0	0
42	B	Janitor's Closet	Recessed	M	4'T12	1	4	40	S	2	260	24	184	96	T8	Recessed	4'T8	E	S	1	4	32	2	260	13	141	73	22	0	22
43	B	Pump Rm	Recessed	M	4'T12	2	2	40	S	1	260	15	190	49	T8	Recessed	4'T8	E	S	2	2	32	1	260	6	140	36	13	0	13
44	B	Bottom Stairs	Exit Sign	N	Inc	1	2	15	N	24	365	0	30	263	LEDex	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	210	0	210
45	1	Entrance	Exit Sign	N	Inc	3	2	15	N	24	365	0	90	788	LEDex	Exit Sign	LED	N	N	3	1	5	24	365	1	18	158	631	0	631
46	GF	Hallway	2'U-shape	M	4'T12	11	2	40	S	12	260	15	1,045	3,260	T8	2'U-Shape	4'T8	E	S	11	2	32	12	260	6	770	2402	858	0	858
47	1	Entrance	Recessed	E	4'T8	2	2	32	S	2	260	6	140	73	N/A	Recessed	4'T8	E	S	2	2	32	2	260	6	140	73	0	0	0
48	1	Const Hallway	Recessed	M	4'T12	3	3	40	S	12	260	20	420	1,310	T8	Recessed	4'T8	E	S	3	3	32	12	260	10	318	992	318	0	318
49	1	Const Reception	Recessed	M	4'T12	6	4	40	S	12	260	24	1,104	3,444	T8	Recessed	4'T8	E	OS	6	4	32	9	260	13	846	1980	805	660	1465
50	1	Fire Marshall	Recessed	M	4'T12	4	4	40	S	12	260	24	736	2,296	T8	Recessed	4'T8	E	OS	4	4	32	9	260	13	564	1320	537	440	977

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)
51	1	Back Hallway	Recessed	E	4'T8	2	2	32	S	8	260	6	140	291	N/A	Recessed	4'T8	E	S	2	2	32	8	260	6	140	291	0	0	0
52	1	Records Storage	Recessed	M	4'T12	3	4	40	S	1	260	24	552	144	T8	Recessed	4'T8	E	S	3	4	32	1	260	13	423	110	34	0	34
53	1	Storage	Recessed	M	4'T12	2	2	40	S	1	260	15	190	49	T8	Recessed	4'T8	E	S	2	2	32	1	260	6	140	36	13	0	13
54	1	Meeting Rm	Recessed	M	4'T12	6	4	40	S	8	260	24	1,104	2,296	T8	Recessed	4'T8	E	OS	6	4	32	6	260	13	846	1320	537	440	977
55	1	Tax Collector	Recessed	M	4'T12	2	4	40	S	1	260	24	368	96	T8	Recessed	4'T8	E	S	2	4	32	1	260	13	282	73	22	0	22
56	1	Maint Closet	2'U-shape	M	4'T12	1	2	40	S	1	260	15	95	25	T8	2'U-Shape	4'T8	E	S	1	2	32	1	260	6	70	18	7	0	7
57	1	Men's Restroom	Recessed	M	4'T12	2	3	40	S	12	260	20	280	874	T8	Recessed	4'T8	E	OS	2	3	32	9	260	10	212	496	212	165	378
58	1	Women's Restroom	Recessed	M	4'T12	2	3	40	S	12	260	20	280	874	T8	Recessed	4'T8	E	OS	2	3	32	9	260	10	212	496	212	165	378
59	1	Hallway	2'U-shape	M	4'T12	15	2	40	S	12	260	15	1,425	4,446	T8	2'U-Shape	4'T8	E	S	15	2	32	12	260	6	1050	3276	1170	0	1170
60	1	Payroll	Recessed	M	4'T12	4	4	40	S	8	260	24	736	1,531	T8	Recessed	4'T8	E	OS	4	4	32	6	260	13	564	880	358	293	651
61	1	Court Office	Recessed	M	4'T12	9	4	40	S	8	260	24	1,656	3,444	T8	Recessed	4'T8	E	OS	9	4	32	6	260	13	1269	1980	805	660	1465
62	1	Storage Rm	Recessed	M	4'T12	2	3	40	S	8	260	20	280	582	T8	Recessed	4'T8	E	S	2	3	32	8	260	10	212	441	141	0	141
63	1	Tax Office	Recessed	M	4'T12	7	4	40	S	8	260	24	1,288	2,679	T8	Recessed	4'T8	E	OS	7	4	32	6	260	13	987	1540	626	513	1139
64	1	Safe	Recessed	E	4'T8	1	2	32	S	8	260	6	70	146	N/A	Recessed	4'T8	E	S	1	2	32	8	260	6	70	146	0	0	0
65	1	CFO's office	Recessed	M	4'T12	4	4	40	S	8	260	24	736	1,531	T8	Recessed	4'T8	E	OS	4	4	32	6	260	13	564	880	358	293	651
66	1	Printing Rm	Recessed	M	4'T12	2	4	40	S	8	260	24	368	765	T8	Recessed	4'T8	E	S	2	4	32	8	260	13	282	587	179	0	179
67	1	Borough Clerk	Recessed	M	4'T12	4	4	40	S	8	260	24	736	1,531	T8	Recessed	4'T8	E	OS	4	4	32	6	260	13	564	880	358	293	651
68	1	Hallway	Exit Sign	N	Inc	3	2	15	N	24	365	0	90	788	LEDex	Exit Sign	LED	N	N	3	1	5	24	365	1	18	158	631	0	631
69	1	Storage Rm	Recessed	M	4'T12	2	4	40	S	8	260	24	368	765	T8	Recessed	4'T8	E	OS	2	4	32	6	260	13	282	440	179	147	326
70	1	Kitchen	2'U-shape	M	4'T12	4	2	40	S	8	260	15	380	790	T8	2'U-Shape	4'T8	E	OS	4	2	32	6	260	6	280	437	208	146	354
71	1	Old Payroll	Recessed	M	4'T12	4	4	40	S	8	260	24	736	1,531	T8	Recessed	4'T8	E	OS	4	4	32	6	260	13	564	880	358	293	651
72	1	Closet	Recessed	M	4'T12	1	3	40	S	1	260	20	140	36	T8	Recessed	4'T8	E	S	1	3	32	1	260	10	106	28	9	0	9
73	1	Mayor's Office	2'U-shape	M	4'T12	6	2	40	S	4	260	15	570	593	T8	2'U-Shape	4'T8	E	S	6	2	32	4	260	6	420	437	156	0	156
74	1	Rear Exit	2'U-shape	M	4'T12	2	2	40	S	24	365	15	190	1,664	T8	2'U-Shape	4'T8	E	S	2	2	32	24	365	6	140	1226	438	0	438
75	1	Kitchen	2'U-shape	M	4'T12	4	2	40	S	8	260	15	380	790	T8	2'U-Shape	4'T8	E	S	4	2	32	8	260	6	280	582	208	0	208
76	2	Hallway	2'U-shape	M	4'T12	17	2	40	S	3	260	15	1,615	1,260	T8	2'U-Shape	4'T8	E	S	17	2	32	3	260	6	1190	928	332	0	332
77	2	Council Chambers	2'U-shape	M	4'T12	6	2	40	S	1	260	15	570	148	T8	2'U-Shape	4'T8	E	S	6	2	32	1	260	6	420	109	39	0	39
78	2	AHU Rm	Screw-in	N	Inc	3	1	75	S	4	260	0	225	234	CFL	Screw-in	CFL	N	S	3	1	25	4	260	0	75	78	156	0	156
79	2	Court Rm	Recessed	M	4'T12	15	4	40	S	3	260	24	2,760	2,153	T8	Recessed	4'T8	E	S	15	4	32	3	260	13	2115	1650	503	0	503
80	2	Judge's Chamber	Recessed	M	4'T12	2	2	40	S	3	260	15	190	148	T8	Recessed	4'T8	E	S	2	2	32	3	260	6	140	109	39	0	39
81	2	Court Back Rm	Screw-in	N	Inc	1	1	100	S	3	260	0	100	78	CFL	Screw-in	CFL	N	S	1	1	35	3	260	0	35	27	51	0	51
82	2	Staircase	Exit Sign	N	Inc	3	2	15	N	24	365	0	90	788	LEDex	Exit Sign	LED	N	N	3	1	5	24	365	1	18	158	631	0	631
83	2	Court Rm	Exit Sign	N	Inc	2	2	15	N	24	365	0	60	526	LEDex	Exit Sign	LED	N	N	2	1	5	24	365	1	12	105	420	0	420
84	2	Staircase	Circline	M	2'T12	1	1	24	S	3	260	8	32	25	T8	Circline	2'T8	E	S	1	1	20	3	260	4	24	19	6	0	6
85	2	Staircase	Screw-in	N	Inc	1	1	60	S	3	260	0	60	47	CFL	Screw-in	CFL	N	S	1	1	20	3	260	0	20	16	31	0	31
86	R	Attic	Screw-in	N	Inc	2	1	75	S	1	260	0	150	39	CFL	Screw-in	CFL	N	S	2	1	25	1	260	0	50	13	26	0	26
87	2	Main Stairs	Exit Sign	N	Inc	1	2	15	N	24	365	0	30	263	LEDex	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	210	0	210
88	2	Clock Twr bot rm	2'U-shape	M	4'T12	1	2	40	S	1	260	15	95	25	T8	2'U-Shape	4'T8	E	S	1	2	32	1	260	6	70	18	7	0	7
89	2	Stairs	2'U-shape	M	4'T12	1	2	40	S	12	260	15	95	296	T8	2'U-Shape	4'T8	E	S	1	2	32	12	260	6	70	218	78	0	78
90	Ext	Main Entrance	Recessed	M	4'T12	1	2	40	S	16	365	15	95	555	T8	Recessed	4'T8	E	S	1	2	32	16	365	6	70	409	146	0	146
91	Ext	Flagpoles	Exterior	E	MH	2	1	100	PC	12	365	25	250	1,095	PSMH	Exterior	PSMH	E	PC	2	1	65	12	365	14	158	692	403	0	403
92	Ext	Outside Doors	Exterior	E	MH	4	1	100	PC	12	365	25	500	2,190	PSMH	Exterior	PSMH	E	PC	4	1	65	12	365	14	316	1384	806	0	806
93	Ext	Flood Lights	Exterior	E	MH	3	1	100	PC	12	365	25	375	1,643	PSMH	Exterior	PSMH	E	PC	3	1	65	12	365	14	237	1038	604	0	604
94	Ext	Entrance	Exterior	N	Inc	1	1	60	S	8	260	0	60	125	CFL	Exterior	CFL	N	S	1	1	20	8	260	0	20	42	83	0	83
Totals:						**300**	**237**	**3,906**				**1,425**	**37,247**	**122,143**						**300**	**229**	**2,763**			**711**	**27,441**	**75,733**	**33,087**	**13,323**	**46,410**

Rows Highlighed Yellow Indicate an Energy Conservation Measure is recommended for that space

Legend:

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

Proposed Lighting Summary Table			
	16,100		
Average Power Cost ($/kWh)	0.1610		
Exterior Lighting	**Existing**	**Proposed**	**Savings**
Exterior Annual Consumption (kWh)	5,607	3,565	**2,043**
Exterior Power (watts)	1,280	801	**479**
Internal Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	116,536	72,169	**46,410**
Lighting Power (watts)	35,967	26,640	**9,327**
Lighting Power Density (watts/SF)	2.23	1.65	**0.58**
Estimated Cost of Fixture Replacement ($)	**56,680**		
Estimated Cost of Controls Improvements ($)	**6,600**		
Total Consumption Cost Savings ($)	**9,609**		

Appendix B: Third Party Energy Suppliers (ESCOs)

http://www.state.nj.us/bpu/commercial/shopping.html

PSE&G ELECTRICAL SERVICE TERRITORY Last Updated: 06/15/09		
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095 (800) 437-7872 www.hess.com	**BOC Energy Services, Inc.** 575 Mountain Avenue Murray Hill, NJ 07974 (800) 247-2644 www.boc.com	**Commerce Energy, Inc.** 4400 Route 9 South, Suite 100 Freehold, NJ 07728 (800) 556-8457 www.commerceenergy.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446 (888) 635-0827 www.newenergy.com	**Direct Energy Services, LLC** 120 Wood Avenue Suite 611 Iselin, NJ 08830 (866) 547-2722 www.directenergy.com	**FirstEnergy Solutions Corp.** 300 Madison Avenue Morristown, NJ 07962 (800) 977-0500 www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640 (877) 569-2841 www.glacialenergy.com	**Integrys Energy Services, Inc.** 99 Wood Ave, South, Suite 802 Iselin, NJ 08830 (877) 763-9977 www.integrysenergy.com	**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	**Pepco Energy Services, Inc.** 112 Main St. Lebanon, NJ 08833 (800) ENERGY-9 (363-7499) www.pepco-services.com	**PPL EnergyPlus, 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 www.semprasolutions.com	**South Jersey Energy Company** One South Jersey Plaza Route 54 Folsom, NJ 08037 (800) 800-756-3749 www.south jerseyenergy.com	**Suez Energy Resources NA, Inc.** 333 Thornall Street 6th Floor Edison, NJ 08837 (888) 644-1014 www.suezenergyresources.com
UGI Energy Services, Inc. 704 East Main Street Suite 1 Moorestown, NJ 08057 (856) 273-9995 www.ugienergyservices.com		

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 Borough, 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 expresses 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.

Gas Rate and Electric Rate ($/therm and $/kWh): The gas rate and electric rate used in the financial analysis is the total annual energy cost divided by the total annual energy usage for the 12 month billing period studied. The graphs of the monthly gas and electric rates reflect the total monthly energy costs divided by the monthly usage, and display how the average rate fluctuates throughout the year. The average annual rate is the only rate used in energy savings calculations.

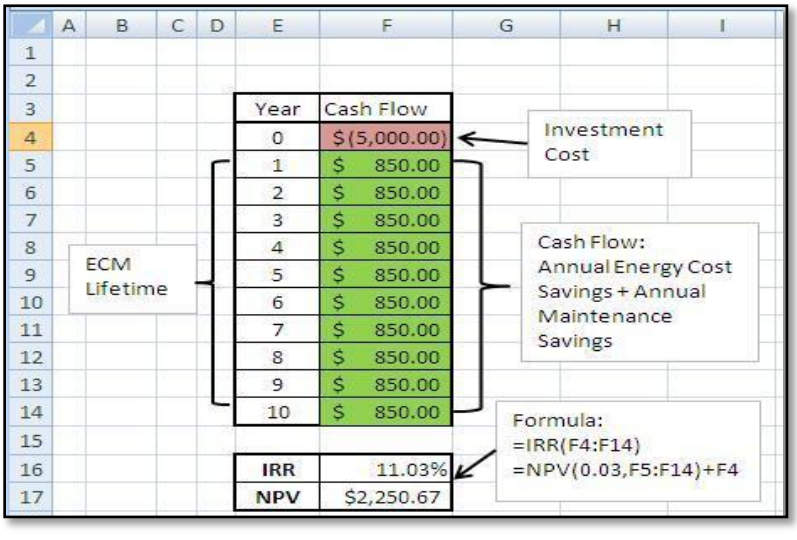
Calculation References

Term	Definition
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
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)]

* 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).

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:



Solar PV ECM Calculation

There are several components to the calculation:

Costs:	Material of PV system including panels, mounting and net-metering + Labor
Energy Savings:	Reduction of kWh electric cost for life of panel, 25 years
Incentive 1:	NJ Renewable Energy Incentive Program (REIP), for systems of size 50kW or less, $1/Watt incentive subtracted from installation cost
Incentive 2:	Solar Renewable Energy Credits (SRECs) – Market-rate incentive. Calculations assume $600/Megawatt hour consumed per year for a maximum of 15 years; added to annual energy cost savings for a period of 15 years. (Megawatt hour used is rounded to nearest 1,000 kWh)
Assumptions:	A Solar Pathfinder device is used to analyze site shading for the building and determine maximum amount of full load operation based on available sunlight. When the Solar Pathfinder device is not implemented, amount of full load operation based on available sunlight is assumed to be 1,180 hours in New Jersey.

Total lifetime PV energy cost savings =
kWh produced by panel * [$/kWh cost * 25 years + $600/Megawatt hour /1000 * 15 years]

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.

New Jersey Clean Energy Program Commercial & Industrial Lifetimes

Measure	Life Span
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

APPENDIX D: INCENTIVE PROGRAMS

New Jersey Clean Energy Pay for Performance

The NJ Clean Energy Pay for Performance (P4P) Program relies on a network of Partners who provide technical services to clients. LGEA participating clients who are not receiving Direct Energy Efficiency and Conservation Block Grants are eligible for P4P. SWA is an eligible Partner and can develop an Energy Reduction Plan for each project with a whole-building traditional energy audit, a financial plan for funding the energy measures and an installation construction schedule.

The Energy Reduction Plan must define a comprehensive package of measures capable of reducing a building's energy consumption by 15+%. P4P incentives are awarded upon the satisfactory completion of three program milestones: submittal of an Energy Reduction Plan prepared by an approved Program Partner, installation of the recommended measures and completion of a Post-Construction Benchmarking Report. Theincentives for electricity and natural gas savings will be paid based on actual savings, provided that the minimum 15%performance threshold savings has been achieved.

For further information, please see: http://www.njcleanenergy.com/commercial-industrial/programs/pay-performance/existing-buildings .

Direct Install 2010 Program*

Direct Install is a division of the New Jersey Clean Energy Programs' Smart Start Buildings. It is a turn-key program for small to mid-sized facilities to aid in upgrading equipment to more efficient types. It is designed to cut overall energy costs by upgrading lighting, HVAC and other equipment with energy efficient alternatives. The program pays **up to 60%** of the retrofit costs, including equipment cost and installation costs.

Eligibility:

- Existing small and mid-sized commercial and industrial facilities with peak electrical demand **below 200 kW** within 12 months of applying
- Must be located in New Jersey
- Must be served by one of the state's public, regulated or natural gas companies
    - Electric: Atlantic City Electric, Jersey Central Power & Light, Orange Rockland Electric, PSE&G
    - Natural Gas: Elizabethtown Gas, New Jersey Natural Gas, PSE&G, South Jersey Gas

For the most up to date information on contractors in New Jersey who participate in this program, go to: http://www.njcleanenergy.com/commercial-industrial/programs/direct-install

Smart Start

New Jersey's SmartStart Building Program is administered by New Jersey's Office of Clean Energy. The program also offers design support for larger projects and technical assistance for smaller projects. If your project specifications do not fit into anything defined by the program, there are even incentives available for custom projects.

There are a number of improvement options for commercial, industrial, institutional, government,

and agricultural projects throughout New Jersey. Alternatives are designed to enhance quality while building in energy efficiency to save money. Project categories included in this program are New Construction and Additions, Renovations, Remodeling and Equipment Replacement.

For the most up to date information on how to participate in this program, go to: http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings.

Renewable Energy Incentive Program*

The Renewable Energy Incentive Program (REIP) provides incentives that reduce the upfront cost of installing renewable energy systems, including solar, wind, and sustainable biomass. Incentives vary depending upon technology, system size, and building type. Current incentive levels, participation information, and application forms can be found at the website listed below.

Solar Renewable Energy Credits (SRECs) represent all the clean energy benefits of electricity generated from a solar energy system. SRECs can be sold or traded separately from the power, providing owners a source of revenue to help offset the cost of installation. All solar project owners in New Jersey with electric distribution grid-connected systems are eligible to generate SRECs. Each time a system generates 1,000 kWh of electricity an SREC is earned and placed in the customer's account on the web-based SREC tracking system.

For the most up to date information on how to participate in this program, go to: http://www.njcleanenergy.com/renewable-energy/home/home.

Utility Sponsored Programs

Check with your local utility companies for further opportunities that may be available.

Energy Efficiency and Conservation Block Grant Rebate Program

The Energy Efficiency and Conservation Block Grant (EECBG) Rebate Program provides supplemental funding up to $20,000 for eligible New Jersey local government entities to lower the cost of installing energy conservation measures. Funding for the EECBG Rebate Program is provided through the American Recovery and Reinvestment Act (ARRA).

For the most up to date information on how to participate in this program, go to: http://njcleanenergy.com/EECBG

Other Federal and State Sponsored Programs

Other federal and state sponsored funding opportunities may be available, including BLOCK and R&D grant funding. For more information, please check http://www.dsireusa.org/.

*Subject to availability. Incentive program timelines might not be sufficient to meet the 25% in 12 months spending requirement outlined in the LGEA program.