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March 24th, 2010

Local Government Energy Program
Energy Audit Final Report

Township of Lower
Planning and Zoning Annex
2600 Bayshore Road
Villas, NJ 08251

Project Number: LGEA31

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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 Township of Lower. The audit included a review of the Township of Lower Municipal Building, Planning and Zoning Annex, Recreation Building, Millman Senior Center, Public Safety Building, Department of Public Works Administrative Offices and Department of Public Works Garage. The buildings are located in both Erma and Villas, NJ. A separate energy audit report is issued for each of the referenced buildings.

This report addresses the Planning and Zoning Annex located at 2600 Bayshore Road, Villas, NJ. The current conditions and energy-related information were collected in order to analyze and suggest the implementation of building improvements and energy conservation measures.

The Planning and Zoning Annex located at 2600 Bayshore Road was originally constructed in 1979, when it was used as a police headquarters. It is a single story free standing building with approximately 4,256 square feet of conditioned space and is part of a complex that includes other township owned buildings such as the municipal building and recreation center. The building itself is the headquarters of the towns zoning, construction and planning departments and their staff. There are approximately 10 full time employees working in the building with typical hours of 8:30 am to 4:30 pm Monday through Friday except holidays.

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

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

- Section 1 and section 2 of the report cover a description and analysis of the building existing conditions.
- Section 3 provides a detail inventory of major electrical and mechanical systems in the building.
- Sections 4 through 5 provide a description of our recommendations.
- Appendices include further details and information supporting our recommendations.

EXECUTIVE SUMMARY

The Planning and Zoning Annex is a single story free standing building with approximately 4,256 square feet of conditioned space and is part of a complex that includes other township owned buildings such as the Municipal building and Recreation center. The building itself is the headquarters of the towns zoning, construction and planning departments and their staff.

Based on the field visit performed by the SWA staff on November 9th, 2009 and the results of a comprehensive energy analysis, this report describes the site's current conditions and recommendations for improvements. Suggestions for measures related to energy conservation and improved comfort are provided in the scope of work. Energy and resource savings are estimated for each measure that results in a reduction of heating, cooling, and electric usage.

Existing conditions

From October 2008 through October 2009, the period of analysis for this audit, the building consumed 65,120 kWh or $11,063 worth of electricity at an approximate rate of $0.170/kWh and 2,009 gallons or $3,412 worth of #2 fuel oil at an approximate rate of $1.698/gallon. The joint energy consumption for the building, including both electricity and fossil fuel was 501 MMBTUs of energy that cost a total of $14,475.

SWA has entered energy information about the Planning and Zoning Annex building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, the building does not receive a performance rating due to its size which means that it is ineligible for an energy performance rating. SWA encourages the Township of Lower to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time.

The Site Energy Use Intensity is 114.0 kBtu/sq ft yr compared to the national average of an office consuming 77.0 kBtu/sq ft yr. The Site Energy Use Intensity seems excessively high compared to the national average; however the Portfolio Manager has a limited sample size of buildings that are less than 5,000 square feet. Due to the limited sample size, projected national averages are commonly much lower than expected. Implementing this report's highly recommended Energy Conservations Measures (ECMs) will reduce use by approximately 30.6 kBtu/sqft yr, with an additional 17.9 kBtu/sq ft yr from the recommended ECMs.

Implementing this report's recommendations will reduce use by approximately 48.5 kBtu/ft^{2}yr, which would decrease the building's energy use intensity to 65.5 kBtu/ft^{2}yr.

Recommendations

The Planning and Zoning Annex building uses #2 fuel oil for the main source of heating fuel with supplemental heat provided by electric resistance rooftop units. According to Township of Lower staff members, natural gas lines are already run through the property but are not yet connected to the building. SWA recommends that the building is connected to natural gas and heating equipment is upgraded to gas-fired units, including a dual-fuel boiler. It is important to note that the average #2 fuel oil rate that the building currently pays is less than the average cost in NJ. If natural gas is connected, the Township of Lower should be sure to negotiate rates with the utility company. Connecting dual-fuel equipment would give the building the ability to switch between each fuel, depending on which is cheaper. Much of the equipment can be upgraded, but first the building must be properly connected to the natural gas line. SWA recommends a package of

measures that includes lighting upgrades, a 15 kW solar Photovoltaic system as well as a Building Management System (BMS) complete with programmable thermostats. The building HVAC system is currently operated 24 hours per day with only manual controls over the system. A BMS system together with programmable thermostats would allow better control of the HVAC system, including night and weekend setbacks and setting an outdoor temperature cutoff point.

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

Category I Recommendations: Capital Improvement Measures

- Connect building to natural gas line
- Install a dual-fuel boiler
- Install a gas-fired domestic hot water heater
- Install gas-fired packaged rooftop units

Category II Recommendations: Operations and Maintenance

- Insulate heating hot water and domestic hot water pipes
- Install/repair and maintain gutters, downspouts and downspout deflectors
- Repair all sections of cracked spandrel
- Bi-annual maintenance inspections of exterior walls
- Bi-annual maintenance inspections of roof surfaces
- Bi-annual maintenance inspections of windows and exterior doors.
- Provide weather stripping / air sealing
- Provide water efficient fixtures and controls
- Use Energy Star labeled appliances

Category III Recommendations: Energy Conservation Measures

At this time, SWA highly recommends a total of **3** Energy Conservation Measures (ECMs) for the Planning and Zoning Annex building that is summarized in the following Table 1. The total investment cost for these ECMs with incentives is **$9,287**. SWA estimates a first year savings of **$3,600** with a simple payback of **2.6 years**. SWA also recommends **3** ECMs with a 5-10 year payback that is summarized in Table 2 and no End of Life Cycle ECMs.

The implementation of all the recommended ECMs would reduce or offset the building electric usage by 37,902 kWh annually, or 58% of the building's current electric consumption. The recommended ECMs would also reduce the building #2 fuel oil usage by 556 gallons annually, or 28% of the building's current fuel consumption. SWA estimates that implementing these ECMs will reduce the carbon footprint of the Zoning Annex building by **73,992 lbs of CO_2**, which is equivalent to removing approximately 5 cars from the roads each year or avoiding the need of 179 trees to absorb the annual CO_2 produced. SWA also recommends that Township of Lower contacts third party energy suppliers in order to negotiate a lower electricity rate. Comparing the current electric rate to average utility rates of similar type buildings in New Jersey, it may be possible to save up to $0.020/kWh, which would equate to $1,302 for the past 12 months.

There are various incentives that Township of Lower could apply for that could also help lower the cost of installing the ECMs. SWA recommends that the Township of Lower apply for the NJ SmartStart program through the New Jersey Office of Clean Energy. This incentive can help provide technical assistance for the building in the implementation phase of any energy

conservation project. A new NJ Clean Power program, Direct Install could also assist to cover 80% of the capital investment.

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

The following two tables summarize the proposed Energy Conservation Measures (ECM) and their economic relevance.

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	gallons, 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 14 new CFL fixtures	RS Means	703	0	703	3,153	0.7	0	2.5	15	551	5	2,509	1.3	257	51	73	1,806	5,645
2	Install a central BMS system and 4 programmable thermostats	RS Means	7,184	0	7,184	10,028	4.0	556	26.2	0	2,649	10	22,366	2.7	211	21	25	15,182	24,084
3	Install 7 new Occupancy Sensors	RS Means	1,540	140	1,400	2,355	0.5	0	1.9	0	400	15	4,711	3.5	236	16	13	3,311	4,217
	TOTALS		**9,427**	**140**	**9,287**	**15,536**	**5.2**	**556**	**30.6**	**15**	**3,600**	**-**	**29,586**	**2.6**	**-**	**-**	**-**	**20,299**	**33,946**

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	gallons, 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 2 new LED exit signs	RS Means	407	40	367	259	0.1	0	0.2	14	58	15	683	6.3	86	6	9	316	464
5	Install 68 new T8 fluorescent fixtures	RS Means	12,977	1,020	11,957	4,401	0.9	0	3.5	1,033	1,781	15	20,959	6.7	75	5	8	9,002	7,880
6	Install a 15 kW solar Photovoltaic system	Similar Projects	105,000	15,000	90,000	17,706	15.0	0	14.2	0	13,210	25	224,985	6.8	150	6	8	81,289	31,703
	TOTALS		**118,384**	**16,060**	**102,324**	**22,366**	**16.0**	**0**	**17.9**	**1,047**	**15,049**	**-**	**246,627**	**6.8**	**-**	**-**	**-**	**90,607**	**40,046**

1. HISTORIC ENERGY CONSUMPTION

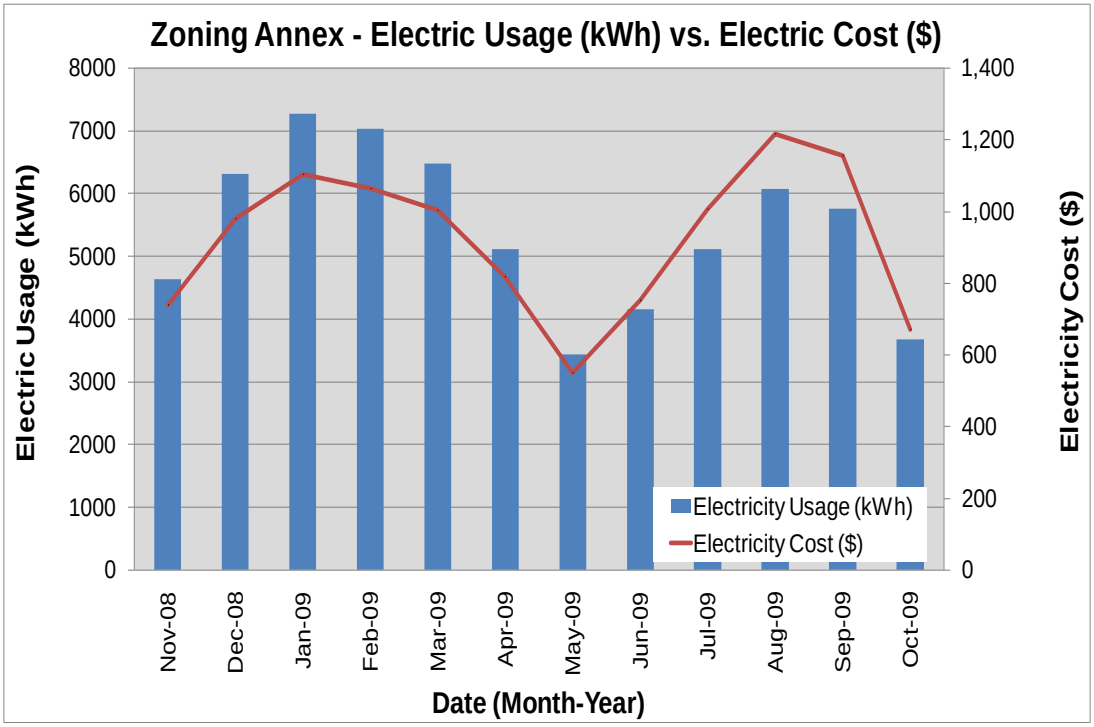
1.1. Energy usage, load profiles and cost analysis

SWA analyzed utility bills from **October 2008 through October 2009**(period of analysis) that were received from the utility companies supplying the Zoning Annex with electric and #2 fuel oil.

Electricity - The Planning and Zoning Annex buys electricity from Atlantic City Electric at **an average rate of $0.170/kWh** based on 12 months of utility bills from October 2008 to October 2009. The building purchased **approximately 65,120 kWh or $11,063 worth of electricity** in the previous year and is currently charged for demand (kW) which has been factored into each monthly bill. The building had an average monthly demand of **21.6 kW** and an annual peak demand of **21.6 kW.**

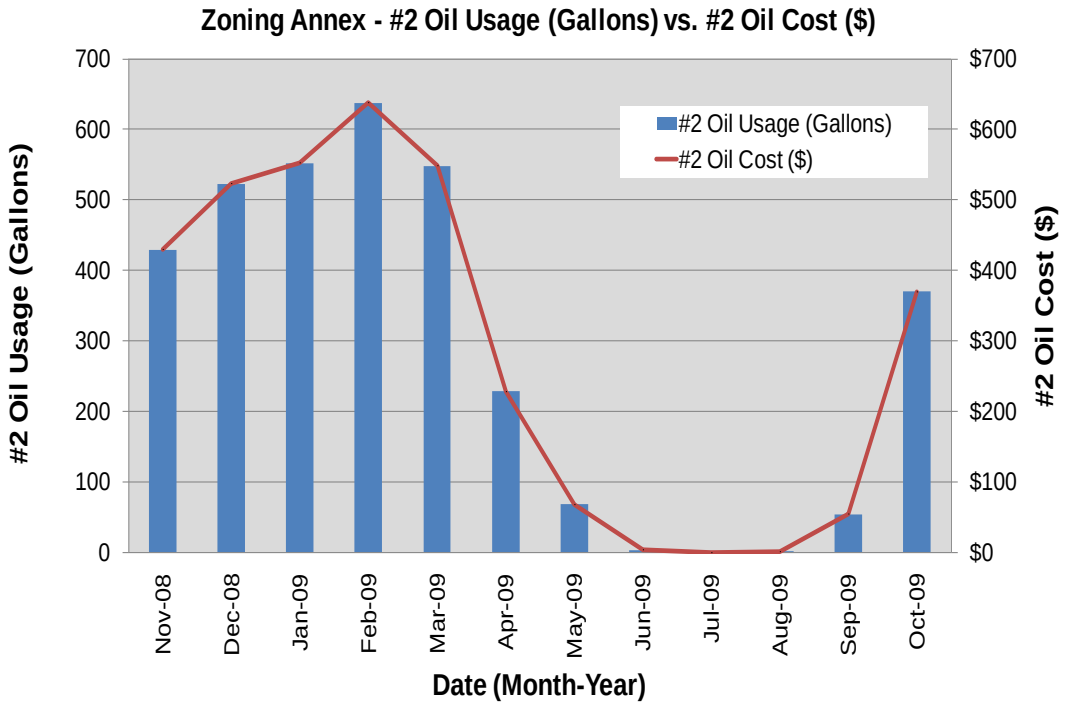
#2 Fuel Oil - The Planning Zoning Annex is currently served by one fuel delivery company, Pedroni Fuel, which acts as the supply and delivery company at **an average aggregated rate of $1.698/gallon** and purchased **approximately 2,009 gallons or $3,412 worth of #2 fuel oil** in the 12 months from October 2008 to October 2009.

The following chart shows electricity use versus cost for the Planning and Zoning Annex building based on utility bills for the 12 month period of October 2008 to October 2009.



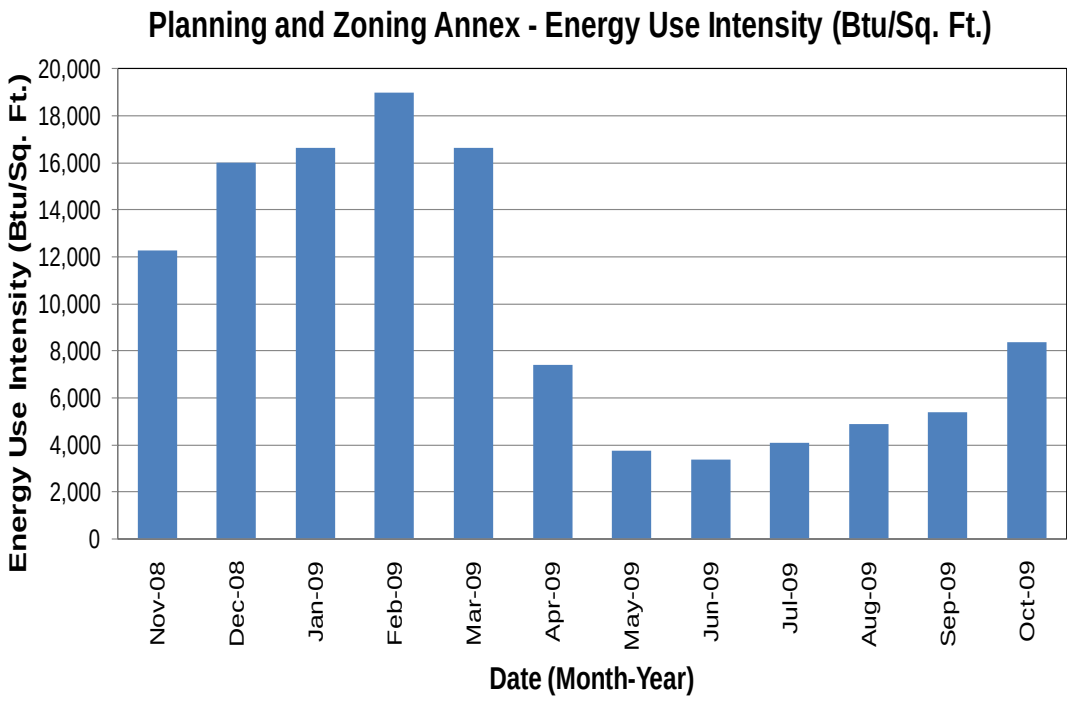
Electricity use follows a trend that is expected for this building because of its existing heating and cooling systems with usage peaking during the winter when the electrically powered heating units are used for space heating purposes. Electricity usage may also increase during the winter due to Christmas lights that are installed during the holiday season. The cost of electricity fluctuates as expected with usage.

The following is a chart of the #2 fuel oil annual load profile for the building versus #2 fuel oil costs, peaking in the coldest months of the year and a chart showing #2 fuel oil consumption following the "heating degree days" curve.



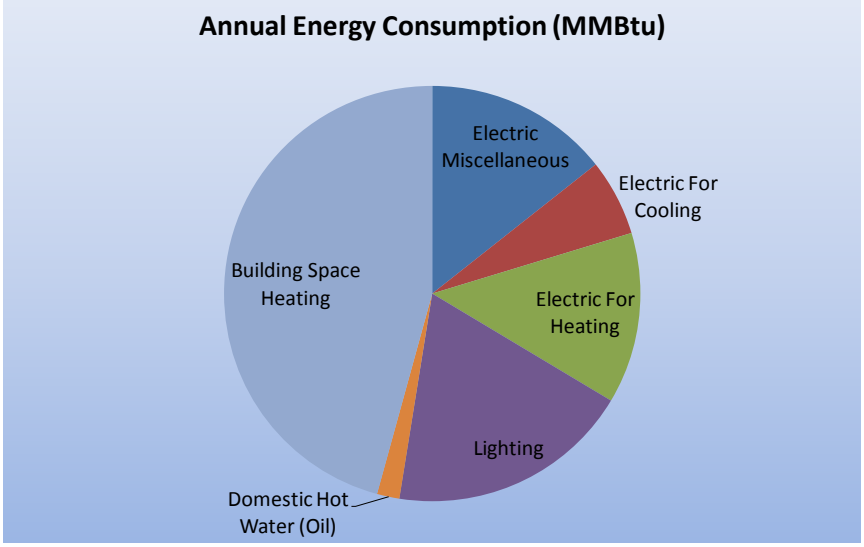
In the above chart, the #2 fuel oil use follows a heating trend as expected. The usage is based on #2 fuel oil billing that occurs when oil is delivered to the building. Unlike natural gas or electricity, #2 fuel oil is stored on-site and is not metered. Usage is based on billing since #2 fuel oil is delivered on an as-needed basis. During the summer it is clear that the #2 fuel oil use is very minimal which reflects that heat is not being used and the domestic hot water (DHW) load is minimal.

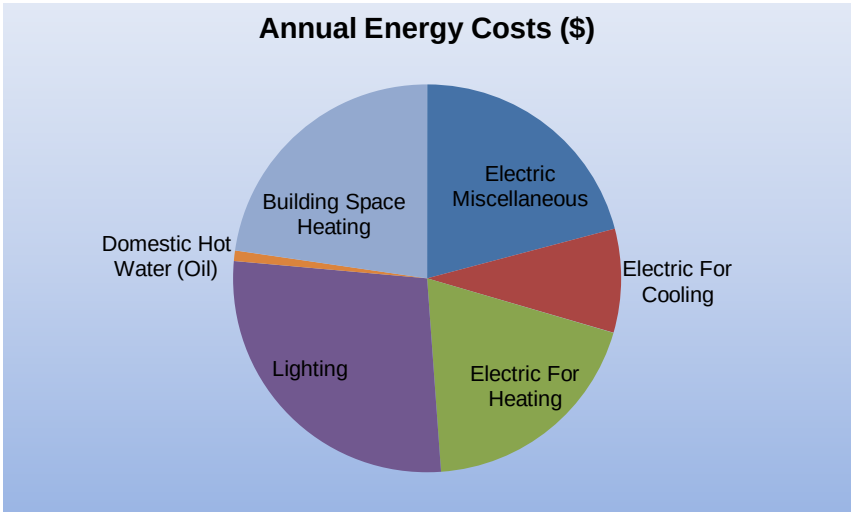
The following chart shows combined #2 fuel oil and electric consumption in Btu/sq ft for the Planning and Zoning Annex based on utility bills for the 12 month period of October 2008 to October 2009.



The following table and pie chart show energy use for the Planning and Zoning Annex building based on utility bills for the 12 month period of October 2008 to October 2009. Note electrical cost at $50/MMBtu of energy is almost 3 times as expensive to use as #2 fuel oil at $17/MMBtu.

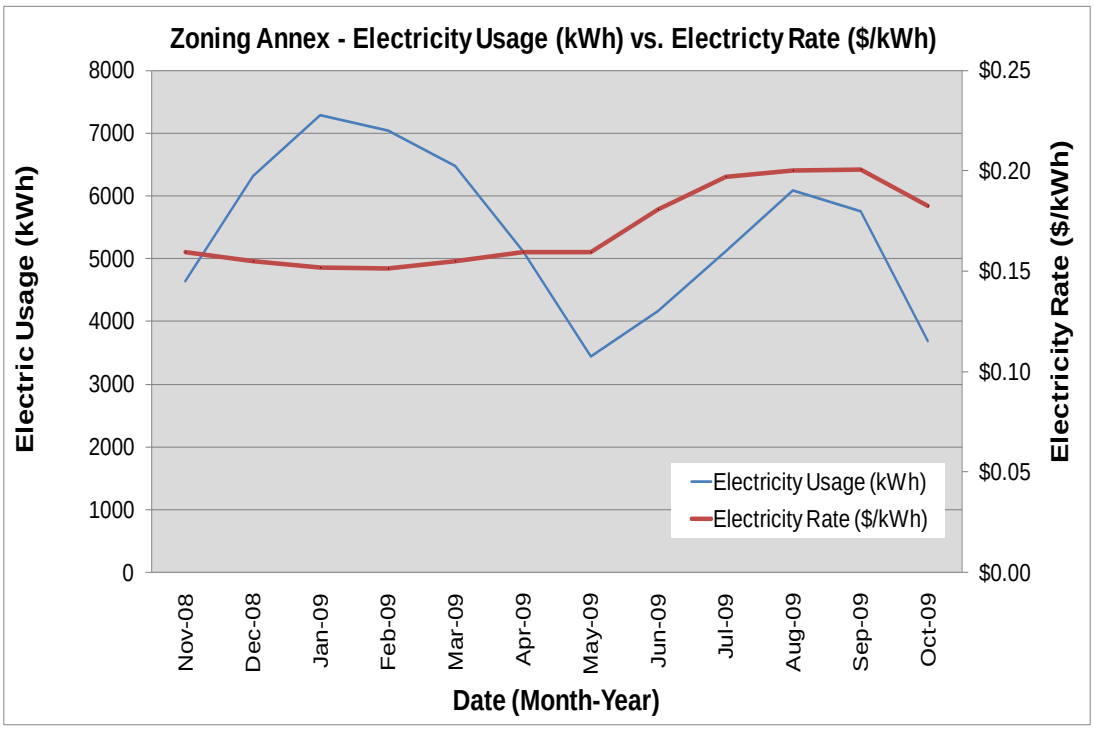
Nov 08 - Oct 09 Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	61	14%	$3,024	21%	50
Electric For Cooling	25	6%	$1,250	9%	50
Electric For Heating	56	13%	$2,800	19%	50
Lighting	80	19%	$3,989	28%	50
Domestic Hot Water (Oil)	7	2%	$125	1%	17
Building Space Heating	193	46%	$3,287	23%	17
Totals	423	100%	$14,475	100%	
Total Electric Usage	222	53%	$11,063	76%	50
Total Oil Usage	201	47%	$3,412	24%	17
Totals	423	100%	$14,475	100%	



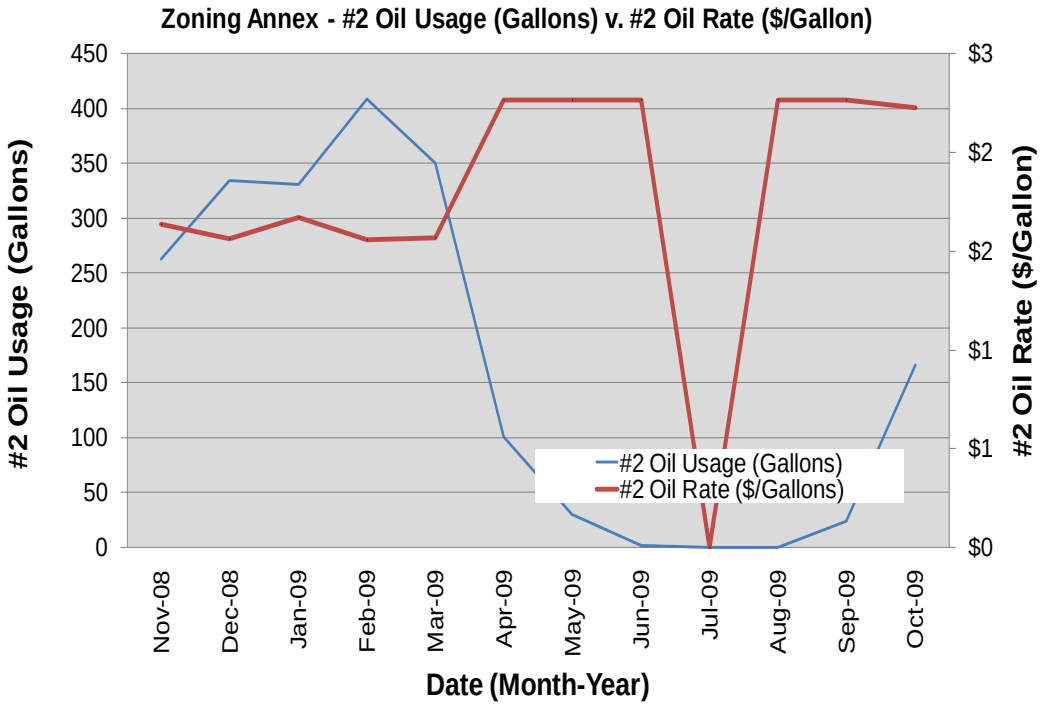


1.2. Utility rate analysis

The Planning and Zoning Annex currently purchases electricity from Atlantic City Electric at a general service market rate for electricity use (kWh) including a separate (kW) demand charge that is factored into each monthly bill. The Zoning Annex currently pays an average rate of approximately $0.170/kWh based on the 12 months of utility bills of October 2008 to October 2009. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. The electric rate does not show large fluctuations throughout the year except for an anticipated rise in the summer time and small increase in the winter that corresponds to a spike in fuel prices. Based on these observations this appears to be the appropriate rate for the building.



The Planning and Zoning Annex currently purchases #2 fuel oil from Pedroni Fuel Corp. which acts as the transportation company and energy supplier at a general service market rate for #2 fuel oil. The average aggregated rate (supply and transport) for the oil supply is approximately $1.698/gallon based on 12 months of utility bills for October 2008 to October 2009. The suppliers' general service rates for #2 fuel oil charge a market-rate price. Typically, the #2 fuel oil prices increase during the summer months when #2 fuel oil is only used by the hot water boilers. In general though there is also a price drop in the second half of 2008 due to the overall decline in the price of oil on the commodities exchange.



1.3. Energy benchmarking

SWA has entered energy information about the Planning and Zoning Annex in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, the building does not receive a performance rating due to its size which means that it is still ineligible for Energy Star score. SWA encourages the Township of Lower to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time.

The Site Energy Use Intensity is 114.0 kBtu/sq ft yr compared to the national average of an office consuming 77.0 kBtu/sq ft yr. Implementing this report's highly recommended Energy Conservations Measures (ECMs) will reduce use by approximately 30.6 kBtu/sqft yr, with an additional 17.9 kBtu/sq ft yr from the recommended ECMs.

Per the LGEA program requirements, SWA has assisted the Township of Lower to create an *Energy Star Portfolio Manager* account and has shared the building facility information to allow future data to be added and tracked using the benchmarking tool. SWA is sharing this Portfolio Manager Site information with TRC Energy Services. As per requirements, the account information is provided below:

Username: LowerTownship
Password: LOWER

The statement of energy performance generated based on historical energy consumption from the Portfolio Manager Benchmarking tool follows:

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Township of Lower - Planning and Zoning Annex

Building ID: 1933112
For 12-month Period Ending: September 30, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: February 05, 2010

Facility	Facility Owner	Primary Contact for this Facility
Township of Lower - Planning and Zoning Annex 2600 Bayshore Road Villas, NJ 08251	N/A	N/A

Year Built: 1979
Gross Floor Area (ft²): 4,256

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

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	223,625
Fuel Oil (No. 2) (kBtu)	261,780
Natural Gas - (kBtu)[4]	0
Total Energy (kBtu)	485,405

Energy Intensity[5]

Site (kBtu/ft²/yr)	114
Source (kBtu/ft²/yr)	238

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	53

Electric Distribution Utility
Pepco - Atlantic City Electric Co

National Average Comparison

National Average Site EUI	77
National Average Source EUI	182
% Difference from National Average Source EUI	31%
Building Type	Office

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 freestanding single story (slab on grade), 4,256 square feet Planning and Zoning Annex building was originally constructed in 1979 when it was originally used as a police headquarters. It is part of a complex that includes other township owned buildings such as the Zoning Annex and recreation center. The building itself is the headquarters of the towns zoning, construction and planning departments and their staff.

West Façade

Partial South Façade

Partial East Façade

North Façade

2.2. Building Occupancy Profiles

Its occupancy is approximately 10 employees daily on Monday through Friday from 8:30 AM to 4:30 PM. This building is not open to the public however; it does receive a constant stream of scheduled visitors throughout the day.

2.3. Building Envelope

Due to unfavorable weather conditions (min. 18 deg. F delta-T in/ outside & no/ low wind) no 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.

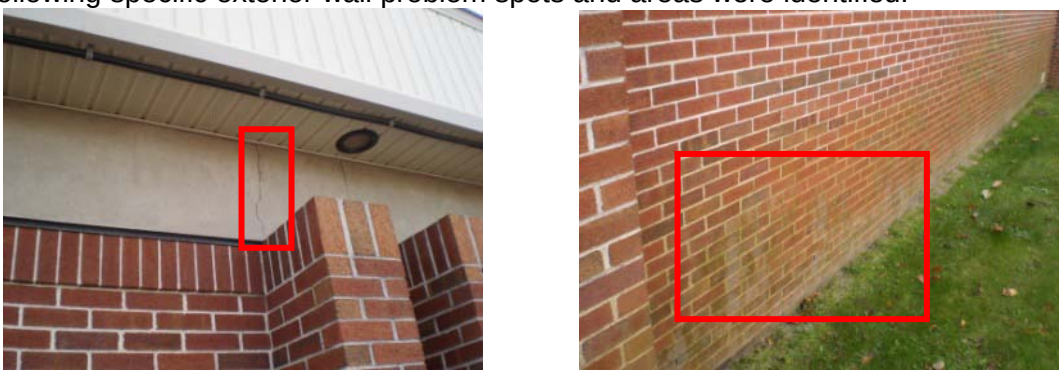
2.3.1. Exterior Walls

The exterior wall envelope is mostly constructed of 4" brick veneer over 8" concrete block with 1 inch of "Dyfoam" insulation. The upper portion of the exterior walls is of similar construction however instead of the brick finish there is a cement plaster spandrel section and plywood siding.

Note: Wall insulation levels could not be verified in the field and are based on available construction plans.

During the field audit exterior and interior wall surfaces were inspected. They were found/ reported to be in overall good/ age appropriate condition with only a few signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues detected on all facades.

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



Cracked spandrel and water damaged bricks

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

1. Install/ repair and maintain gutters, downspouts and downspout deflectors to minimize uncontrolled roof water run-off causing exterior wall damage.

2. Repair all sections of cracked spandrel.

3. Inspect the exterior walls biannually with a focus on cracks and pointing of the masonry, degraded caulking, and locating sources of water and air leakage

2.3.2. Roof

The building's roof is predominantly a flat, no parapet type over steel decking with a built-up asphalt and membrane finish. It was recently installed. 2 inches of foam board roof insulation were recorded.

Note: Roof insulation levels could not be verified in the field and are based on available construction plans.

During the field audit roofs, related flashing, gutters and downspouts were inspected. They were found/ reported to be in overall good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues detected on all roof areas.

The following typical roof system was identified:

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Biannual maintenance inspections with a focus on the drainage, penetrations, flashing and seams of the roof.

2.3.3. Base

The building's base is composed of a slab-on-grade floor with a perimeter footing with poured concrete foundation walls and a slab edge/ perimeter insulation. The floor is a 4" concrete slab-on-grade with a vapor barrier layer. The base also has a 2" layer of rigid perimeter insulation that typically extends 3'-0" from the footing.

Slab/ perimeter insulation levels could not be verified in the field and are based on available construction plans.

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 good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues neither visible on the interior nor exterior.

2.3.4. Windows

The building contains basically two different types of windows.

1. 2 and 3 unit clerestory type windows with a non-insulated aluminum frame, clear single glazing and no interior or exterior shading devices. The windows are located throughout the building and are original/ have never been replaced
2. There are also sidelight and transom windows that are part of the glass door systems.

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 good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following typical window was identified:

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Maintain and inspect biannually all windows with a focus on the caulking, condition of the frame, tight air seal, properly operating hardware and signs of water damage and infiltration.

2.3.5. Exterior doors

The building contains two different types of exterior doors..

1. Solid metal type exterior doors. They are located on the east facade and are original/ have never been replaced.

2. glass with aluminum frame type exterior doors. They are located on the west and east facade and are original/ have never 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 good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following typical doors were identified:

In light of the exterior wall conditions mentioned above SWA has the following recommendations:

1. Maintain and inspect biannually all doors with a focus on weather-stripping, frame damage, properly functioning hardware, a tight air seal and any evidence of water damage or infiltration.

2.3.6. Building air-tightness

Overall the field auditors found the building to be reasonably air-tight, considering the building's use and occupancy, 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 and chimney walls that are part of or penetrate the exterior envelope and where air-leakage can occur.

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

2.4. HVAC Systems

The Zoning Annex is served by one main heating plant that contains one Weil-McLain oil-fired boiler. This boiler provides heating hot water to baseboards located throughout the building. The building also contains two packaged rooftop units that provide DX cooling as well as electric resistance heating to the building space.

2.4.1. Heating

The Zoning Annex building contains one Weil-McLain, #2 oil-fired boiler that has reached the end of it's useful lifetime. This boiler provides heating hot water to the building heating loop to heat baseboards located throughout the building. Heating for the baseboards is controlled by two non-programmable thermostats located in each wing of the building.

In addition to the main boiler, the building contains two rooftop packaged units that provide electric resistant heating as well as DX cooling and ventilation to the general spaces of the building. These units were observed to be in good condition and would not be cost-effective to replace at this point in time.

2.4.2. Cooling

Cooling is provided by the two rooftop packaged units. These units, as mentioned above in Section 2.4.1 provide electric resistance heating as well as DX cooling and ventilation to the general spaces of the building. These units are also controlled by non-programmable thermostats located in the building space.

2.4.3. Ventilation

The rooftop units for this building mix fresh outside air with return air before conditioning it and distributing it to different zones within the building.

In addition to the rooftop unit, rooftop exhaust fans rid the building of stale air and help induce fresh air into the building.

2.4.4. Domestic Hot Water

The building contains one American electric hot water heater with a 1500W element and 20 gallons of storage capacity. This unit is approximately 8 years old and was observed to have limited insulation on DHW hot water supply piping.

2.5. Electrical systems

2.5.1. Lighting

Interior Lighting – The Zoning Annex contains mostly inefficient lighting. There is primarily inefficient lighting such as the existing 2' and 4' T12 fixtures with magnetic ballasts and screw in incandescent fixtures however, there are also CFL's (Compact Fluorescent Light bulb) that should remain. SWA recommends replacing the T12 lights with T8 electronic ballast fixtures and incandescent fixtures with CFL's as well as installing 7 new occupancy

sensors to reduce electricity usage. See attached lighting schedule in Appendix A for a complete lighting inventory throughout the building and estimated power consumption.

Exit Lights - Exit signs were found to be fluorescent fixtures and should be replaced with an LED fixture.

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be a combination of halogen and CFL's. SWA recommends installing CFL's in place of the halogens.

2.5.2. Appliances

SWA performed a basic survey of appliances installed at the Zoning Annex and has determined that it would be cost-effective to replace any appliances at this time due to the age of the building. 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.

Computers left on in the building consume a lot of energy. A typical desk top computer uses 65 to 250 watts and uses the same amount of energy when the screen saver is left on. Televisions in meeting areas use approximately 3-5 watts of electricity when turned off. SWA recommends all computers and all appliances (i.e. refrigerators, coffee makers, televisions, etc) be plugged in to power strips and turned off each evening just as the lights are turned off. The Zoning Annex computers are generally programmed for the power save mode, to shut down after a period of time that they have not been used.

2.5.3. Elevators

The Zoning Annex does not have any installed elevators.

2.5.4. Process and others electrical systems

There is no process equipment or other electrical systems at this building.

3. EQUIPMENT LIST

Inventory

Building System	Description	Physical Location	Make/ Model	Fuel	Space served	Date Installed	Estimated Remaining useful life %
Heating	Weil-McLain oil-fired boiler, #2 fuel oil, 218,000 BTUH input, 190,000 BTUH output, estimated 82% efficiency based on combustion efficiency test, #1 on smoke scale	Boiler room, back of building	Weil-McLain, Model #P-668-W, Serial #NA	#2 Fuel Oil	All areas	1974	20%
Heating/ Cooling	RTU-1; Bryant packaged unit, cooling capacity 115.0 MBH, 7.5 ton, 10.3 EER, R-22 refrigerant, electric heat	Rooftop	Bryant, Model #558FPX090000AA--, Serial #2501G33252	Electricity	All areas	2001	64%
Heating/ Cooling	RTU-2; Bryant packaged unit, cooling capacity 115.0 MBH, 7.5 ton, 10.3 EER, R-22 refrigerant, electric heat	Rooftop	Bryant, Model #558FPX090000AA--, Serial #2501G33251	Electricity	All areas	2001	64%
Domestic Hot Water	American Water Heater, electric water heater, Upper element 1500W, Total Watts 1500W, 20 gallons	Boiler room, back of building	American Water Heater, Model #E51-20U-0155, Serial #9532170578, Product #0220013	Electricity	All areas	2002	20%
Lighting	See Appendix A	-	-	-	-	-	-

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

4. ENERGY CONSERVATION MEASURES

Based on the assessment of The Zoning Annex, 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

- Connect building to natural gas line – The building is currently operated on #2 fuel oil and electricity. Recently, natural gas service was extended to reach the area of the Zoning Annex. SWA recommends connecting the building to the natural gas line in order to be able to install gas-fired heating equipment, which is cheaper to operated than electric heat and can give the building flexibility between #2 fuel oil or natural gas.

- Install a dual-fuel boiler – The current boiler was installed in 1974 and is beginning to show signs of aging. According to Township of Lower staff members, the Township is interested in connecting the building to the newly run natural gas lines. SWA recommends that when the building is connected to the natural gas line, that a new dual-fuel boiler is installed. Install a dual-fuel boiler would allow the Township of Lower to use either natural gas or #2 fuel oil, depending on which market price is lower. The Township could request to be put on an interruptible gas rate, which would allow the building to use natural gas but reduce costs by switching to #2 fuel oil when natural gas prices rise du to demand.

- Install a gas-fired domestic hot water heater – The current electric water heater was observed in good condition, however it uses electricity to heat the water which is expensive. SWA recommends that the unit be replaced with a gas-fired unit if the building is connected to the natural gas line.

- Install gas-fired, packaged rooftop units – The current packaged rooftop units contain electric heaters. These electric heaters are expensive to operated during the winter. SWA recommends that the Township of Lower connect the Annex building to the natural gas line and then consider replacing the rooftop units with gas-fired package units. Natural gas is a cheaper fuel to use for heating.

Category II Recommendations: Operations and Maintenance

- Insulate heating hot water and domestic hot water pipes – The hot water pipes for building heating and domestic hot water services were observed to have limited insulation installed. SWA recommends that building maintenance staff re-insulate these pipes in order to prevent excessive heat loss from the heating system plumbing.

- Install/repair and maintain gutters, downspouts and downspout deflectors – It was observed that there are several areas where water is not properly drained from the building roof and diverted away from the building. SWA recommends that gutters, downspouts, drains and diverters are repaired or replaced to properly allow water to be diverted away from the building.

- Repair all sections of cracked spandrel – SWA recommends repairing all cracked spandrel in order to prevent air infiltration and water damage.

- Bi-annual maintenance inspections of exterior walls – SWA recommends that bi-annual inspections are conducted of the exterior walls as part of a preventative maintenance plan. The focus should be inspecting exterior walls for cracks, pointing of masonry, degraded caulking and locating other possible sources of water and air leakage.

- Bi-annual maintenance inspections of roof surfaces – SWA recommends that bi-annual inspections are conducted of the roof surfaces as part of a preventative maintenance plan. The focus of the inspections should be deterioration in surface condition, proper drainage and locating any sources for possible water or air penetration.

- Bi-annual maintenance inspections of windows and exterior doors – SWA recommends that bi-annual inspections are conducted of the roof surfaces as part of a preventative maintenance plan. The focus of the inspections should be on window and door frames, proper sealing between the frame and the exterior wall, proper sealing between the window/door and the frame, locating any sources of possible air or water leakage.

- Provide weather stripping / air sealing – SWA observed that all windows and doors had proper weather-stripping and air sealing due to their age. As a best practice, SWA recommends that each window and door is inspected twice per year for deficiencies. Any time that a seal has been compromised, building maintenance staff should repair and replace the seal immediately to ensure that thermal barriers are not breached.

- Provide water efficient fixtures and controls - Adding controlled on / off timers on all lavatory faucets is a cost-effective way to reduce domestic hot water demand and save water. Building staff can also easily install faucet aerators and / or low-flow fixtures to reduce water consumption. There are many retrofit options, which can be installed now or incorporated as equipment is replaced. Routine maintenance practices that identify and quickly address water leaks are a low-cost way to save water and energy. Retrofitting with more efficient water-consumption fixtures / appliances will save both energy and money through reduced energy consumption for water heating, while also decreasing water / sewer bills.

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

Category III Recommendations: Energy Conservation Measures

Summary table

ECM#	Description of Highly Recommended 0-5 Year Payback ECMs
1	Install 14 new CFL fixtures
2	Install a central BMS system and 4 programmable thermostats
3	Install 7 new Occupancy Sensors
	Description of Recommended 5-10 Year Payback ECMs
4	Install 68 new T8 fluorescent fixtures
5	Install 2 new LED exit signs
6	Install a 15 kW solar Photovoltaic system

ECM#1: *Install 14 new CFL lamps*

Description:
The Zoning Annex building contains 3 exterior halogen light bulbs and 11 interior incandescent light bulbs that are inefficient and should be replaced. SWA recommends replacing the above mentioned bulbs with Compact Fluorescent Lamps (CFLs) for interior fixtures and CFL reflective lamps for exterior fixtures that have an equivalent light output. Typically, CFL replacement bulbs will have the same light output while consuming 2/3 less power. See Appendix A for complete lighting schedule and analysis.

Installation cost:
Estimated installed cost: $703
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	gallons, 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 14 new CFL fixtures	RS Means	$703	$0	$703	3,153	0.7	0	2.5	$15	$551	5	$2,509	1.3	257%	51%	73%	$1,806	5,645

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumes operation cost savings based on avoided bulb replacement when upgrading to lighting that consists of longer rated burn hours.

Rebates / financial incentives:
There are currently no 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#2: *Install a central BMS system and 4 programmable thermostats*

Description:
The Zone Annex building contains a #2 oil-fired boiler that provides heating hot water to baseboards throughout the building. In addition to the boiler, the building contains two packaged rooftop units that supply supplemental heat via electric resistance heaters. All units are allowed to operate 24 hours per day and do not setback at night. Since the boiler has no central control system, the unit is manually controlled and does not have an outside temperature cutoff point. SWA recommends adding a BMS system to better control the boiler and allow the boiler to automatically shut off if building heating loads are met and outside temperatures are above a set temperature. SWA also recommends installing 4 programmable thermostats in order to control the hot water baseboards as well as the package rooftop units. These programmable thermostats would setback the temperature at night and on the weekends, so the heating equipment is not operated unnecessarily.

Installation cost:
Estimated installed cost: $7,184
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	gallons, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
2	Install a central BMS system and 4 programmable thermostats	RS Means	7,184	0	7,184	10,028	4.0	556	26.2	0	2,649	10	22,366	2.7	211	21	25	15,182	24,084

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumes operational hours based on field observations, billing analysis and staff interviews. SWA assumes energy savings by setting back temperatures 1 hour after the building closes and resumes schedule 1 hour before the building opens.

Rebates / financial incentives:
There are no incentives available 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#3: *Install 7new Occupancy Sensors*

Description:
The Zoning Annex building contains 7 areas that could benefit from the installation of occupancy sensors. These areas were identified as areas with sporadic usage. Occupancy sensors are equipped with a delay timer that automatically shuts off lights when no motion is detected for a set amount of time. See Appendix A for complete lighting schedule and analysis.

Installation cost:
Estimated installed cost: $1,400
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	gallons, 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	Install 7 new Occupancy Sensors	RS Means	1,540	140	1,400	2,355	0.5	0	1.9	0	400	15	4,711	3.5	236	16	13	3,311	4,217

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumes operational hours based on field observations, billing analysis and staff interviews.

Rebates / financial incentives:
NJ Clean Energy – Occupancy Sensors ($20 per sensor)
Maximum incentive amount is $140.

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#4: *Install 2 new LED exit signs*

Description:
The Zoning Annex building currently contains 2 inefficient fluorescent exit signs. SWA recommends replacing these units with new, more efficient LED fixtures. Exit signs present a good opportunity for savings since they are operated 24 hours per day. See Appendix A for complete lighting schedule and analysis.

Installation cost:
Estimated installed cost: $367
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	gallons, 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 2 new LED exit signs	RS Means	407	40	367	259	0.1	0	0.2	14	58	15	683	6.3	86	6	9	316	464

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumes operation cost savings based on avoided bulb replacement when upgrading to lighting that consists of longer rated burn hours.

Rebates / financial incentives:
NJ Clean Energy Prescriptive Lighting – LED exit signs ($20 per fixture)
Maximum incentive amount is $40

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: *Install 68 new T8 fluorescent fixtures*

Description:
The Zoning Annex building currently contains 68 inefficient T12 fluorescent fixtures with magnetic ballasts. SWA recommends replacing each one of these T12 fixtures with equivalent T8 fluorescent fixtures with electronic ballasts. Typically, T8 fluorescent fixtures with electronic ballasts use 30% less energy than equivalent T12 fixtures with magnetic ballasts. In addition, there will be operating cost savings associated with each bulb since CFLs have a longer rated lifetime than incandescent bulbs. See Appendix A for complete lighting schedule and analysis.

Installation cost:
Estimated installed cost: $11,957
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	gallons, 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	Install 68 new T8 fluorescent fixtures	RS Means	12,977	1,020	11,957	4,401	0.9	0	3.5	1,033	1,781	15	20,959	6.7	75	%	8	9,002	7,880

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumes operation cost savings based on avoided bulb replacement when upgrading to lighting that consists of longer rated burn hours.

Rebates / financial incentives:
NJ Clean Energy Prescriptive Lighting – T-5 and T8 lamps with electronic ballast in existing facilities ($15 per fixture)
Maximum incentive amount is $1,020

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: *Install a 15 kW Solar Photovoltaic system*

Description:
Currently, the Zoning Annex building 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 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. SWA presents below the economics, and recommends at this time that Township of Lower further review installing a 15 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 Zoning Annex building is not eligible for a 30% federal tax credit. Instead, Township of Lower 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. Atlantic City Electric provides the ability to buy SRECs at $600 / MWh or best market offer.

There are a few locations for a 15 kW PV installation on the building roofs and away from shade. A commercial multi-crystalline 123 watt panel (17.2 volts, 7.16 amps) has 10.7 square feet of surface area (11.51 watts per square foot). A 15 kW system needs approximately 123 panels which would take up 1,278 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: $90,000
Source of cost estimate: *Similar projects*

Economics:

ECM #	ECM description	Source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	gallons, 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	Install a 15 kW solar Photovoltaic system	Similar Projects	105,000	15,000	90,000	17,706	15.0	0	14.2	0	13,210	25	224,985	6.8	150	6	8	81,289	31,703

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 (123 Watts, model #ND-123UJF). 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. Incentive amount for this application is $15,000.

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 1000kWh (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. $10,200 has been incorporated in the above costs for a period of 15 years; 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

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

Pleases see the above recommended ECM#6

5.4. Solar Thermal Collectors

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

CHP is not applicable for this building because of the existing HVAC system and insufficient domestic hot water use.

5.6. Geothermal

Geothermal is not applicable for this building because current HVAC would require significant changes and would not be cost-effective.

6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

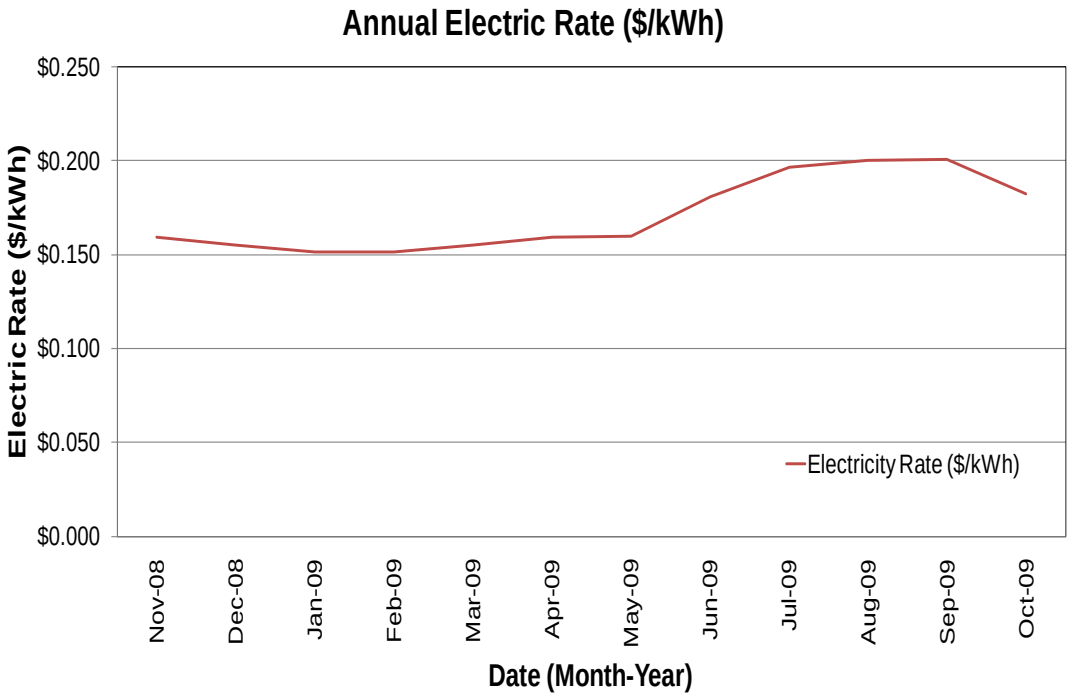
6.1. Energy Purchasing

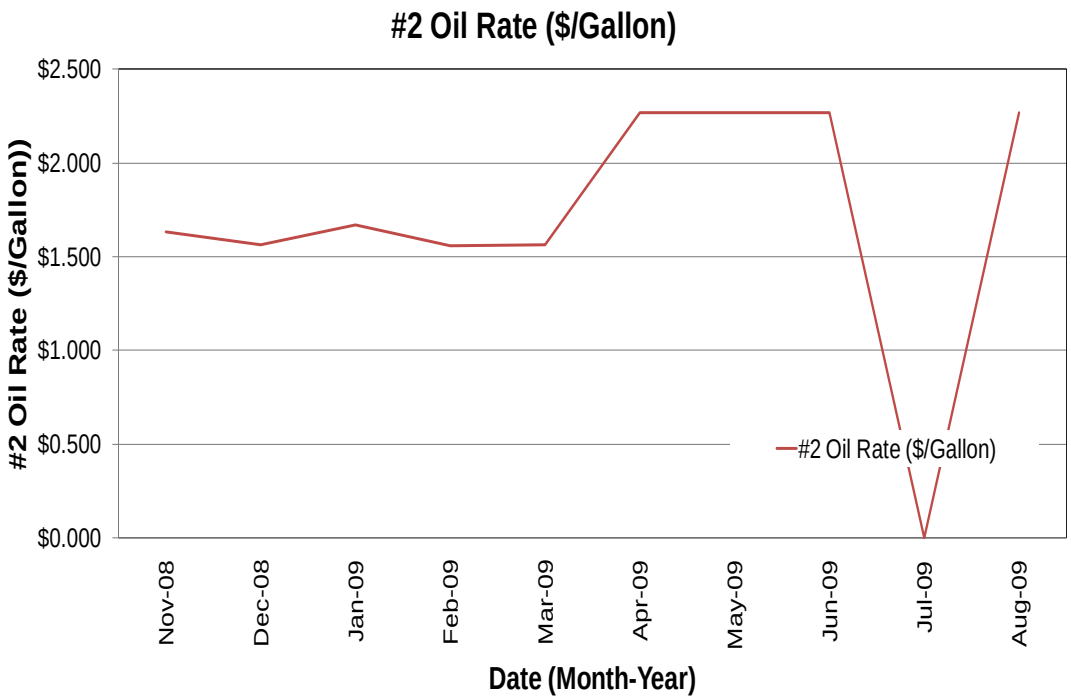
The Zoning Annex receives #2 fuel oil via one incoming meter from Pedroni Fuel Corp. which acts as the transportation company and energy supplier. There is not an ESCO engaged in the process. An Energy Services Company (ESCO) is a consultancy group that engages in a performance based contract with a 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 Zoning Annex from Atlantic City Electric without an ESCO. SWA analyzed the utility rate for #2 fuel oil and electricity supply over an extended period. Electric bill analysis shows fluctuations of 21% over the 12 month period between January 2008 and January 2009. #2 fuel oil bill analyses shows fluctuations up to 57% over the 12 month period between January 2008 and January 2009.

Currently, New Jersey commercial buildings of similar type pay $0.150/kWh for electricity and $2.19/gallon for #2 fuel oil. Currently, the electricity rate for the Zoning Annex is $0.170/kWh, which means there is a potential cost savings of $1,302 per year. The current #2 fuel oil rate for

the Zoning Annex is $1.698/gallon which means there is no potential cost savings as they are paying below market rate. SWA recommends that the Township of Lower consider having the building connected to the natural gas line. Once the building receives natural gas service, SWA recommends replacing rooftop units with gas-fired units and installing a dual fuel boiler. Installing a dual fuel boiler could allow the building to choose between natural gas and #2 fuel oil, depending on which market rate is lower at the time.

A cost savings potential for electricity exists, however this involves contacting third party suppliers and negotiating utility rates. SWA recommends that the Township of Lower further explore opportunities of purchasing electricity from third party energy suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for The Zoning Annex. Appendix B contains a complete list of third party energy suppliers for the Township of Lower service area. The Township of Lower may want to consider partnering with other school districts, municipalities, townships and communities to aggregate a substantial electric and #2 fuel oil 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.





6.2. Energy Procurement strategies

Also, The Zoning Annex 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.

7. METHOD OF ANALYSIS

7.1. Assumptions and tools

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

7.2. Disclaimer

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

THE RECOMMENDATIONS PRESENTED IN THIS REPORT ARE BASED ON THE RESULTS OF ANALYSIS, INSPECTION, AND PERFORMANCE TESTING OF A SAMPLE OF COMPONENTS OF THE BUILDING SITE. ALTHOUGH CODE-RELATED ISSUES MAY BE NOTED, 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 of the Planning and Zoning Annex

Location			Existing Fixture Information												Retrofit Information												Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
1	1	Vestibule	Recessed	M	4'T12	1	2	40	S	8	261	15	95	198	T8	Recessed	4'T8	E	S	1	2	32	8	261	6	70	146	52	0	52
2	1	Lobby	Recessed	M	4'T12	2	4	40	S	8	261	24	368	768	T8	Recessed	4'T8	E	S	2	4	32	8	261	13	282	589	180	0	180
3	1	Reception	Recessed	M	4'T12	4	4	40	S	8	261	24	736	1,537	T8	Recessed	4'T8	E	S	4	4	32	8	261	13	564	1178	359	0	359
4	1	Office	Recessed	M	4'T12	4	4	40	S	8	261	24	736	1,537	T8	Recessed	4'T8	E	OS	4	4	32	6	261	13	564	883	359	294	654
5	1	Office - Enforcement	Recessed	M	4'T12	6	4	40	S	8	261	24	1,104	2,305	T8	Recessed	4'T8	E	OS	6	4	32	6	261	13	846	1325	539	442	980
6	1	Storage Room	Screw-in	N	CFL	1	1	13	S	2	261	0	13	7	N/A	Screw-in	CFL	N	S	1	1	13	2	261	0	13	7	0	0	0
7	1	Janitor's Closet	Screw-in	N	Inc	1	1	40	S	2	261	0	40	21	CFL	Screw-in	CFL	N	S	1	1	15	2	261	0	15	8	13	0	13
8	1	Hallway	2'U-shape	M	2'T12	9	2	24	S	8	261	16	576	1,203	T8	2'U-shape	2'T8	E	S	9	2	18	8	261	5	369	770	432	0	432
9	1	Hallway	Recessed	M	4'T12	1	4	40	S	8	261	24	184	384	T8	Recessed	4'T8	E	S	1	4	32	8	261	13	141	294	90	0	90
10	1	Hallway	Exit Sign	M	Fl.	2	4	15	S	8	261	8	136	284	LEDex	Exit Sign	LED	M	S	2	1	5	8	261	1	12	25	259	0	259
11	1	Office	Recessed	M	4'T12	6	4	40	S	8	261	24	1,104	2,305	T8	Recessed	4'T8	E	OS	6	4	32	6	261	13	846	1325	539	442	980
12	1	Office	Recessed	M	4'T12	4	4	40	S	8	261	24	736	1,537	T8	Recessed	4'T8	E	OS	4	4	32	6	261	13	564	883	359	294	654
13	1	Storage Room	Recessed	M	4'T12	2	4	40	S	2	261	24	368	192	T8	Recessed	4'T8	E	S	2	4	32	2	261	13	282	147	45	0	45
14	1	Office	Recessed	M	4'T12	4	4	40	S	8	261	24	736	1,537	T8	Recessed	4'T8	E	OS	4	4	32	6	261	13	564	883	359	294	654
15	1	Storage Room	Screw-in	N	Inc	1	1	40	S	2	261	0	40	21	CFL	Screw-in	CFL	N	S	1	1	15	2	261	0	15	8	13	0	13
16	1	Kitchen	Screw-in	N	Inc	2	1	40	S	8	261	0	80	167	CFL	Screw-in	CFL	N	S	2	1	15	8	261	0	30	63	104	0	104
17	1	Office	Recessed	M	4'T12	4	4	40	S	8	261	24	736	1,537	T8	Recessed	4'T8	E	OS	4	4	32	6	261	13	564	883	359	294	654
18	1	Office	Recessed	M	4'T12	4	4	40	S	8	261	24	736	1,537	T8	Recessed	4'T8	E	OS	4	4	32	6	261	13	564	883	359	294	654
19	1	Storage Room	Recessed	M	4'T12	2	4	40	S	2	261	24	368	192	T8	Recessed	4'T8	E	S	2	4	32	2	261	13	282	147	45	0	45
20	1	Bathroom	2'U-shape	M	2'T12	1	2	24	S	8	261	16	64	134	T8	2'U-shape	2'T8	E	S	1	2	18	8	261	5	41	86	48	0	48
21	1	Boiler Room	Screw-in	N	CFL	2	1	13	S	2	261	0	26	14	N/A	Screw-in	CFL	N	S	2	1	13	2	261	0	26	14	0	0	0
22	1	Copy Room	Parabolic	M	4'T12	5	2	40	S	2	261	15	475	248	T8	Parabolic	4'T8	E	S	5	2	32	2	261	6	350	183	65	0	65
23	1	Copy Room	Screw-in	N	CFL	2	1	13	S	2	261	0	26	14	N/A	Screw-in	CFL	N	S	2	1	13	2	261	0	26	14	0	0	0
24	1	Storage Room	Parabolic	M	4'T12	2	2	40	S	2	261	15	190	99	T8	Parabolic	4'T8	E	S	2	2	32	2	261	6	140	73	26	0	26
25	1	Storage Room	Parabolic	M	4'T12	1	4	40	S	2	261	24	184	96	T8	Parabolic	4'T8	E	S	1	4	32	2	261	13	141	74	22	0	22
26	1	Storage Room	Parabolic	M	4'T12	1	4	40	S	2	261	24	184	96	T8	Parabolic	4'T8	E	S	1	4	32	2	261	13	141	74	22	0	22
27	1	Bathroom Men	Screw-in	N	CFL	2	1	13	OS	4	261	0	26	27	N/A	Screw-in	CFL	N	OS	2	1	13	4	261	0	26	27	0	0	0
28	1	Bathroom Men	2'U-shape	M	2'T12	2	2	24	OS	4	261	16	128	134	T8	2'U-shape	2'T8	E	OS	2	2	18	4	261	5	82	86	48	0	48
29	1	Bathroom Women	2'U-shape	M	2'T12	2	2	24	OS	4	261	16	128	134	T8	2'U-shape	2'T8	E	OS	2	2	18	4	261	5	82	86	48	0	48
30	1	Bathroom Women	Screw-in	N	CFL	2	1	13	OS	4	261	0	26	27	N/A	Screw-in	CFL	N	OS	2	1	13	4	261	0	26	27	0	0	0
31	1	Storage Room	Parabolic	M	4'T12	1	4	40	S	2	261	24	184	96	T8	Parabolic	4'T8	E	S	1	4	32	2	261	13	141	74	22	0	22
32	1	Storage Room	Parabolic	M	4'T12	1	4	40	S	2	261	24	184	96	T8	Parabolic	4'T8	E	S	1	4	32	2	261	13	141	74	22	0	22
33	Ext	Driveway	Exterior	N	Hal	7	1	75	T	12	365	19	658	2,882	CFL	Exterior	CFL	N	T	7	1	25	12	365	0	175	767	2116	0	2116
34	Ext	Exterior	Exterior	N	CFL	9	1	26	T	12	365	0	234	1,025	N/A	Exterior	CFL	N	T	9	1	26	12	365	0	234	1025	0	0	0
35	Ext	Exterior	Exterior	N	Hal	3	1	75	T	12	365	19	282	1,235	CFL	Exterior	CFL	N	T	3	1	25	12	365	0	75	329	907	0	907
Totals:						**103**	**93**	**1,232**				**539**	**11,891**	**23,624**						**103**	**90**	**871**			**247**	**8,434**	**13,456**	**7,813**	**2,355**	**10,168**

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

Appendix B: Third Party Energy Suppliers (ESCOs)

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

Third Party Electric Suppliers for Atlantic City Electric Service Territory	Telephone & Web Site
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
American Powernet Management, LP 437 North Grove St. Berlin, NJ 08009	(877) 977-2636 www.americanpowernet.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
ConEdison Solutions 535 State Highway 38 Cherry Hill, NJ 08002	(888) 665-0955 www.conedsolutions.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.newenergy.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
FirstEnergy Solutions 300 Madison Avenue Morristown, NJ 07926	(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	(800) 363-7499 www.libertypowercorp.com
Pepco Energy Services, Inc. 112 Main St. Lebanon, NJ 08833	(800) 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 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) 756-3749 www.southjerseyenergy.com
Strategic Energy, LLC 55 Madison Avenue, Suite 400 Morristown, NJ 07960	(888) 925-9115 www.sel.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

Appendix C: Glossary and Method of Calculations

Glossary of ECM Terms

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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 measures (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.

Calculation References

ECM = Energy Conservation Measure
AOCS = Annual Operating Cost Savings
AECS = Annual Energy Cost Savings
LOCS = Lifetime Operating Cost Savings
LECS = Lifetime Energy Cost Savings
NPV = Net Present Value
IRR = Internal Rate of Return
DR = Discount Rate

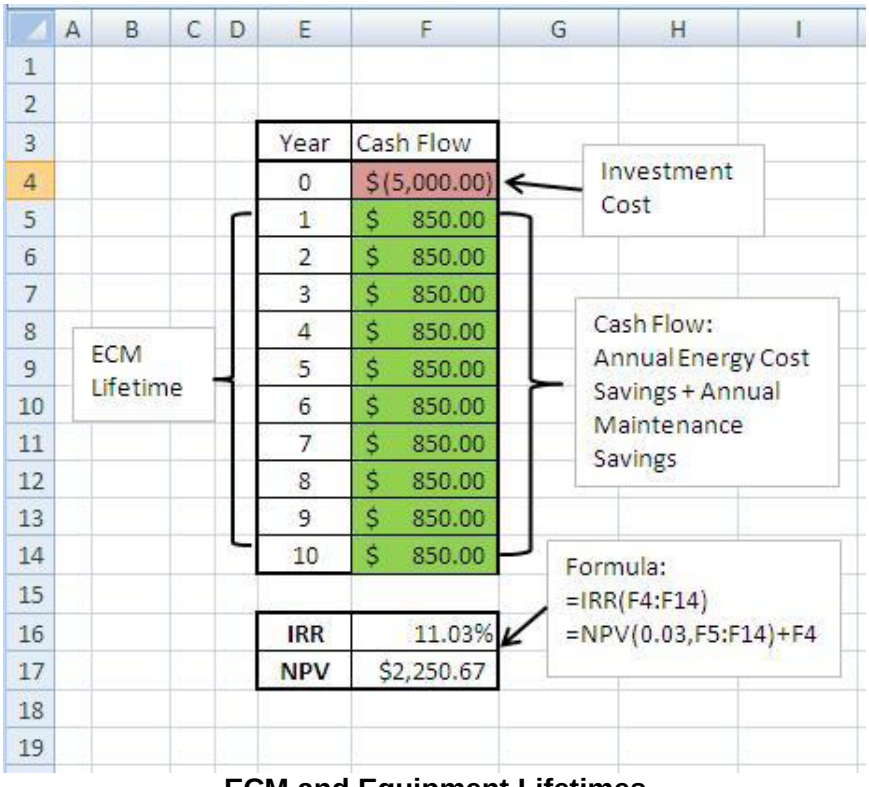
Net ECM Cost = Total ECM Cost – Incentive
LECS = AECS X ECM Lifetime
AOCS = LOCS / ECM Lifetime

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

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

Excel NPV and IRR Calculation

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



ECM and Equipment Lifetimes

Determining a lifetime for equipment and ECM's can sometimes be difficult. The following table contains a list of lifetimes that the NJCEP uses in its commercial and industrial programs. Other valid sources are also used to determine lifetimes, such as the DOE, ASHRAE, or the manufacturer's warranty.
Lighting is typically the most difficult lifetime to calculate because the fixture, ballast, and bulb can all have different lifetimes. Essentially the ECM analysis will have different operating cost savings (avoided equipment replacement) depending on which lifetime is used.

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

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

NJCEP C & I Lifetimes

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