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December 9, 2009

Local Government Energy Program
Energy Audit Final Report

For

Springfield Township Elementary School
Jobstown, NJ 08041

Project Number: LGEA19

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INTRODUCTION

On August 14th and August 28th Steven Winter Associates, Inc. (SWA) performed an energy audit and assessment for the Springfield Township Elementary School. The building is located in Jobstown, NJ.

This report addresses the Springfield Township Elementary School located at 2146 Jacksonville Rd, Jobstown, NJ 08041. 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 Springfield Township Elementary School was built in 1939 and houses the Board of Education, the school library, computer lab, classrooms, cafeteria and kitchen with a separate building for the gymnasium. Renovations took place in 1957, 1964, 1982 (gym addition), and 1993. The building consists of 38,000 square feet of conditioned space and the detached gymnasium is 5,320 square feet for a total of 43,320 square feet. The building houses approximately 55 faculty and staff employees with an average attendance of 320 students.

The building is operated approximately sixty hours per week including periodic evening activities. Normal weekday operating hours are 8:00 am to 4:00 pm with 3-4 evening activities per month, adult basketball in the winter, and 4 weeks of summer programs.

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

SWA was informed by the Springfield Board of Education that there is a plan to expand the school and upgrade the envelope, interior spaces, mechanical and electrical systems, which will be presented in a referendum for approval by the township voters in December of 2009.

EXECUTIVE SUMMARY

The energy audit performed by Steven Winter Associates (SWA) encompasses The Springfield Township Elementary School located at 2146 Jacksonville Rd, Jobstown, NJ 08041. The Springfield Township Elementary School is a one story building with a combined floor area of 43,320 square feet (including the detached gymnasium). The original structure was built in 1939 with additions / renovations in 1957, 1964, 1982, and 1993.

Based on the field visits performed by the SWA staff on August 14th and August 28th 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.

In 2008, the most recent year, the Springfield Township Elementary School consumed 314,130 kWh or $48,659 worth of electricity and 26,489 therms or $42,455 worth of natural gas. The joint energy consumption for the building, including both electricity and natural gas, was 3,721 MMBtu of energy that cost a total of $91,114.

SWA benchmarked the Springfield Township Elementary School using the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The building performance rating received is a score of 29 when compared to other buildings of its kind. This indicates that there are good opportunities for the Springfield Township Elementary School to decrease energy (natural gas or electric use or a combination thereof) use to reach a more desirable Energy Star rating of 75. The site energy intensity and use is 87 kBtu/ft^2 yr compared to average buildings of its kind consuming 73 kBtu/ft^2 yr. The wastewater treatment plant uses over 2.5 kBtu/ft^2 yr. As described in this report's ECMs, heating / cooling controls and building envelope insulation (such as windows) could account for at least 14.5 kBtu/ft^2 yr, which when implemented would make the school energy consumption better than the national average.

Based on the assessment of the Springfield Township Elementary School, 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

- Related Safety Items - Upgrade building to comply with latest ADA regulations
- Back-up Generator - Provide an emergency 150 kVA back-up generator for the building critical systems
- Upgrade / Protect Exterior Walls - install proper flashing and correct masonry efflorescence
- Window Replacement - As part of a capital improvement plan replace all windows (approximately 110 single-pane) with newer models with thermal breaks, dual glazing and a low-e rating
- Door Replacement - Replace approximately 45 outdated exterior doors and their mechanisms
- Slate Roof - Replace slate roof and cupola that are in disrepair with falling pieces for improved safety and thermal insulation.
- New Boiler - The existing boiler has 8-9 years of expected operating life left on it. An upgrade to a condensing type boiler with efficiency in the high 85% cannot be justified by energy savings alone
- Replace Unit Ventilators - The 32 Nesbitt unit ventilators are operating beyond their useful operating lives with spare parts difficult to find and increased maintenance repair costs. There is better control offered by the newer units, although the energy savings improvements are negligible
- Replace Exhaust Fans - The building exhaust fans are operating beyond their useful operating lives. The fan motors are small, fractions of Hp and the replacement units will have negligible energy savings

- Gymnasium Furnace - It is operating beyond its useful operating life and should be replaced in kind (with a high efficiency model) if it is decided that no major upgrade will occur to the gymnasium space
- Replace Domestic Hot Water (DHW) heaters - as they reach the end of their useful operating lives
- Well Pump - It is operating beyond its useful operating life and should be replaced in kind
- Wastewater Treatment System - The 1964 system went through a minor rehab and epoxy painting 5 years ago. The system is operating beyond its useful operating life and considerations should be given to performing a major upgrade or replacement in kind (with a high efficiency model). SWA recommends basin wall thicknesses be measured in the upcoming summer of 2010 and basing further decisions on the findings.
- Building Management System (BMS) - The existing control system seems to be working fine, however in a major building HVAC overhaul, it should be upgraded to a DDC state of the art system
- Premium Motors - Upgrade all new motor driven equipment to premium efficiency motors
- Replacing T12 and Metal Halide fixtures with T8 and T5 fixtures with electronic ballasts cannot be justified by energy savings alone and should be considered as part of a major renovation plan

Category II Recommendations: Operations and Maintenance

- Boiler Room Piping Insulation - Insulate un-insulated hot water piping to efficiently deliver heat
- Asbestos Abatement - Abate asbestos insulating old piping per local codes and regulations
- Roof Maintenance - SWA recommends regular maintenance to verify water is draining correctly
- Downspouts - Repair missing downspouts and areas of brick veneer damage to prevent water infiltration
- Weather Stripping / Air Sealing - Doors and vestibules should be observed annually for deficient weather-stripping and replaced as needed. Any other accessible gaps or penetrations in the thermal envelope penetrations should also be sealed with caulk or spray foam.
- Water Efficient Fixtures & Controls - Retrofitting with more efficient water-consumption fixtures / appliances will save both energy and money through reduced energy consumption for water heating
- Domestic Hot Water - Set the heaters to produce water at or below 120 ^{o}F and install timers
- Energy Star labeled appliances such as refrigerators should replace older energy inefficient equipment.
- Smart power electric strips with occupancy sensors should be used to power down computer equipment when left unattended for extended periods of time.
- Create an educational program that teaches both students and their teachers how to minimize their energy use in the classroom. The US Department of Energy offers free information.

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

At this time, SWA highly recommends a total of **3** Energy Conservation Measures (ECMs) for the Springfield Township Elementary School that are summarized in the following Table 1. The total investment cost for these ECMs with incentives is **$3,478**. SWA estimates a first year savings of **$2,038** (inclusive of operations and maintenance savings) with a simple payback of **1.7 years**. SWA estimates that implementing the highly recommended ECMs will reduce the carbon footprint of the Springfield Township Elementary School by **17,550 lbs of CO_2.** SWA also recommends another **6** ECMs with 5-10 year payback that are summarized in the following Table 2.

There are various incentives that the Springfield Township Board of Education could apply for that could also help lower the cost of installing the ECMs. SWA recommends that the Springfield Township Elementary School 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, to be rolled out soon, could also assist to cover 80% of the capital investment.

Specifically, the building could qualify for $180 for installing premium efficiency motors, $280 for installing the recommended wall-mounted occupancy sensors and $100 for installing LED Exit signs. The Springfield Township Elementary School could also take advantage of incentives based on the installation of a photovoltaic (PV) system. Currently, the New Jersey Office of Clean Energy offers a Renewable Energy Incentive program that would pay $5,000 for the installation of a 5kW PV system. There is also an incentive that issues a Solar Renewable Energy Certificate for every 1,000kWh (1MWh) of electricity generated that can be sold or traded for the current market rate of electricity. $3,600 of SRECs may be received annually; however it requires proof of performance, application approval and negotiations with the utility. 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 (ECM) and their economic relevance.

Table 1 - Highly Recommended 0-5 Year Payback ECMs

ECM #	ECM description	Installed Cost		1st year energy savings						SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
		Estimate $	Source	Use	Unit	Demand / mo	Unit	Savings / year $	kBtu /sq ft			Cost Savings $		
1	Install timer for wastewater treatment grinder	$1,600	Similar Projects	9,178	kWh	2.6	kW	1,423	0.7	1.1	12	13,993	64.5	12,574
2	Replace 2 waste treatment blower 3 Hp motors with Premium Efficiency with INCENTIVE	$1,158	Similar Projects, DOE Motor Master Internatio-nal selection & savings analysis	1,978	kWh	0.6	kW	307	0.2	3.8	20	4,478	14.3	2,710
3.1	replace 36 incand lamps to CFL	$720	RS Means, Lit Search	1,654	kWh	0.5	kW	309	0.1	2.3	7	1,910	23.6	2,266
	Total Proposed	**$3,478**	-	-	-	**3.6**	**kW**	**$2,038**	**1.0**	**1.7**	**14**	**22,230**	**39.6**	**17,550**

Definitions: SPP - Simple Payback (years); LoM: Life of Measure (years); ROI: Return on Investment (%)
Assumptions: Discount Rate: 3.2% per DOE FEMP; Energy Price Escalation Rate: 0% per DOE FEMP Guidelines
Note: A 0.0 electrical demand / month indicates that it is very low / negligible

Table 2 - Recommended 5-10 Year Payback ECMs														
ECM #	ECM description	Installed Cost		1st year energy savings						SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
		Estimate $	Source	Use	Unit	Demand / mo	Unit	Savings / year $	kBtu /sq ft			Cost Savings $		
4	Retro-Commission-ing	$54,150	Similar Projects	31,413 2,649	kWh therms	8.9 -	kW -	10,935	8.6	5.0	12	107,562	8.2	74,029
5	Install 5 kW PV System (with $1/W INCENTIVE and $600/1MWh SREC)	$30,000	Similar projects	5,902	kWh	5.0	kW	4,515	0.5	6.6	25	76,894	6.3	8,086
3.2	install 14 occupancy sensors, with INCENTIVES	$1,260	RS Means, Lit Search, NJ Clean Energy Program	1,216	kWh	0.3	kW	188	0.1	6.7	12	1,854	3.9	1,666
3.3	replace 5 Fluorescent EXIT sign with LED type, with INCENTIVES	$500	RS Means, Lit Search, NJ Clean Energy Program	394	kWh	0.1	kW	61	0.0	8.2	20	892	3.9	540
6	replace 2 Faculty Lounge refrigerators with Energy Star models	$1,000	Manufac-turer and Store Info	732	kWh	0.2	kW	113	0.1	8.8	15	1,335	2.2	1,003
7	Replace 2 hot water circulator pump 7.5 Hp motors with Premium Efficiency with INCENTIVE	$1,122	Similar Projects, DOE Motor Master Internatio-nal selection & savings analysis	674	kWh	0.2	kW	105	0.1	10.7	20	1,527	1.8	924

1. HISTORIC ENERGY CONSUMPTION

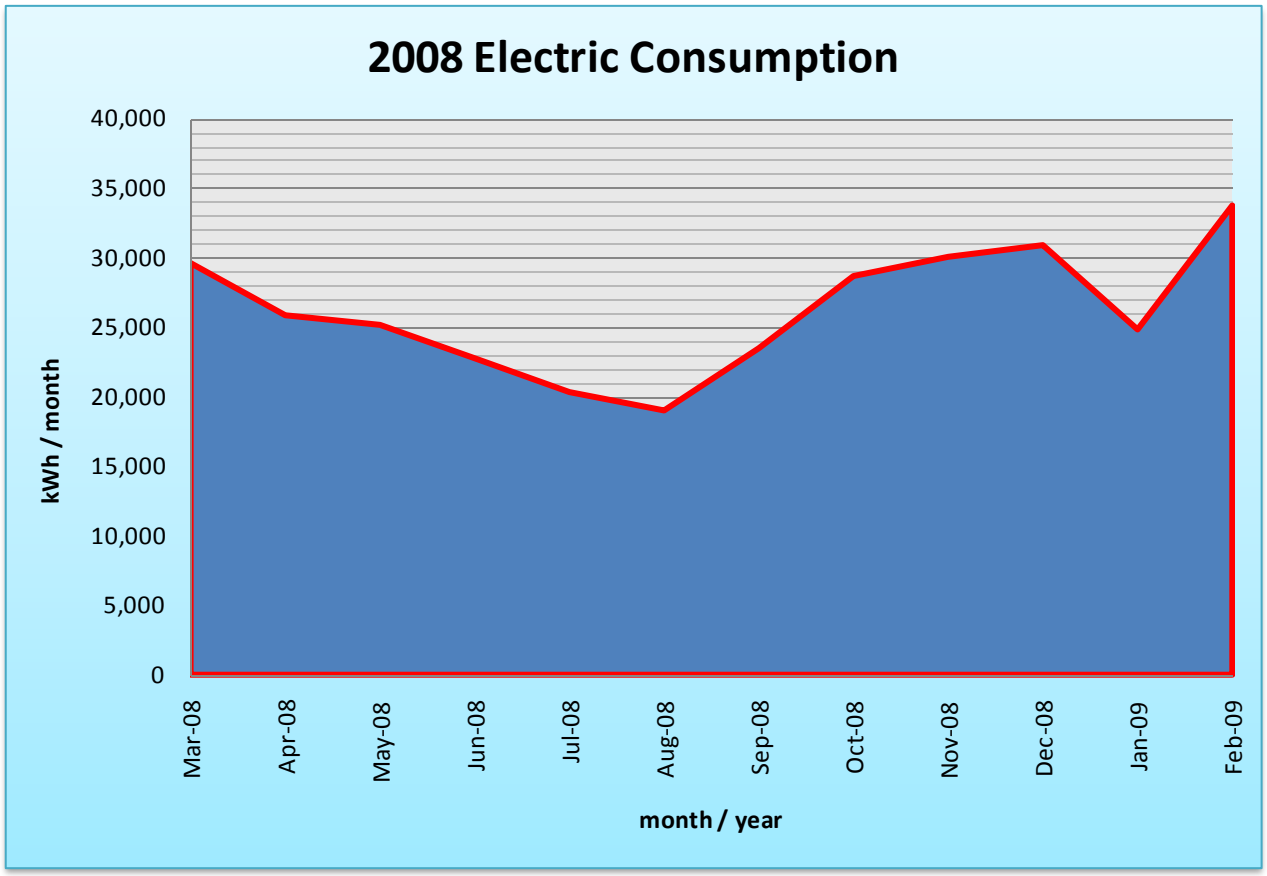
1.1. Energy usage and cost analysis

SWA analyzed utility bills from March 2008 through February 2009 that were received from the utilities supplying the Springfield Township Elementary School with electric and natural gas.

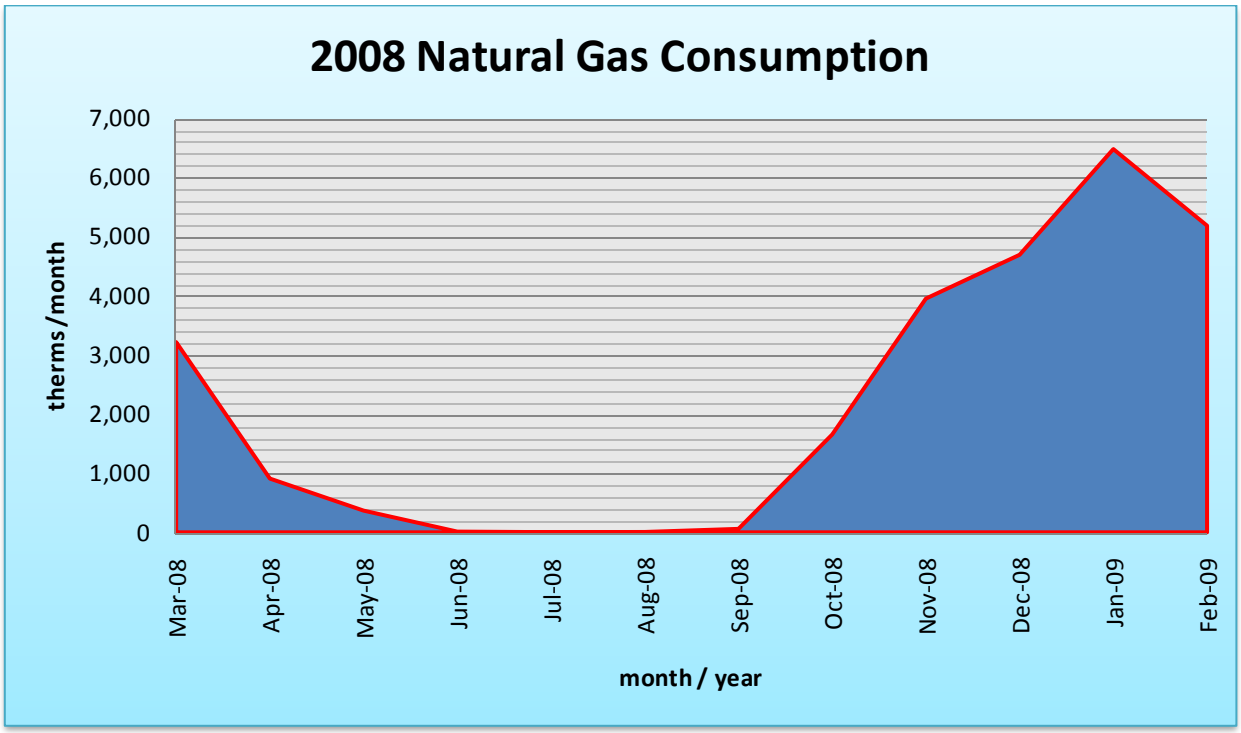
Electricity - The Springfield Township Elementary School is currently served by one electric meter. The Springfield Township Elementary School currently buys electricity from PSE&G at **an average rate of $0.155/kWh** based on 12 months of utility bills for 2008. The Springfield Township Elementary School purchased **approximately 314,130 kWh or $48,659.04 worth of electricity** in the previous year. The average monthly demand was 88 kW.

Natural Gas - The Springfield Township Elementary School is currently served by one meter for natural gas. The Springfield Township Elementary School currently buys natural gas from PSE&G (supplied by Hess) at **an average aggregated rate of $1.603/therm** based on 12 months of utility bills for 2008. The Springfield Township Elementary School purchased **approximately 26,489 therms or $42,455 worth of natural gas** in the previous year.

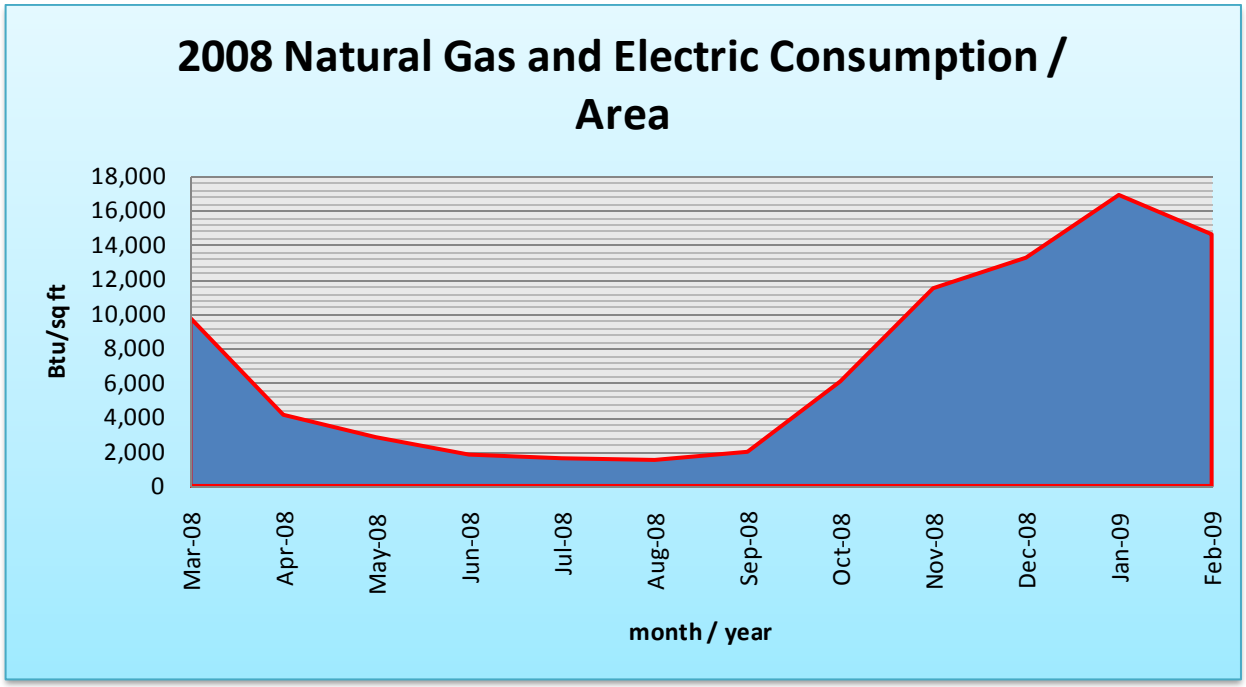
The following chart shows electricity use for the Springfield Township Elementary School based on utility bills for the 12 month period of March 2008 - February 2009.



The following chart shows the natural gas consumption for the Springfield Township Elementary School based on utility bills for the 12 month period of March 2008 - February 2009.

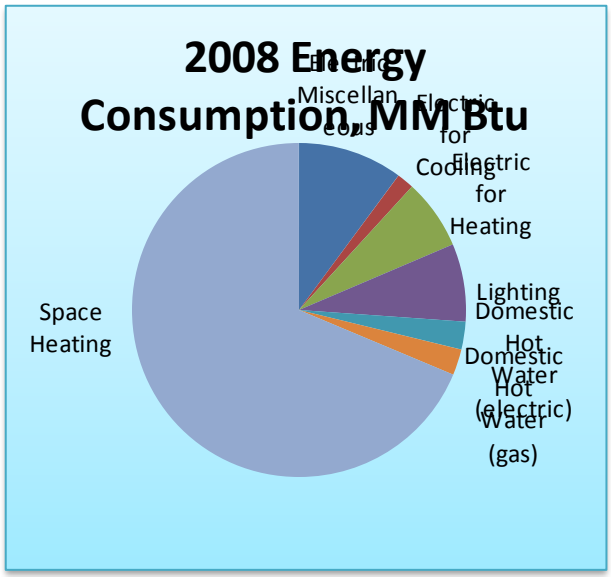


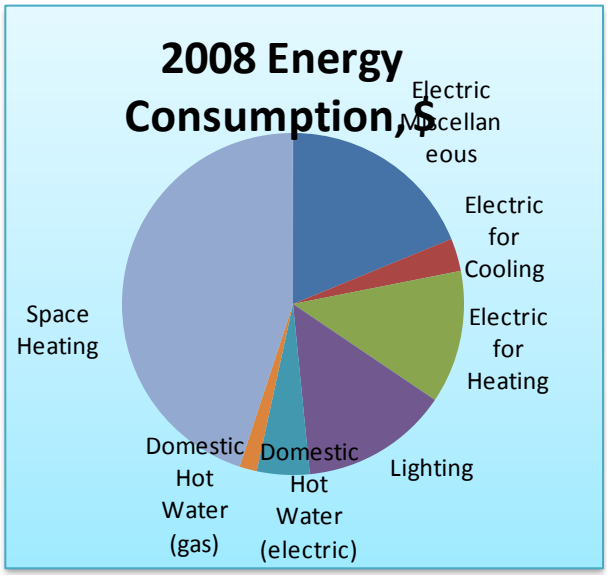
The following chart shows combined natural gas and electric consumption in Btu/ft2 for the Springfield Township Elementary School, based on utility bills for the 12 month period of March 2008 - February 2009.



The following table and chart pies show energy use for the Springfield Township Elementary School based on utility bills for the 12 month period of March 2008 - February 2009. Note electrical cost at $45/MMBtu of energy is approximately 3 times as expensive to use as natural gas at $16/MMBtu. It is assumed that the electrical miscellaneous usage includes building fans that operate throughout the year.

2008 Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	377	10%	$17,130	19%	$45
Electric for Cooling	62	2%	$2,810	3%	$45
Electric for Heating	252	7%	$11,461	13%	$45
Lighting	280	8%	$12,715	14%	$45
Domestic Hot Water (electric)	100	3%	$4,543	5%	$45
Domestic Hot Water (gas)	94	3%	$1,503	2%	$16
Building Space Heating	2,555	69%	$40,952	45%	$16
Totals	3,721	100%	$91,114	100%	$24
Total Electric Use	1,072	29%	$48,659	53%	$45
Total Gas Use	2,649	71%	$42,455	47%	$16
Totals	3,721	100%	$91,114	100%	$24





1.2. Utility rate

The Springfield Township Elementary School currently purchases electricity from PSE&G at a general service market rate for electricity use (kWh) with a separate (kW) demand charge. The Springfield

Township Elementary School currently pays an average rate of approximately $0.155/kWh based on 12 months of utility bills for 2008.

The Springfield Township Elementary School currently purchases natural gas supply from Hess at a general service market rate for natural gas (therms). PSE&G acts as the transport company. There is one gas meter that provides natural gas service to the Springfield Township Elementary School currently. The average aggregated rate (supply and transport) for the meter is approximately of $1.603/therm based on 12 months of utility bills for 2008.

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

The Springfield Township Elementary School information and utility data were entered into the U.S. Environmental Protection Agency's (EPA) Energy Star Portfolio Manager Energy benchmarking system. The building performance rating received is a score of 29 when compared to other buildings of its kind. This indicates that there are good opportunities for the Springfield Township Elementary School to decrease energy (natural gas or electric use or a combination thereof) use to reach a more desirable Energy Star rating of 75.

Buildings achieving an Energy Star rating of 75 or higher and professionally verified to meet current indoor environmental standards are eligible to apply for the Energy Star award and receive the Energy Star plaque to convey superior performance to students, parents, taxpayers, and employees. These ratings also greatly help when applying for Leadership in Energy and Environmental Design (LEED) building certification to the United States Green Building Council (USGBC). The site energy use intensity for the Springfield Township Elementary School is 87 kBtu/sq.ft./year. After energy efficiency improvements are made, future utility bills can be added to the Portfolio Manager and the site energy use intensity for a different time period can be compared to the year 2008 baseline to track the resulting impact on energy consumption over time.

Per the LGEA program requirements, SWA has assisted the Springfield Board of Education to create an *Energy Star Portfolio Manager* account and share the Springfield Township Elementary School 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 Springfield Board of Education (user name of SPRINGFIELDBOE with a password of GOGREEN09) and TRC Energy Services (user name of TRC-LGEA).

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Springfield Township BOE - Elementary School

Building ID: 1845472
For 12-month Period Ending: January 31, 2009[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: September 26, 2009

Facility
Springfield Township BOE - Elementary School
2146 Jacksonville Jobstown Road
Jobstown, NJ 08041

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1939
Gross Floor Area (ft²): 43,320

Energy Performance Rating[2] (1-100) 29

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	1,094,884
Natural Gas (kBtu)[4]	2,681,892
Propane (kBtu)	211
Total Energy (kBtu)	3,776,987

Energy Intensity[5]

Site (kBtu/ft²/yr)	87
Source (kBtu/ft²/yr)	149

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	309

Electric Distribution Utility
PSE&G - Public Service Elec & Gas Co

National Average Comparison

National Average Site EUI	73
National Average Source EUI	124
% Difference from National Average Source EUI	20%
Building Type	K-12 School

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 single story 38,000 square feet Springfield Elementary School building was built in 1939, with renovations 1957, 1964, 1982 (gymnasium) and 1993. The detached gymnasium's size is approximately 5,320 square feet.

The main building is comprised of classrooms, library, computer lab, cafeteria, kitchen, administrative offices and areas for the Board of Education.

2.2. Building occupancy profiles

The 55 teachers / Board of Education members and 320 students occupy the building an average of 60 hours per week with daily hours from 8:00 AM until 4:00 PM and periodic evening activities, usually scheduled 3-4 times per month. Adult basketball is played in the winter in the gymnasium. Summer occupancy is 4 weeks, half days with a staff of 13 and 40-50 students.

2.3. Building envelope

2.3.1. Exterior Walls

The exterior walls consist mostly of 8" CMU and brick veneer finish. On the interior, walls are partially framed. Due to warm temperature conditions at the time of the field visits, insulation levels could not be verified with help of infrared technology. If desired, the municipality could contract a separate envelope inspection during cooler months.

Repairs are needed on rusting metal panels above windows. Some down spouts need to be either reinstalled or fixed. Caulking needs to be installed around window sills and damaged aged brick veneer needs to be re-pointed. SWA recommends proper maintenance due to concerns with water/ moisture infiltration potential, which can significantly contribute to high energy costs when insulation is compromised. Overall, exterior and interior finishes of the envelope walls were found to be in age-appropriate condition.

Missing downspouts and areas of brick veneer damage due to water/ moisture infiltration

2.3.2. Roof

The slate roof is coming apart and SWA recommends that it is replaced to prevent water damage underneath and the building interior. The flat roof is constructed of dark colored rubber membrane. No reports or obvious signs of roof leaks were reported or noticed during the field audit. Pooling was however apparent. SWA recommends cleaning out all roof drains and possibly installing dedicated air conditioner condensate drains to minimize standing water over long periods of time. The sloped 1939 slate roof and cupola area showing signs of age and replacements are recommended. Insulation could not be verified. As mentioned under 2.3.1 Exterior Walls, a separate envelope inspection should be conducted during cooler months. SWA suggests basing further extensive insulation related roof improvement discussions on the outcome of those future findings.

Pooling on Roof

Aged Slate Roof on left

2.3.3. Base

The building's base is a 4" concrete slab-on grade with a perimeter footing. There weren't any reported problems with water penetration or moisture. The slab edge or perimeter insulation could not be verified and should be confirmed at the time of the above recommended insulation inspection during cooler months for usable infrared data evaluation.

2.3.4. Windows

The building contains fixed and operable windows with single-glazing. SWA recommends replacing single pane aluminum windows with double pane low-e type. SWA also recommends either professionally installed retrofit window foils applied to the inside or operable commercial blinds to control the amount of natural light that enters the building in an effort to improve thermal and / or glare control.

Although natural day lighting has been shown to improve occupant health, solar heat gain and glare from older glazing often negatively impact activities and comfort within the space. To understand the comfort concerns and identify those classrooms with the most significant problems, building staff can conduct an occupant survey. For problem areas, it may be beneficial to install tinted glazing or a window film to reduce the glare and solar heat gains. This recommendation will not provide energy savings but may improve occupant comfort.

Original single glazed aluminum framed windows

2.3.5.Exterior doors

The metal framed exterior doors were observed to be in good condition except for some missing or worn weather-stripping in the gym area. The wood doors should be replaced with insulated type doors due to age. SWA recommends that the exterior doors of the building be weather-stripped in order to decrease the amount of conditioned air that is lost around each door. SWA also recommends checking the weather-stripping of each door on a regular basis and replacing any broken seals immediately. Tight seals around the doors will help ensure that the building is kept continuously tight and insulated.

Worn or missing weather-stripping

2.3.6.Building air tightness

Based on a visual inspection, the building could benefit from tightly sealed windows and doors, plumbing, and wire penetrations. Any water damage due to condensing un-insulated pipes, condensate lines dripping, plumbing leaks, or roof leaks should be repaired immediately and ceiling tiles should be replaced. Ceiling tiles act as an air barrier containing expensive conditioned air from leaking into ceiling or wall cavities.

2.4. HVAC Systems

2.4.1.Heating

In the Springfield Elementary School building, pumps circulate hot water through approximately 32 Nesbitt Aire fan coil units serving the classrooms. Each fan coil unit contains a heating coil, fan assembly, damper, filter, and controls within a metal cabinet located on the outside wall of each classroom. Outdoor air is brought directly into the cabinets via grilles located on the outside wall of the classrooms. The fan coil units are designed to mix room air with outside air, condition the air as necessary, and deliver it to the classrooms through grilles located in the top of the fan coil unit. The

proportion of outside air is controlled by the position of the fresh air dampers. The water is heated by a HB Smith 13 section boiler.

The boiler was designed for 100 Hp or 3,347 MBtu/hr. A few years ago it was down-rated in order to allow black seal licensed mechanics to operate it. The Power Flame burner was similarly restricted in gas flow. SWA was told that the existing boiler barely keeps up with the building heat load requirements on very cold days and when the outside doors are opened in the winter for students to go in or come out, it takes approximately 20 minutes for the building to come back up to the heating set point. SWA recommends that the existing high efficiency Power Flame burner gas pressure be raised so that it can burn close but still below 3,347 MBtu/hr, however higher than the present burning restriction of 2,577 MBtu/hr.

2.4.2.Cooling

Window air conditioner units were found to serve the faculty lounge area and administrative offices in the building. SWA recommends the removal of these units during heating season if possible in order to reduce the loss of expensive conditioned air. If the removal of these units is not possible, SWA recommends a product similar to Chill Stop-R, which effectively creates an air barrier and seal around the unit.

Improperly sized plywood as air barrier above air conditioning unit

Three rooftop units with DX coils cool the library and the computer lab during warm weather.

SWA cautions the Springfield Township Elementary School that future plans to air condition the entire building, estimated at 125 Tons vs. present use of approximately 14 Tons of refrigeration will significantly increase the building's energy consumption. At the same time, uncomfortable hot weather and unpleasant Indoor Air Quality is not conducive to a good learning atmosphere.

2.4.3.Ventilation

The Springfield Township Elementary School is provided with outside air via the unit ventilators. The main building has a number of rooftop exhaust fans, a few at the end of their useful operating lives. They should be replaced in kind. The fan motors are small, fractions of Hp and the replacement units will have negligible energy savings over the existing.

Similarly, the two exhaust gym fans are at the end of their useful operating lives and should be replaced in kind. In general, they are operated for a limited amount of hours during the summer.

2.4.4. Domestic Hot Water

There are four domestic hot water (DHW) heaters in the buildings. Three are with 40 gal tanks and electric heated. The kitchen DHW is natural gas heated and also supplies an electric booster heater feeding hot water to the dish washer.

Water heater timers can be cost-effective. If the water heater timer can be set so that the heating elements mostly operate during off hours, savings can be realized from the lower electric rates for off hours. In this particular case the savings are expected to be fairly small due to low hot water use.

2.5. Electrical systems

2.5.1. Lighting

Interior Lighting - The Springfield Township Elementary School currently consists of mostly updated T8 fluorescent fixtures with electronic ballasts. There are many incandescent bulbs found in bathrooms, closets, and offices. SWA recommends replacement of all incandescent bulbs with compact fluorescents. SWA also recommends installing occupancy sensors in bathrooms, closets, offices and areas that are occupied only part of the day. Since bathrooms are used sporadically throughout the day and lighting is commonly left on far beyond the necessary hours of operation, SWA recommends installing occupancy sensors with time delay and acoustic capabilities. Typically, occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion or sound is detected within a set time period. The Springfield Elementary School should also consider replacing the gymnasium metal halide lamps with the more efficient T5 lamp fixtures (ECM #3.5). See attached lighting schedule in Appendix A for a complete inventory of lighting throughout the building and estimated power consumption.

Exit Lights - Exit signs were found to have a mix of LED or fluorescent bulbs. SWA recommends replacing all fluorescent exit signs with LED bulbs.

Exterior Lighting - The exterior lighting surveyed during the building audit were found to be a mix of metal halide and flood lamps. Since this lighting is mainly for Safety as well as for Security, SWA has deemed it not cost effective to replace exterior the metal halide lamp lighting at this time. SWA recommends the replacement of all incandescent flood lights with compact fluorescent lights. All exterior lighting is controlled by astronomical timers. There is not any immediate need to upgrade these lighting or astronomical timers.

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. Look for the Energy Star label when replacing appliances and equipment, including: refrigerators, printers, computers, copy machines, etc. More information can be found in the “Products” section of the Energy Star website at: http://www.energystar.gov. Also, energy vending miser devices are now available for conserving energy usage by Drinks and Snacks vending machines. When equipped with the vending miser devices, vending machines use less energy and are comparable in daily energy performance to new ENERGY STAR qualified machines.

Computers left on in the building consume a lot of energy. A typical desk top computer uses 65 to 250 watts and uses the same amount of energy when the screen saver is left on. Televisions in

meeting areas use approximately 3-5 watts of electricity when turned off. SWA recommends all computers and all appliances (i.e. fridges, coffee makers, televisions, etc) be plugged in to power strips and turned off each evening just as the lights are turned off. The Springfield Township Elementary School computers are generally programmed for the power save mode, to shut down after a period of time that they have not been used.

Wastewater Treatment Packaged Skid

A few hundred yards and in back of the school, a wastewater treatment system processes the sewerage generated by the school. The system's design capacity is 7,500 gpd (gallons per day). It has an aeration chamber with 2 air blowers, a clarifier and effluent treatment stages with a UV light prior to clean effluent released into the local creek. The system operates during the summer at 300 gpd and winter at 1,500 gpd. It may be possible to reduce the blower size and reduce power use, since the design is 5 times the actual average flow rate; however this change may require a discharge permit management of change application and approval, since it is not just a simple upgrade of a motor or blower efficiency. The 1982 system went through a minor rehab and epoxy painting 5 years ago. The system is operating beyond its useful operating life and considerations should be given to performing a major upgrade or replacement in kind.

2.5.3. Elevators

The Springfield Township Elementary School is a one story building and therefore there are no elevators.

2.5.4. Others electrical systems

There is a small Generac emergency generator operated on propane in the waste treatment area to back-up the process loads.

There are not currently any other electrical systems installed at the Springfield Township Elementary School.

3. EQUIPMENT LIST

Inventory

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	boiler, designed <100 Hp or 3,347 M Btu/hr so that also a black seal licensed operator can operate it	boiler rm	HB Smith, 13 sections, 2,791 MBH input, can do 4,025 MBH output;	Natural Gas	Elementary School	1993	35%
Heating	boiler burner	boiler rm	1.5 Hp Power Flame Burner (C3-G-20) - 2,577 MBH	Natural Gas	Elementary School	2000	60%
Heating	32 unit ventilators in classrooms	class rooms	mostly Nesbitt Aire (in 3 wings) with some Trane (in 1 wing) - electric / hydraulic controlled	Electric	Elementary School	varies, mostly very old	0%, operating past expected useful life
Heating	2 hot water circulator pumps	boiler rm	US Electric 7.5 Hp motors	Electric	Elementary School	very old	0%, operating past expected useful life
Heating	gym hot air system	gym mech rm	Armstrong Air Condi Inc. LG14-350/450B60-2A - 420 MBH input and 340 MBH output, burner - 420 MBH	Electric / Natural Gas	Gymnasium	1982	0%, operating past expected useful life
Cooling	3 RTU condensers	roof	a 2 ton Lennox for computer lab (~750 sq ft, ~25 computers); 2 Rheem 92-20842-15-00 - 3 tons each (serving the Library)	Electric	Computer Lab and Library	1993	35%
Cooling	several window AC units throughout the building	a few offices and class rooms	various models and sizes, mostly ~1 Ton	Electric	some offices and classrooms	varies	varies, estimating 20%
Ventilation	8+ rooftop exhaust fans; additional exhausts for kitchen and bathrooms	roof	powered exhausts: 3 in '39 wing, 5 in '93 wing	Electric	Elementary School	varies	varies, estimating 20%
Ventilation	2 exhaust air fans for the gym	gym	-	Electric	Gymnasium	1982	0%, operating past expected useful life
Domestic Hot Water	40 gal with circulating pump in '93 wing	'93 wing janitor's closet	Rheem Power Vent	Electric	'93 wing	1993	0%, operating past expected useful life
Domestic Hot Water	40 gal in kitchen (with hot water booster for dish washer)	kitchen	Lochinvar Industries ETA040KK, upper 4,500 Watts, lower 4,500 Watts	Electric	Kitchen	2000	40%
Domestic Hot Water	40 gal in boiler room	boiler rm	Bradford White	Natural Gas	Elementary School	1993	35%

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Building System	**Description**	**Location**	**Model #**	**Fuel**	**Space Served**	**Year Installed**	**Estimated Remaining Useful Life %**
Domestic Hot Water	40 gal in gym	gym mech rm	State Industries PV 40 20LS9 F, upper 4,500 Watts, lower 4,500 Watts	Electric	Gymnasium	1982	0%, operating past expected useful life
Well Pump	well pump station - located behind school	behind school	-	Electric	Elementary School	old	0%, operating past expected useful life
Sump Pump	a couple for water seepage	boiler rm	-	Electric	Elementary School	old	not an issue presently; 0%, operating past expected useful life
Waste water Treat-ment (wwt)	2 HP grinder operates 24/7 during school year	wwt skid	packaged wastewater treatment unit	Electric	Elementary School	1982	0%, operating past expected useful life
Waste water Treat-ment	2 blowers (1 standby) with std 3 HP motors (230V/3 phase/60 Hz) each	wwt skid	packaged wastewater treatment unit	Electric	Elementary School	1982	0%, operating past expected useful life
Waste water Treat-ment	small generator (operates on propane)	wwt yard	Generac	Electric	Elementary School	1982	0%, operating past expected useful life
Waste water Treat-ment	effluent UV treatment light in discharge pipe	wwt effluent pit	packaged wastewater treatment unit	Electric	Elementary School	1982	0%, operating past expected useful life
Lighting	See details - Appendix A	building	-	Electric	Elementary School	varies	varies, average 60%

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 Springfield Township Elementary School, 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

- Related Safety Items - Upgrade building to comply with latest ADA regulations
- Back-up Generator - Provide an emergency back-up generator for the building critical systems, Wastewater Treatment and Demand Response program sized to approximately 150 kVA:

  The Springfield Elementary School is considering as part of the major upgrade plan to install an emergency generator to back-up the school's critical electrical and safety systems. SWA is recommending that this new generator, of approximately 150 kVA, should be sized to incorporate the waste treatment loads and the existing small unit, which is at the end of its useful operating life, be removed.

  The Springfield Township Elementary School could be eligible for enrollment in a Demand Response Program, if the new generator would be wired in such a way to offer capability to shed a minimum of 100 kW electric demand when requested by the utility during peak demand periods, which is the typical threshold for considering this option. This setup will allow the Springfield Township Elementary School to negotiate a reimbursement program with the utility company.

- Upgrade / Protect Exterior Walls - SWA recommends as part of a capital improvement plan to install weep holes, install proper flashing and correct masonry efflorescence on approximately 28,000 sq ft.
- Window Replacement - SWA evaluated, as part of a capital improvement plan replacing all windows (approximately 110 single-pane) with newer models with thermal breaks, dual glazing and a low-e rating. Proper flashing and caulking should be performed upon installation of the new windows.

  The building contains fixed and casement aluminum-framed windows with single-glazing. These windows appear to be original to the building. In context of other energy measures proposed in this report and in an effort to maximize the cost-benefit factor for improvements, SWA recommends to delay window replacements at this time and make it part of the next major capital improvement / renovation project. Windows considered for replacement should have the following outline specifications besides conforming to local code and regulations: the windows shall be aluminum frame thermally manufactured as double hung commercial type modules. The clear, low-e, argon filled dual glazing should be 2 independent panes. The walls should be extruded aluminum with integral poured-in-place thermal barrier. All horizontal rails should be of tubular shape and joinery should be butted and coped with stainless steel screws. Air infiltration shall not exceed 0.10 cfm/sf of unit. The conductive thermal transmittance (U-Value) shall not be more than 0.51 BTU/hr ft^2 °F.

  The installed cost of approximately 110 replacement school window units of the type outlined above is estimated to cost $48,400, based on similar projects. Window replacement rebates and tax incentives are available only for residential buildings at this time. It is assumed that replacing windows with improved thermal insulation qualities will save approximately 25% of the energy load differential when compared to a similar well insulated building. The estimated annual savings are $4,113 and payback for replacing all the school windows is approximately 12 years, which could

reduce the schools energy requirements by at least 5.0 kBtu/ft^2 yr. This investment cannot be justified by energy savings alone and should be considered as part of a major renovation plan.

In the meanwhile, operable commercial grade blinds for more glair and thermal control can be an economical solution throughout the building where necessary, while selected window films are only effective on thermally manufactured window frames or tight vinyl frames.

- Door Replacement - Replace approximately 45 outdated exterior doors and mechanisms that cannot be properly and further repaired or weather stripped for improved safety and thermal insulation
- Slate Roof - Replace approximately 11K sq ft slate roof and cupola that are in disrepair with falling pieces for improved safety and thermal insulation. The crawl attic space under the slate roof becomes very hot during hot summer days, raising concerns with the wooden trusses supporting the roof and conditioned spaces below. It is difficult to estimate the thermal loses in this part of the building due to the irregular condition of the roof. Once a new insulated and asphalt shingle roof is applied, there may be a need to install attic fan(s) if natural venting will not be sufficient.
- New Boiler - The existing boiler has 8-9 years of expected operating life left on it. An upgrade to a condensing type boiler with efficiency in the high 85% cannot be justified by energy savings alone. However, replacement (and or keeping the existing boiler as a back-up) should be re-considered with a major renovation and heating system upgrades.

  Should the mechanical upgrades be approved in the December referendum, this boiler should be kept as a backup and a new condensing type boiler system be installed as primary. The new high efficiency condensing flexible water tube boiler(s) should have a guaranteed minimum thermal efficiency of 85% at the worst case condensing boiler operating conditions, such as 160° return water, 180° supply water at 100% firing load, and efficiencies of 95% achievable with lower return water temperatures. The boiler(s) flue gas should be sub 30 PPM NOx levels utilizing a hybrid metal fiber 5:1 turndown burner and hydronic safety controls and interface systems. The stainless steel tubes should be flexible and easily replaceable. The air blower should be variable speed combustion with access panels easily removable.

- Replace Unit Ventilators - The 32 Nesbitt unit ventilators are operating beyond their useful operating lives with spare parts difficult to find and increased maintenance repair costs. There is better control offered by the newer electronically controlled units, although the energy savings improvements are negligible.

  The 32 Nesbitt Aire unit ventilators are operating beyond their useful operating lives. Replacement parts are hard to find when units are breaking down, which is happening at an accelerated rate. SWA evaluated replacement of all 32 units with new. The updated fan coils should be double-inlet, forward-curved of centrifugal variety; have a maximum speed of 1,000 rpm with permanent split capacitor motors. The fan housing should be constructed of heavy gauge metal to help reduce air noise during operation. Wheel motors are to be premium efficiency, single-speed, permanent split capacitor with overload protection. Each fan should be equipped with a three speed switch for air balancing. An ultra-low leak, blade type outside air damper will ensure low leakage of the outside air when the equipment is off. The unit shall have a solid state, a defrost control system and two separate filters. The provided air-to-air heat exchanger should be designed to support two separate air streams in a counter-flow direction. The heat exchanger matrix shall prevent less than one percent of cross contamination between the air streams. The heat exchanger shall have the effectiveness of up to 80% with equal airflow. The proposed unit will not be that much more efficient than the existing. The estimated payback on enhancements is greater than 25 years.

- Replace Exhaust Fans - The building exhaust fans are operating beyond their useful operating lives. The fan motors are small, fractions of Hp and the replacement units will have negligible energy savings over the existing.
- Gymnasium Furnace - It is operating beyond its useful operating life and should be replaced in kind (with a high efficiency model) if it is decided that no major upgrade will occur to the gymnasium space for the foreseeable future.
- Replace Domestic Hot Water (DHW) heaters - as they reach the end of their useful operating lives.

  SWA evaluated the gymnasium electric hot water heater, which is at the end of its useful operating life and could be replaced with two under sink in-pipe electric heaters.

  The '93 building wing DHW is also at the end of its useful operating life and should be replaced prior to catastrophic failure with a similar unit since gas piping or another water heater is not available close-by. SWA recommends that the DHW heater flow be monitored and recorded for a time to determine new heater proper sizing. The new heater should have an Energy Star label. A water heater timer can be used to turn the water heater on for high-use periods and off during low-use periods. Most timers will allow multiple on / off periods per day and have a manual override switch to allow water heating at any time.

- Well Pump - It is operating beyond its useful operating life and should be replaced in kind (with a high efficiency model).
- Wastewater Treatment System - The 1964 system went through a minor rehab and epoxy painting 5 years ago. The system is operating beyond its useful operating life and considerations should be given to performing a major upgrade or replacement in kind (with a high efficiency model).

  SWA was told that during the last rehab the walls of the treatment basins were sandblasted, patch welded where needed and epoxied. There weren't any recordings of the wall thicknesses and there aren't any past records of how the anodes were maintained since the 1964 installation. SWA recommends that in the upcoming summer of 2010, it may be appropriate to pump out the basins and record with an ultrasonic device the wall thicknesses. This could be done in one day for approximately $8,000. Future decisions could then be made upon the findings and analysis. SWA reviewed the size of the blower and energy consumption. The purpose of the blower is two-fold, to keep the wastewater aerated and grow the bugs and stir up the mixture thoroughly in the basin. There is opportunity to reduce the size of the blower and have energy savings, however this will require a study, experimenting and by the time it's all said and done the cost of the effort may not justify the reduction in blower size. Therefore, best to put the effort of energy savings toward other prioritized recommendations in this report.

- Building Management System (BMS) - The existing control system seems to be working fine, however in a major building HVAC overhaul the automatic temperature control system for the entire building should be upgraded to a DDC state of the art system.
- Premium Motors - Upgrade all new motor driven equipment to premium efficiency motors when replacing them at the end of their useful operating lives. This cannot be justified at this time on energy savings alone on some equipment while on a few blower and pumps, SWA has made recommendations in ECM#2&7.
- Replacing T12 and Metal Halide fixtures with T8 and T5 fixtures with electronic ballasts:

  On the day of the site visit, SWA completed a lighting inventory of the Springfield Township Elementary School (see Appendix A). The existing lighting consists of many T8 fluorescent fixtures with electronic ballasts, and a T12s. Many of the lights in the Springfield Township Elementary

School appear to have been upgraded to T8 fixtures. SWA has performed an evaluation of upgrading all the T12 magnetic ballast fixtures to T8 electronic ballast fixtures. Evaluations include replacing the gymnasium metal halide lamps with the more efficient T5 lamp fixtures. The labor in all these installations was evaluated using prevailing electrical contractor wages. The Springfield Township Elementary School may decide to perform this work with in-house resources from its Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor, to obtain savings. The estimated cost for replacing T12s with T8s and the gymnasium Metal Halides with T5s is $5,309 with a payback of approximately 20 years. This investment cannot be justified by energy savings alone and should be considered as part of a major renovation plan.

Category II Recommendations: Operations and Maintenance

- Boiler Room Piping Insulation - Insulate un-insulated hot water piping to efficiently deliver heat where required and provide personnel protection.
- Asbestos Abatement - Abate asbestos insulating old piping and other building systems per local codes and regulations.
- Roof Maintenance - SWA recommends regular maintenance to verify water is draining correctly. SWA suggests verifying the terms of the roof warranty and contacting the roofing installer to correct areas with insufficient slope as needed.
- Downspouts - Repair missing downspouts and areas of brick veneer damage to prevent water / moisture infiltration and insulation damage. SWA recommends cleaning out all roof drains and installing dedicated air conditioner condensate drains to minimize standing water on roof over long periods of time.
- Weather Stripping / Air Sealing - SWA observed that exterior door weather-stripping in places was beginning to deteriorate. Doors and vestibules should be observed annually for deficient weather-stripping and replaced as needed. The perimeter of all window frames should also be regularly inspected and any missing or deteriorated caulking should be re-caulked to provide an unbroken seal around the window frames. SWA recommends the removal of window AC units during the heating season if possible in order to reduce the loss of expensive conditioned air. If the removal of these units is not possible, SWA recommends a product similar to Chill Stop-R, which effectively creates an air barrier and seal around the units. Any other accessible gaps or penetrations in the thermal envelope penetrations should also be sealed with caulk or spray foam.
- Water Efficient Fixtures & 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.
- Domestic Hot Water - Consider setting the heaters to produce hot water at or below 120 ^{o}F and installing timers on electric heaters with storage and set so that the heating elements mainly operate during off hours. Savings can be realized (actual savings will depend on the difference between standard and off peak rates).
- Energy Star labeled appliances such as refrigerators should replace older energy inefficient equipment.
- Smart power electric strips with occupancy sensors should be used to power down computer equipment when left unattended for extended periods of time.
- Create an educational program that teaches both students and their teachers how to minimize their energy use in the classroom. The US Department of Energy offers free information for hosting energy efficiency educational programs and K-12 lesson 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 timer for Wastewater Treatment grinder
2	Install premium efficiency motors on Wastewater Treatment blowers
3.1	Upgrade building lighting: incandescent lamps to CFLs
	Description of Recommended 5-10 Year Payback ECMs
4	Undertake retro-commissioning of building systems and controls to optimize performance
5	Install 5 kW Photovoltaic system
3.2 & 3.3	Upgrade building lighting: occupancy sensors for some offices and Exit fluorescents to LED
6	Replace old refrigerators
7	Install premium efficiency motors on hot water circulators

ECM#1: *Install Timer on Wastewater Treatment Grinder*

Description:

Wastewater contains large solids and grit that can interfere with the treatment process or cause undue mechanical wear and increased maintenance on wastewater treatment equipment. To minimize potential problems, these materials require separate handling. Preliminary treatment removes these constituents from the influent wastewater. Comminuting and grinding devices are installed in the wastewater flow channel to grind and shred material up to 6 to 19 mm (0.25 to 0.75 in) in size. Comminutors consist of a rotating slotted cylinder through which wastewater flow passes. Solids that are too large to pass through the slots are cut by blades as the cylinder rotates, reducing their size until they pass through the slot openings.

At the Springfield Elementary School, the comminutor / grinder operates at all times in the entrance chamber to the wastewater treatment plant in order to keep the system from plugging up with large particles. In fact, the comminutor / grinder need only operate several times a day for short periods of time (~15 min) to perform the needed grinding. By limiting the grinder to a shorter interval operation, energy will be saved and equipment life will be extended. SWA recommend that a programmable timer device be installed in the comminutor / grinder starter electrical panel.

Installation cost:

Estimated installed cost: $1,600
Source of cost estimate: *Similar projects and established costs*

Economics (without incentives):

ECM description	Installed Cost		1st year energy savings						SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate $	Source	Use	Unit	Demand /mo	Unit	Savings / year $	kBtu /sq ft			Cost Savings $		
Install timer for wastewater treatment grinder	$1,600	Similar Projects	9,178	kWh	2.6	kW	1,423	0.7	1.1	12	13,993	64.5	12,574

Assumptions: SWA calculated the savings for this measure using measurements taken the day of the field visit and using the billing analysis. The grinder is assumed to operate only a couple of hours a day with the installed timer.

Rebates/financial incentives: *This measure does not qualify for a rebate or 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 Wastewater Treatment Blowers*

Description:

The Wastewater Treatment system contains 2 air blowers (one is back-up) to aerate the wastewater and grow the microorganism that break down the organic matter in the wastewater. The 3 Hp explosion proof motors are standard efficiency. The Springfield Elementary School will realize electrical savings by switching the blower motors (one operates at all times) to premium efficiency motors.

Installation cost:

Estimated installed cost: $1,158
Source of cost estimate: *Similar projects and DOE Motor Master International selection & savings analysis*

Economics (with incentives):

ECM description	Installed Cost		1st year energy savings						SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate $	Source	Use	Unit	Demand /mo	Unit	Savings / year $	kBtu /sq ft			Cost Savings $		
Replace 2 waste treatment blower 3 Hp motors with Premium Efficiency with INCENTIVE	$1,158	Similar Projects, DOE Motor Master International - nal selection & savings analysis	1,978	kWh	0.6	kW	307	0.2	3.8	20	4,478	14.3	2,710

Assumptions: SWA calculated the savings for this measure using measurements taken the day of the field visit and using the billing analysis. The DOE Motor Master International selection and calculator was used with the assumption that a blower is operating at all times.

Rebates/financial incentives:

NJ Clean Energy - Three-phase premium 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 Springfield Township Elementary School (see Appendix A). The existing lighting consists of many T8 fluorescent fixtures with electronic ballasts, and a few incandescent lights and T12s. Many of the lights in the Springfield Township Elementary School appear to have been upgraded to T8 fixtures and LED lighted Exit signs. SWA has performed an evaluation of upgrading incandescent bulbs to CFLs, installing occupancy sensors in offices and bathrooms (and classrooms as it makes sense) that may be left unoccupied a considerable amount of time throughout the day and replacing fluorescent EXIT sign with LED type. The labor in all these installations was evaluated using prevailing electrical contractor wages. The Springfield Township Elementary School may decide to perform this work with in-house resources from its Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor, to obtain savings. SWA recommends at a minimum that the incandescent bulbs be replaced with CFLs, occupancy sensors be installed in a number of offices and bathrooms. See Appendix A for recommendations.

Installation cost:

Estimated installed cost: $2,480
Source of cost estimate: RS *Means; Published and established costs*

Economics (Some of the options considered with incentives):

ECM description	Installed Cost		1st year energy savings						SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate $	Source	Use	Unit	Demand /mo	Unit	Savings / year $	kBtu /sq ft			Cost Savings $		
3.1 - replace 36 incand lamps to CFL	$720	RS Means, Lit Search	1,654	kWh	0.5	kW	309	0.1	2.3	7	1,910	23.6	2,266
3.2 - install 14 occupancy sensors, with INCENTIVES	$1,260	RS Means, Lit Search, NJ Clean Energy Program	1,216	kWh	0.3	kW	188	0.1	6.7	12	1,854	3.9	1,666
3.3 - replace 5 Fluorescent EXIT sign with LED type, with INCENTIVES	$500	RS Means, Lit Search, NJ Clean Energy Program	394	kWh	0.1	kW	61	0.0	8.2	20	892	3.9	540
Total Proposed	$2,480		3,264	kWh	0.9	kW	558	0.3	4.4	11	5,230	9.8	4,472

Assumptions: SWA calculated the savings for this measure using measurements taken the day of the field visit and using the billing analysis. SWA also assumed an aggregated 1.5 hrs/yr to replace aging burnt out lamps vs. newly installed and included this with the annual savings.

Rebates/financial incentives:

NJ Clean Energy - Wall Mounted occupancy sensors ($20 per control)
Maximum incentive amount is $280.

NJ Clean Energy - LED Exit signs ($10-$20 per fixture)
Maximum incentive amount is $100.

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: *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 Springfield Township Elementary School have undergone renovations in the last ten 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 should also be reviewed to identify opportunities for optimizing system performance.

Installation cost:

Estimated installed cost: $54,150
Source of cost estimate: Similar projects

Economics (without incentives):

ECM description	Installed Cost		1st year energy savings						SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate $	Source	Use	Unit	Demand /mo	Unit	Savings / year $	kBtu /sq ft			Cost Savings $		
Retro-Commission-ing	$54,150	Similar Projects	31,413	kWh	8.9	kW	10,935	8.6	5.0	12	107,562	8.2	74,029
			2,649	therms	-	-							

Assumptions: Since the utility bills have some accounting fluctuations, it is difficult to determine the amount of energy used for heating and cooling the Springfield Township Elementary School. 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 43,320. 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 and included this with the annual savings.

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#5: *Install 5kW PV System*

Please see section 5: RENEWABLE AND DISTRIBUTED ENERGY MEASURES

ECM#6: *Replace Old Refrigerator with Energy Star models*

Description:

On the day of the site visit, SWA observed that there are 2 old refrigerators in the Faculty Lounge which are not Energy Star rated (each 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 Kenmore 18.2 cu. ft. top freezer refrigerator ENERGY STAR®, Mfr. model #6897, 407 kWh / yr, or equivalent. Besides saving energy, the replacement will also keep the Faculty Lounge 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: $1,000
Source of cost estimate: *Manufacturer and Store established costs*

Economics:

ECM description	Installed Cost		1st year energy savings						SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate $	Source	Use	Unit	Demand / mo	Unit	Savings / year $	kBtu /sq ft			Cost Savings $		
replace 2 Faculty Lounge refrigerators with Energy Star models	$1,000	Manufac- turer and Store Info	732	kWh	0.2	kW	113	0.1	8.8	15	1,335	2.2	1,003

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 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#7: *Install Premium Efficiency Motors on Hot Water Circulators*

Description:

The boiler room houses 2 hot water circulator pumps (one is back-up) to provide hot water to the school's unit ventilators. These pumps are operating beyond their useful operating lives and should be replaced or overhauled (seals, impellers, bearings…) before a catastrophic failure. It should also be taken into account that should one pump fail there is a full back-up pump next to it that can be put into service immediately. The 7.5 Hp pump motors are standard efficiency. The Springfield Elementary School will realize electrical savings by switching the pump motors (one operates at a time during the heating season) to premium efficiency motors.

Installation cost:

Estimated installed cost: $1,122
Source of cost estimate: *Similar projects and DOE Motor Master International selection & savings analysis*

Economics (with incentives):

ECM description	Installed Cost		1st year energy savings						SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate $	Source	Use	Unit	Demand /mo	Unit	Savings / year $	kBtu /sqft			Cost Savings $		
Replace 2 hot water circulator pump 7.5 Hp motors with Premium Efficiency with INCENTIVE	$1,122	Similar Projects, DOE Motor Master International selection & savings analysis	674	kWh	0.2	kW	105	0.1	10.7	20	1,527	1.8	924

Assumptions: SWA calculated the savings for this measure using measurements taken the day of the field visit and using the billing analysis. The DOE Motor Master International selection and calculator was used with the assumption that one pump operates at a time during the heating season.

Rebates/financial incentives:

NJ Clean Energy - Three-phase premium 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

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

ECM#5: *Install 5kW PV system*

Description:

Currently, the Springfield Township Elementary School 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 Springfield Township Elementary School further review installing a 5kW 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 Springfield Township Elementary School is also not eligible for a 30% federal tax credit. Instead, the Springfield Township Elementary School 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 SRECs at $600 / MWh or best market offer.

There are many possible locations for a 5kW PV installation on the building roofs. 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 5kW system needs approximately 41 panels which would take up 435 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: $30,000
Source of cost estimate: Similar projects

Economics (with some incentives):

ECM description	Installed Cost		1st year energy savings						SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate $	Source	Use	Unit	Demand /mo	Unit	Savings / year $	kBtu /sq ft			Cost Savings $		
Install 5 kW PV System (with $1/W INCENTIVE and $600/1MWh SREC)	$30,000	Similar projects	5,902	kWh	5.0	kW	4,515	0.5	6.6	25	76,894	6.3	8,086

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 $5,000.
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. $3,600 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

5.4. 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 existing split system cooling, HW boilers and insufficient domestic hot water use.

5.6. Geothermal

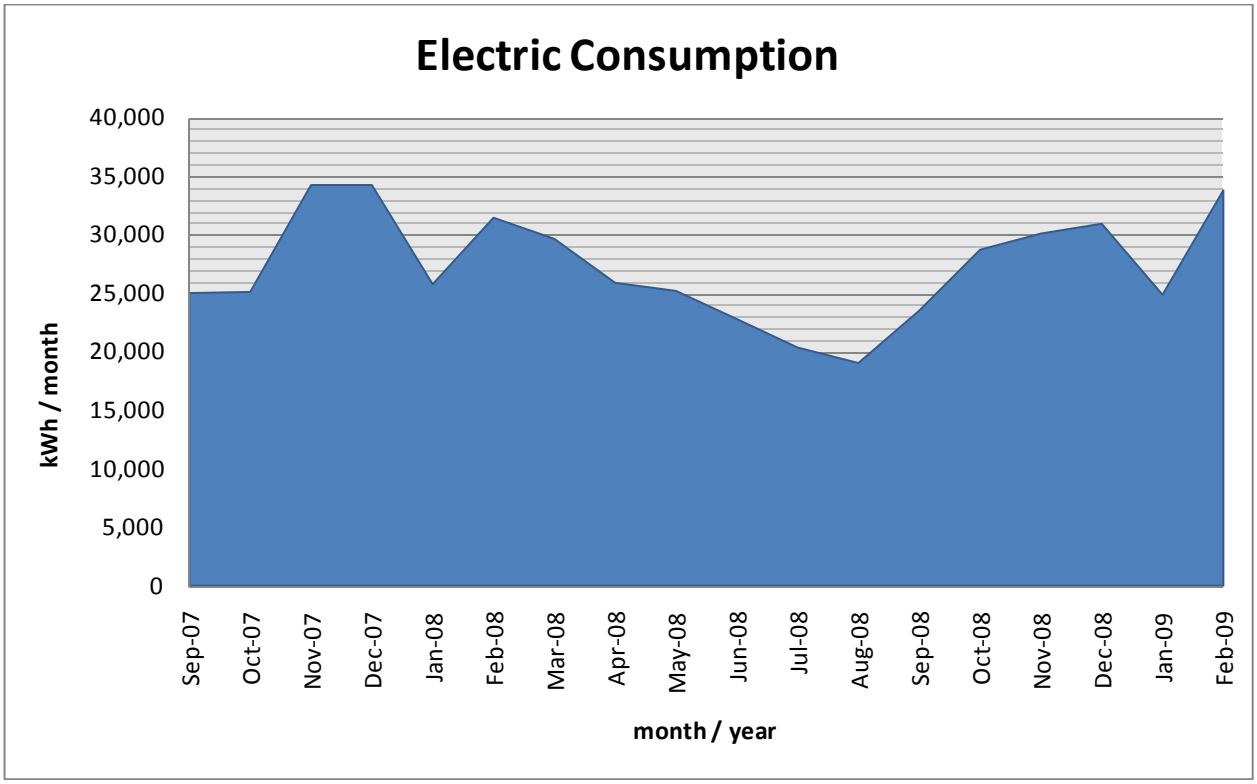
Description:

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

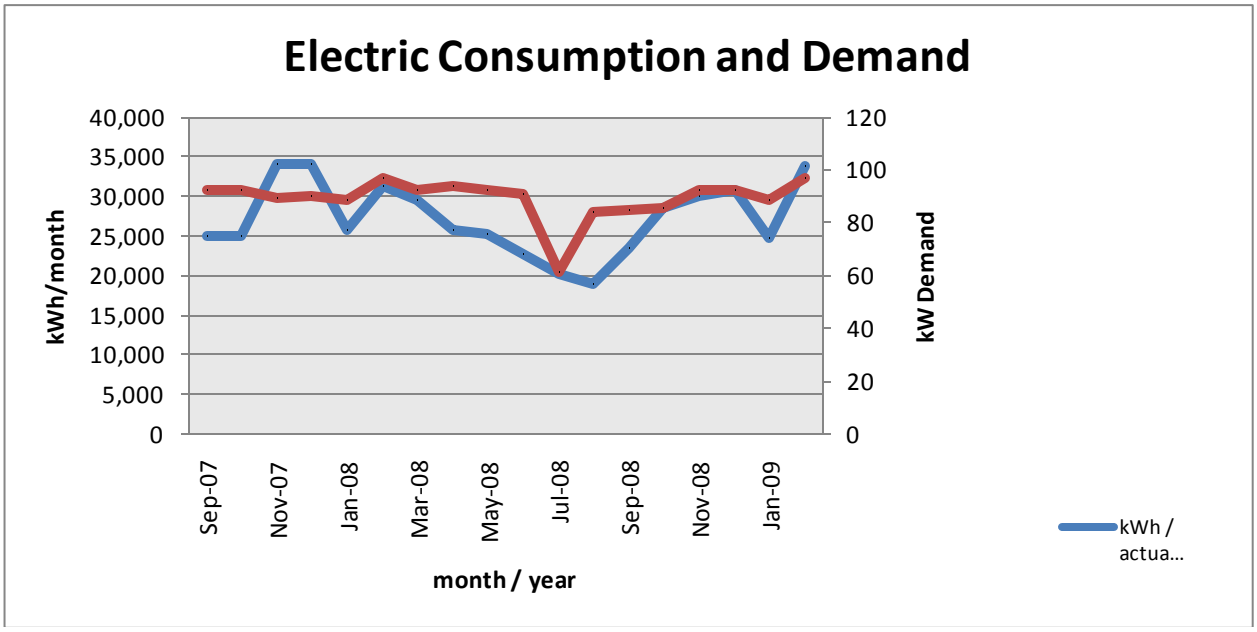
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Load profiles

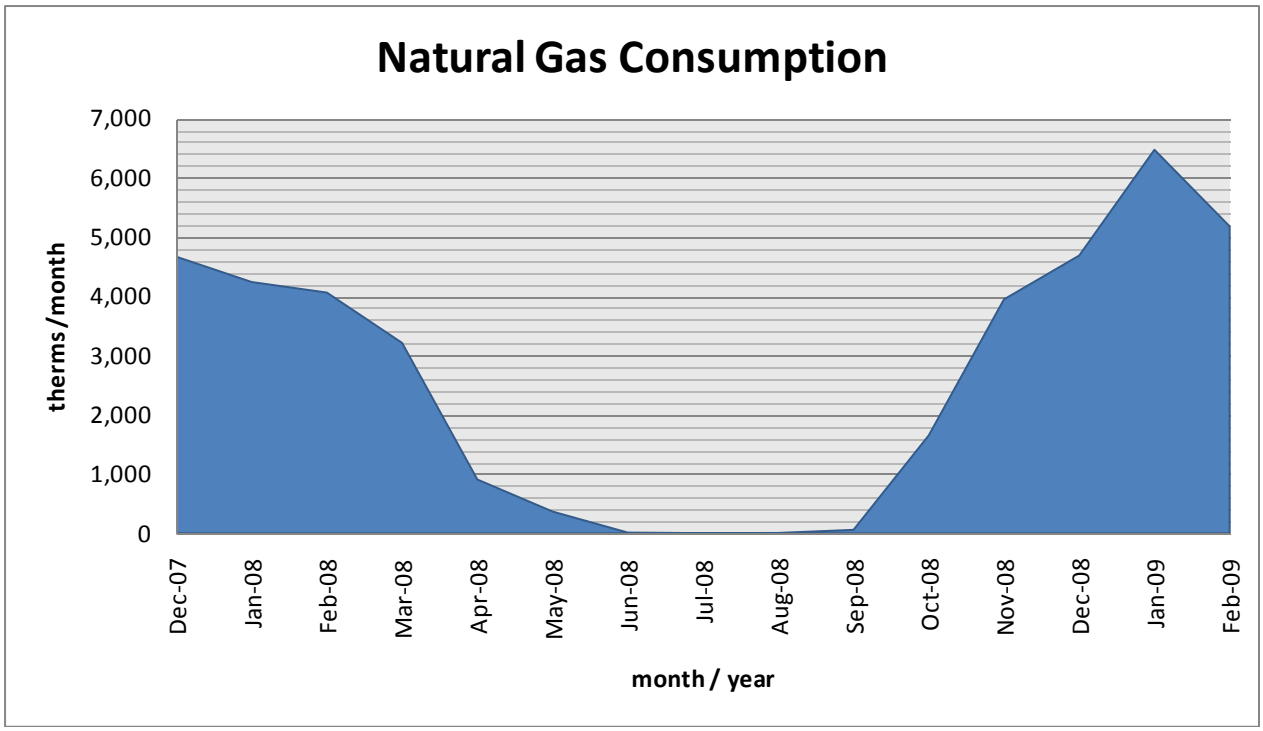
The following are charts that show the annual electric and natural gas load profiles for the Springfield Township Elementary School.

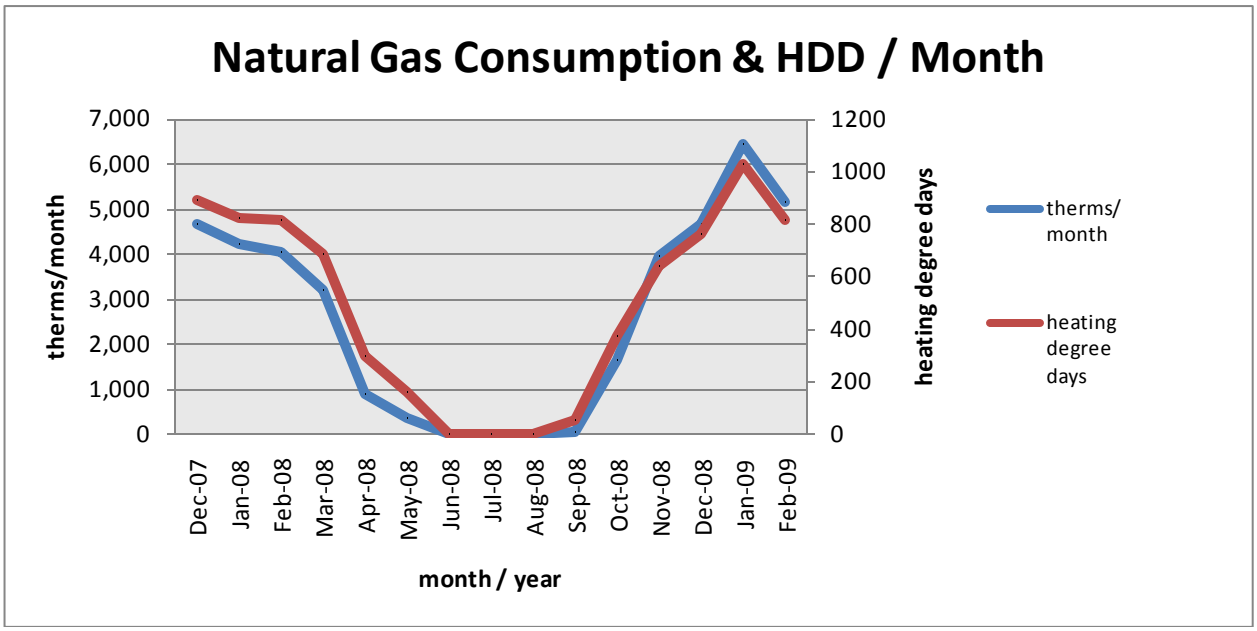


Some minor unusual electric fluctuations shown may be due to adjustments between estimated and actual meter readings. Also, note on the following chart how the electrical Demand peaks (except for a few unusual fluctuation anomalies) follow the electrical consumption peaks.



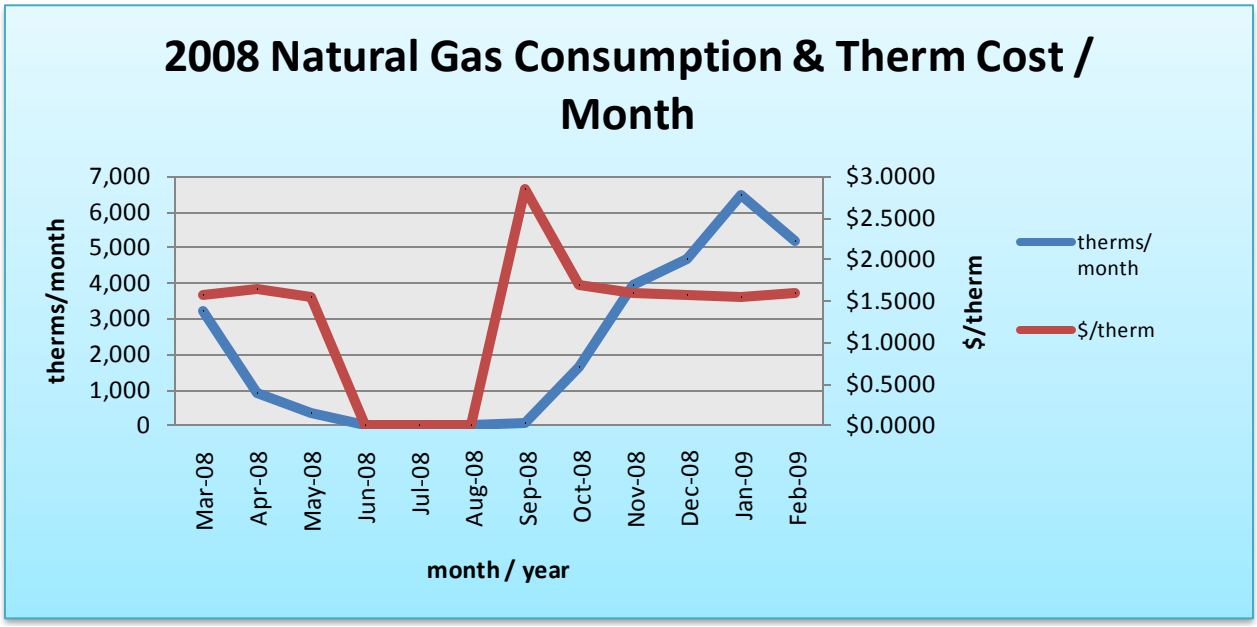
The following is a chart of the natural gas annual load profile for the building, peaking in the coldest months of the year and a chart showing gas consumption following the "heating degree days" curve.





6.2. Tariff analysis

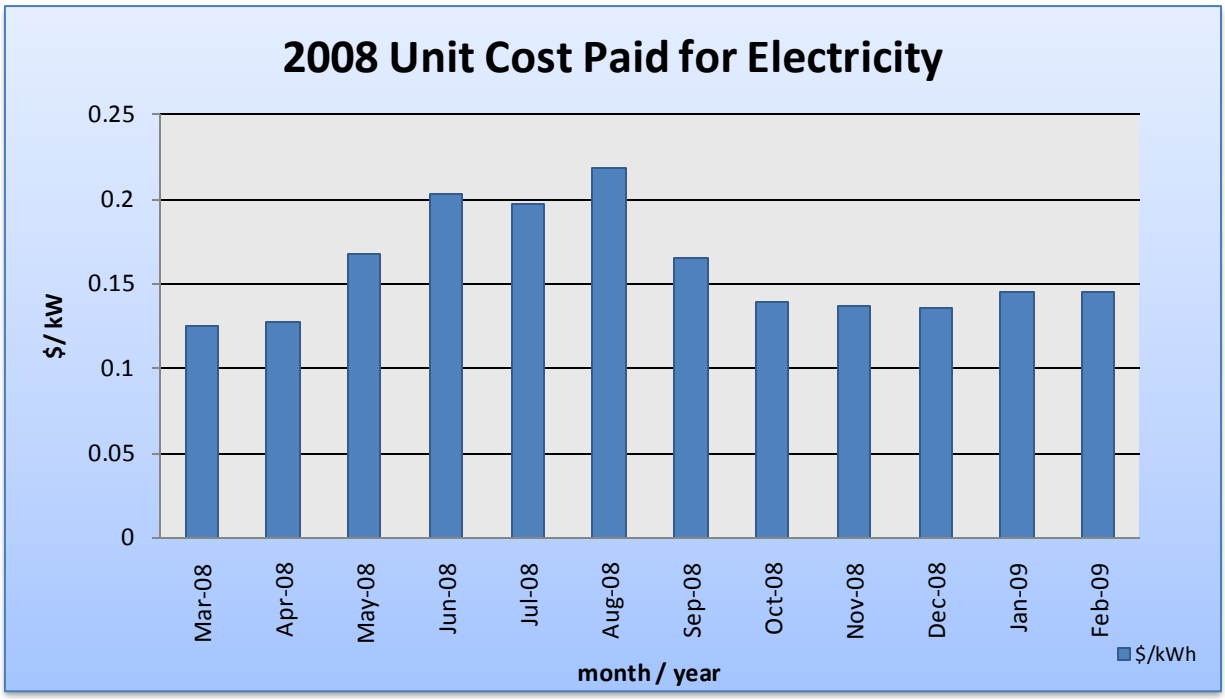
Currently, natural gas is provided to the Springfield Township Elementary School via one gas meter with Elizabethtown Gas Co. acting as the supply and transport company. Gas is provided by Elizabethtown Gas Co. at a general service rate. The suppliers' general service rate for natural gas charges a market-rate price based on use and the Springfield Township Elementary School 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 hot water boiler units. The high gas price per therm fluctuations in the summer may be due to high energy costs that occurred in 2008 and low use caps for the non-heating months. Thus the building pays for fixed costs such as meter reading charges during the summer months. So June, July and August cap payment are excluded from the following chart.

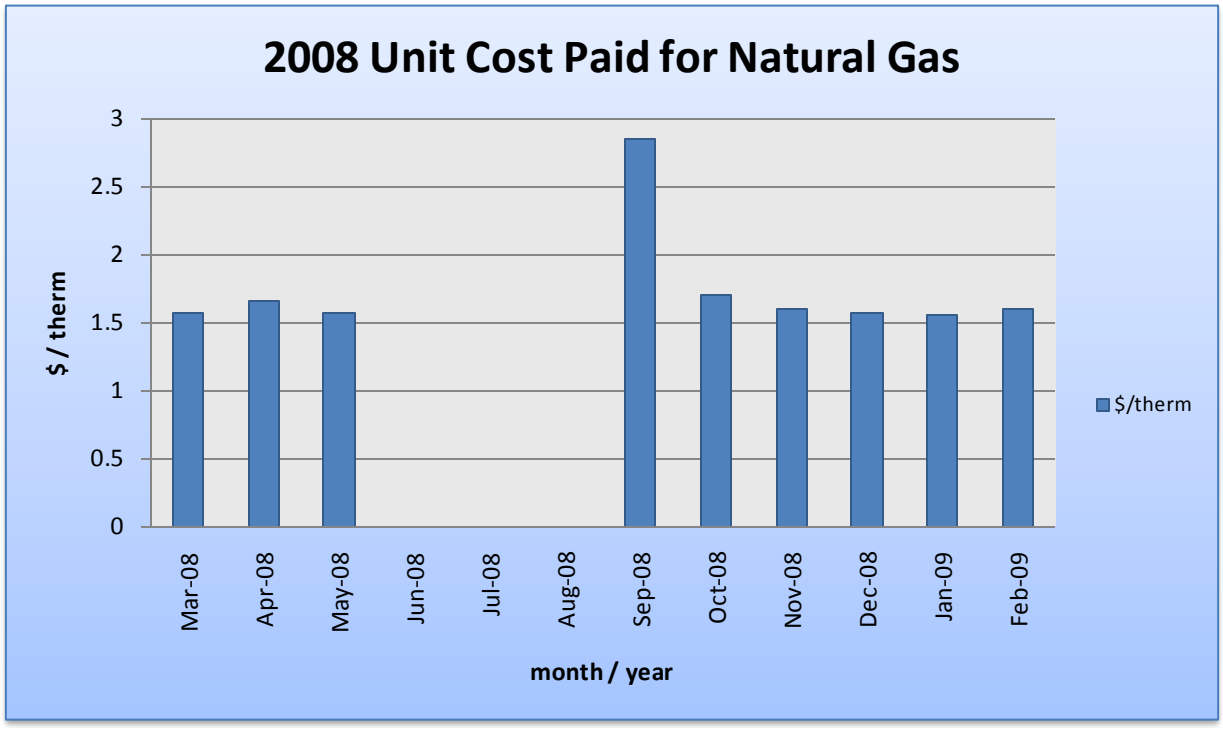


The Springfield Township Elementary School is direct-metered (via one main meter) and currently purchases electricity from PSE&G at a general service rate. The general service rate for electric charges are market-rate based on use and the Springfield Township Elementary School billing does show a breakdown of demand costs. Demand prices are 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 window ACs and rooftop air-handling units.

6.3. Energy Procurement strategies

The Springfield Township Elementary School receives natural gas via one incoming meter. The Hess Corporation supplies the gas and PSE&G 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 Springfield Township Elementary School 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 44% over the most recent 12 month period. Natural gas bill analysis shows fluctuations up to 83% over the most recent 12 month period. Some of these fluctuations may have been caused by adjustments between estimated and actual meter readings, others may be due to unusual high and escalating energy costs in 2008. SWA recommends that the Springfield Township 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 Springfield Township Elementary School. Appendix B contains a complete list of third party energy suppliers for the Springfield Township service area. The Springfield Township Elementary School may want to consider partnering with other school districts, municipalities, townships 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 Springfield Township Elementary School 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 100 kW electric demand when requested by the utility during peak demand periods, which is the typical threshold for considering this option. Demand Response could be an option in the future when the Springfield Elementary School may install a large enough back-up emergency generator. The following charts show the Springfield Township Elementary School monthly spending per unit of energy in 2008.


2008 Unit Cost Paid for Electricity
0.25
0.2
0.15
0.1
0.05
0
$/ kW
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
month / year
$/kWh


2008 Unit Cost Paid for Natural Gas
3
2.5
2
1.5
1
0.5
0
$ / therm
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
month / year
$/therm

7. METHOD OF ANALYSIS

7.1. Assumptions and tools

Energy modeling tool:	established / standard industry assumptions
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

Springfield Elementary School Existing Lighting Conditions															Proposed Lighting										
#	Bldg	Flr	Rm #	Location in Building	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts /Lamp	Hrs/ Day	Energy Use (Watt hours / day)	Con-trols	Day-lighting possible?	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts/ Lamp	Hrs/ Day	Energy Use (Watt hours/ day)	Con-trols	Total Power (Watts)	further W-hr/day reduction with occupancy sensors
1	SES	1st	-	Auditorium	T8 4'	E	9	3	F	32	6	5184	S	No	T8 4'	E	9	3	F	32	6	5184	S	864	
2	SES	1st	-	Auditorium	LED Exit	-	4	1	LED	5	24	480	None	No	LED Exit	-	4	1	LED	5	24	480	None	20	
3	SES	1st	-	Gym	Metal Halide	-	21	1	MH	175	6	22050	S	No	**T5 4'**	**E**	**21**	**2**	**F**	**54**	**6**	**13608**	**S**	**2268**	
4	SES	1st	-	Gym	LED Exit	-	3	1	LED	5	24	360	None	No	LED Exit	-	3	1	LED	5	24	360	None	15	
5	SES	1st	-	Gym office	T8 4'	E	4	2	F	32	6	1536	S	No	T8 4'	E	4	2	F	32	6	1536	S	256	**384**
6	SES	1st	-	Bath Men	T8 4'	E	1	2	F	32	6	384	S	No	T8 4'	E	1	2	F	32	6	384	S	64	**96**
7	SES	1st	-	Gym Janitor's Closet	31w cfl	-	2	1	CFL	31	2	124	S	No	31w cfl	-	2	1	CFL	31	2	124	S	62	
8	SES	1st	-	Gym Bath Women	T8 4'	E	1	2	F	32	6	384	S	No	T8 4'	E	1	2	F	32	6	384	S	64	**96**
9	SES	1st	-	Gym Mech Rm	31w cfl	-	2	1	CFL	31	2	124	S	No	31w cfl	-	2	1	CFL	31	2	124	S	62	
10	SES	1st	8	Class	T8 4'	E	14	4	F	32	8	14336	S	No	T8 4'	E	14	4	F	32	8	14336	S	1792	
11	SES	1st	8	Class bath	Incand	-	1	1	I	75	2	150	S	No	**CFL**	-	**1**	**1**	**CFL**	**15**	**2**	**30**	**S**	**15**	
12	SES	1st	11	Class	T8 4'	E	14	4	F	32	8	14336	S	No	T8 4'	E	14	4	F	32	8	14336	S	1792	
13	SES	1st	11	Class bath	Incand	-	2	1	I	75	2	300	S	No	**CFL**	-	**2**	**1**	**CFL**	**15**	**2**	**60**	**S**	**30**	
14	SES	1st	9	Class	T8 4'	E	14	4	F	32	8	14336	S	No	T8 4'	E	14	4	F	32	8	14336	S	1792	
15	SES	1st	9	Class bath	Incand	-	1	1	I	75	2	150	S	No	**CFL**	-	**1**	**1**	**CFL**	**15**	**2**	**30**	**S**	**15**	
16	SES	1st	10	Class	T8 4'	E	14	4	F	32	8	14336	S	No	T8 4'	E	14	4	F	32	8	14336	S	1792	
17	SES	1st	10	Class closet	Incand	-	1	1	I	75	2	150	S	No	**CFL**	-	**1**	**1**	**CFL**	**15**	**2**	**30**	**S**	**15**	
18	SES	1st	10	Class bath	Incand	-	2	1	I	75	2	300	S	No	**CFL**	-	**2**	**1**	**CFL**	**15**	**2**	**60**	**S**	**30**	
19	SES	1st	10	Class	Incand	-	2	1	I	75	8	1200	S	No	**CFL**	-	**2**	**1**	**CFL**	**15**	**8**	**240**	**S**	**30**	
16	SES	1st	12	Class	T8 4'	E	14	4	F	32	8	14336	S	No	T8 4'	E	14	4	F	32	8	14336	S	1792	
17	SES	1st	12	Class closet	Incand	-	1	1	I	75	2	150	S	No	**CFL**	-	**1**	**1**	**CFL**	**15**	**2**	**30**	**S**	**15**	
18	SES	1st	12	Class bath	Incand	-	2	1	I	75	2	300	S	No	**CFL**	-	**2**	**1**	**CFL**	**15**	**2**	**60**	**S**	**30**	
19	SES	1st	12	Class	Incand	-	2	1	I	75	8	1200	S	No	**CFL**	-	**2**	**1**	**CFL**	**15**	**8**	**240**	**S**	**30**	
24	SES	1st	12	Class	Fluorsnt Exit	-	1	1	F	14	24	336	None	No	**LED Exit**	-	**1**	**1**	**LED**	**5**	**24**	**120**	**None**	**5**	
25	SES	1st	-	Hallway	T8 2'	E	12	2	F	17	10	4080	None	No	T8 2'	E	12	2	F	17	10	4080	None	408	
26	SES	1st	-	Hallway	LED Exit	-	1	1	LED	5	24	120	None	No	LED Exit	-	1	1	LED	5	24	120	None	5	
27	SES	1st	1	Class	T8 4'	E	10	4	F	32	8	10240	S	No	T8 4'	E	10	4	F	32	8	10240	S	1280	
28	SES	1st	-	Faculty lounge	T8 4'	E	10	4	F	32	8	10240	S	No	T8 4'	E	10	4	F	32	8	10240	S	1280	**2,560**
29	SES	1st	-	Faculty bath	28w CFL	-	1	1	CFL	28	2	56	S	No	28w CFL	-	1	1	CFL	28	2	56	S	28	
30	SES	1st	-	Janitor's Closet	31w CFL	-	1	1	CFL	31	3	93	S	No	31w CFL	-	1	1	CFL	31	3	93	S	31	
31	SES	1st	-	Bath Women	T8 4'	E	1	2	F	32	8	512	S	No	T8 4'	E	1	2	F	32	8	512	S	64	**128**
32	SES	1st	3	Office	T8 4'	E	4	2	F	32	8	2048	S	No	T8 4'	E	4	2	F	32	8	2048	S	256	
33	SES	1st	-	Office closet	28w CFL	-	1	1	CFL	28	2	56	S	No	28w CFL	-	1	1	CFL	28	2	56	S	28	
34	SES	1st	-	Office bath	28w CFL	-	1	1	CFL	28	2	56	S	No	28w CFL	-	1	1	CFL	28	2	56	S	28	
35	SES	1st	4	Office	T8 4'	E	7	2	F	32	8	3584	S	No	T8 4'	E	7	2	F	32	8	3584	S	448	**896**
36	SES	1st	4	Office bath	T8 4'	E	1	2	F	32	2	128	S	No	T8 4'	E	1	2	F	32	2	128	S	64	
37	SES	1st	-	Office Asst principal	T8 4'	E	2	2	F	32	8	1024	S	Yes	T8 4'	E	2	2	F	32	8	1024	S	128	**256**
38	SES	1st	-	Office super	T8 4'	E	2	2	F	32	8	1024	S	Yes	T8 4'	E	2	2	F	32	8	1024	S	128	**256**
39	SES	1st	-	Hallway	T8 2'	E	11	2	F	16	10	3520	S	Yes	T8 2'	E	11	2	F	16	10	3520	S	352	
40	SES	1st	6	Class	T8 4'	E	10	4	F	32	8	10240	S	Yes	T8 4'	E	10	4	F	32	8	10240	S	1280	
41	SES	1st	7	Kitchen	T8 4'	E	6	3	F	32	8	4608	S	No	T8 4'	E	6	3	F	32	8	4608	S	576	
42	SES	1st	-	Kitchen closet	28w CFL	-	1	1	CFL	28	2	56	S	No	28w CFL	-	1	1	CFL	28	2	56	S	28	
43	SES	1st	-	Kitchen bath	28w CFL	-	1	1	CFL	28	2	56	S	No	28w CFL	-	1	1	CFL	28	2	56	S	28	
44	SES	1st	-	Kitchen	Fluorsnt Exit	-	1	1	F	14	24	336	None	No	**LED Exit**	-	**1**	**1**	**LED**	**5**	**24**	**120**	**None**	**5**	
45	SES	1st	-	Bath Men	T8 4'	E	2	1	F	32	8	512	S	No	T8 4'	E	2	1	F	32	8	512	S	64	**128**
46	SES	1st	13	Class	T8 4'	E	10	4	F	32	8	10240	S	No	T8 4'	E	10	4	F	32	8	10240	S	1280	
47	SES	1st	14	Class	T8 4'	E	10	4	F	32	8	10240	S	No	T8 4'	E	10	4	F	32	8	10240	S	1280	
48	SES	1st	16	Nurse Office closet	15w CFL	-	1	2	CFL	15	2	60	S	No	15w CFL	-	1	2	CFL	15	2	60	S	30	
49	SES	1st	-	Nurse Office sickrm	T8 4'	E	2	2	F	32	8	1024	S	No	T8 4'	E	2	2	F	32	8	1024	S	128	**256**
50	SES	1st	-	Nurse Office	T8 4'	E	4	2	F	32	8	2048	S	No	T8 4'	E	4	2	F	32	8	2048	S	256	
51	SES	1st	-	Nurse Office bath	T8 4'	E	1	1	F	32	2	64	S	No	T8 4'	E	1	1	F	32	2	64	S	32	
52	SES	1st	-	Storage Rm	Incand	-	1	1	I	100	2	200	S	No	**CFL**	-	**1**	**1**	**CFL**	**30**	**2**	**60**	**S**	**30**	
53	SES	1st	-	Storage Rm server	28w CFL	-	1	1	CFL	28	2	56	S	No	28w CFL	-	1	1	CFL	28	2	56	S	28	
54	SES	1st	15	Class	T8 4'	E	15	2	F	32	8	7680	S	No	T8 4'	E	15	2	F	32	8	7680	S	960	
55	SES	1st	18	Library	T8 4'	E	33	2	F	32	8	16896	S	No	T8 4'	E	33	2	F	32	8	16896	S	2112	
56	SES	1st	-	Library office	T8 4'	E	2	2	F	32	2	256	S	No	T8 4'	E	2	2	F	32	2	256	S	128	
57	SES	1st	-	Bath Men	T8 4'	E	2	2	F	32	8	1024	S	No	T8 4'	E	2	2	F	32	8	1024	S	128	**256**
58	SES	1st	-	Bath Women	T8 4'	E	2	2	F	32	8	1024	S	No	T8 4'	E	2	2	F	32	8	1024	S	128	**256**
59	SES	1st	-	Janitor's Closet	Incand	-	1	1	I	75	2	150	S	No	**CFL**	-	**1**	**1**	**CFL**	**15**	**2**	**30**	**S**	**15**	
60	SES	1st	17	Class	T8 4'	E	15	2	F	32	8	7680	S	No	T8 4'	E	15	2	F	32	8	7680	S	960	
61	SES	1st	20	Class	T8 4'	E	15	2	F	32	8	7680	S	No	T8 4'	E	15	2	F	32	8	7680	S	960	
62	SES	1st	19	Class	T8 4'	E	15	2	F	32	8	7680	S	No	T8 4'	E	15	2	F	32	8	7680	S	960	
63	SES	1st	22	Class	T8 4'	E	15	2	F	32	8	7680	S	No	T8 4'	E	15	2	F	32	8	7680	S	960	
64	SES	1st	21	Class comp lab	T8 4'	E	15	2	F	32	8	7680	S	No	T8 4'	E	15	2	F	32	8	7680	S	960	
65	SES	1st	24a	Class	T8 4'	E	4	4	F	32	8	4096	S	No	T8 4'	E	4	4	F	32	8	4096	S	512	
66	SES	1st	23	Class	T8 4'	E	2	4	F	32	8	2048	S	No	T8 4'	E	2	4	F	32	8	2048	S	256	
67	SES	1st	-	Electrical rm	T8 4'	E	2	1	F	32	2	128	S	No	T8 4'	E	2	1	F	32	2	128	S	64	
68	SES	1st	-	Hallway	T8 2'	E	9	2	F	16	10	2880	S	No	T8 2'	E	9	2	F	16	10	2880	S	288	
69	SES	1st	-	Hallway	T8 U	E	11	2	F	51	10	11220	None	No	T8 U	E	11	2	F	51	10	11220	None	1122	

Springfield Elementary School Existing Lighting Conditions															Proposed Lighting										
#	Bldg	Flr	Rm #	Location in Building	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts /Lamp	Hrs/ Day	Energy Use (Watt hours / day)	Con-trols	Day-lighting possible?	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts/ Lamp	Hrs/ Day	Energy Use (Watt hours/ day)	Con-trols	Total Power (Watts)	further W-hr/day reduction with occupancy sensors
70	SES	1st	-	Hallway	Fluorsnt Exit	-	2	1	F	14	24	672	None	No	**LED Exit**	-	**2**	**1**	**LED**	**5**	**24**	**240**	**None**	**10**	
71	SES	1st	-	Hallway	T8 U	E	1	2	F	51	10	1020	None	Yes	T8 U	E	1	2	F	51	10	1020	None	102	
72	SES	1st	24b	Class	T8 4'	E	6	4	F	32	8	6144	S	No	T8 4'	E	6	4	F	32	8	6144	S	768	
73	SES	1st	24c	Class	T8 4'	E	4	4	F	32	8	4096	S	No	T8 4'	E	4	4	F	32	8	4096	S	512	
74	SES	1st	26a	Class	T8 4'	E	8	4	F	32	8	8192	S	No	T8 4'	E	8	4	F	32	8	8192	S	1024	
75	SES	1st	-	Bath Men	T8 4'	E	2	2	F	32	8	1024	S	No	T8 4'	E	2	2	F	32	8	1024	S	128	**256**
76	SES	1st	-	Bath Women	T8 4'	E	2	2	F	32	8	1024	S	No	T8 4'	E	2	2	F	32	8	1024	S	128	**256**
77	SES	1st	-	Storage Rm	T8 4'	E	1	2	F	32	2	128	S	No	T8 4'	E	1	2	F	32	2	128	S	64	
78	SES	1st	-	Storage Rm	T8 4'	E	1	2	F	32	2	128	S	No	T8 4'	E	1	2	F	32	2	128	S	64	
79	SES	1st	-	Storage Rm	T8 4'	E	1	2	F	32	2	128	S	No	T8 4'	E	1	2	F	32	2	128	S	64	
80	SES	1st	28	Class	T8 4'	E	9	4	F	32	8	9216	S	No	T8 4'	E	9	4	F	32	8	9216	S	1152	
81	SES	1st	28	Class	T8 2'	E	1	2	F	16	8	256	S	No	T8 2'	E	1	2	F	16	8	256	S	32	
82	SES	1st	28	Class	Fluorsnt Exit	-	1	1	F	14	24	336	None	No	**LED Exit**	-	**1**	**1**	**LED**	**5**	**24**	**120**	**None**	**5**	
83	SES	1st	28	Class	LED Exit	-	1	1	LED	5	24	120	None	No	LED Exit	-	1	1	LED	5	24	120	None	5	
84	SES	1st	28	Class closet	T8 4'	E	1	4	F	32	2	256	None	No	T8 4'	E	1	4	F	32	2	256	None	128	
85	SES	1st	28	Class closet	T8 4'	E	1	4	F	32	2	256	S	No	T8 4'	E	1	4	F	32	2	256	S	128	
86	SES	1st	-	Storage Rm	T8 4'	E	1	2	F	32	2	128	S	No	T8 4'	E	1	2	F	32	2	128	S	64	
87	SES	1st	-	Storage Rm	T8 4'	E	1	2	F	32	2	128	S	No	T8 4'	E	1	2	F	32	2	128	S	64	
88	SES	1st	-	Bath staff	T8 4'	E	1	2	F	32	3	192	S	No	T8 4'	E	1	2	F	32	3	192	S	64	
89	SES	1st	-	Hallway	T8 U	E	6	2	F	51	10	6120	S	No	T8 U	E	6	2	F	51	10	6120	S	612	
90	SES	1st	-	Hallway	LED Exit	-	1	1	LED	5	24	120	None	No	LED Exit	-	1	1	LED	5	24	120	None	5	
91	SES	1st	30	Class	T8 4'	E	9	4	F	32	8	9216	S	No	T8 4'	E	9	4	F	32	8	9216	S	1152	
92	SES	1st	30	Class closet	T8 4'	E	1	2	F	32	2	128	S	No	T8 4'	E	1	2	F	32	2	128	S	64	
93	SES	1st	30	Class bath	T8 4'	E	1	2	F	32	2	128	S	No	T8 4'	E	1	2	F	32	2	128	S	64	
94	SES	1st	30	Class bath	T8 4'	E	1	2	F	32	2	128	S	No	T8 4'	E	1	2	F	32	2	128	S	64	
95	SES	1st	25	Class	T8 4'	E	9	4	F	32	8	9216	S	No	T8 4'	E	9	4	F	32	8	9216	S	1152	
96	SES	1st	25	Class bath	T8 4'	E	1	2	F	32	3	192	S	No	T8 4'	E	1	2	F	32	3	192	S	64	
95	SES	1st	27	Class	T8 4'	E	9	4	F	32	8	9216	S	No	T8 4'	E	9	4	F	32	8	9216	S	1152	
96	SES	1st	27	Class bath	T8 4'	E	1	2	F	32	3	192	S	No	T8 4'	E	1	2	F	32	3	192	S	64	
95	SES	1st	29	Class	T8 4'	E	9	4	F	32	8	9216	S	No	T8 4'	E	9	4	F	32	8	9216	S	1152	
96	SES	1st	29	Class bath	T8 4'	E	1	2	F	32	3	192	S	No	T8 4'	E	1	2	F	32	3	192	S	64	
97	SES	1st	-	Janitor's Office	Incand	-	1	1	I	75	8	600	S	No	**CFL**	-	**1**	**1**	**CFL**	**15**	**8**	**120**	**S**	**15**	
98	SES	1st	-	Stage light	Incand	-	12	1	I	100	0.25	300	S	No	**CFL**	-	**12**	**1**	**CFL**	**30**	**0.25**	**90**	**S**	**360**	
99	SES	1st	-	Stage light	T12 4'	M	3	4	F	40	0.25	120	S	No	**T8 4'**	**E**	**3**	**4**	**F**	**32**	**0.25**	**90**	**S**	**384**	
100	SES	1st	-	Hallway to Janitor's closet	28w CFL	-	1	1	CFL	28	8	224	S	No	28w CFL	-	1	1	CFL	28	8	224	S	28	
101	SES	ext	-	Near back doors	28w CFL	-	5	1	CFL	28	8	1120	S	No	28w CFL	-	5	1	CFL	28	8	1120	S	140	
102	SES	ext	-	Exterior	90w Floods (par38)	-	7	1	I	90	10	6300	S	N/A	**CFL**	-	**7**	**1**	**CFL**	**30**	**10**	**2100**	**S**	**210**	
103	SES	ext	-	Exterior	Metal Halide	-	2	1	MH	175	10	3500	Timer	N/A	Metal Halide	-	2	1	MH	175	10	3500	Timer	350	
104	SES	ext	-	Exterior	Metal Halide	-	6	1	MH	400	10	24000	Timer	N/A	Metal Halide	-	6	1	MH	400	10	24000	Timer	2400	
					TOTALS exterior							33,800										29,600			
					TOTALS interior							348,737										335,115		46,938	6,080
annual consumption (kWh)												82,084										76,611	includes occupancy sensors		
estimated cost ($/year)												$12,723										$11,875			OS
Springfield Elementary School total light power (Watt)												50,776										46,938			
Springfield Elementary School light power density (Watt/sq ft)												1.17										1.08			
Proposed Annual Savings (kWh)												5,473													
Proposed Annual Cost Savings ($)												$848													
Proposed Investment ($)												$8,189													
surface area (sq ft)												43,320										43,320			
Legend: SES - Springfield Elementary School; M - Magnetic; E - Electronic ; F - fluorescent; incand - incandescent; CFL - compact fluorescent lamp; HPS - high pressure sodium; MH - Metal Halide; S - on/off Switch: Hal - Halogen;																									
OS - Occupancy motion sensor Switch;																									

Note: Last table column shows additional electrical savings if the decision is to change out switches to occupancy sensors.

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	**Strategic Energy, LLC** 55 Madison Avenue, Suite 400 Morristown, NJ 07960 (888) 925-9115, www.sel.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	**American Powernet Management, LP** 437 North Grove St. Berlin, NJ 08009 (800) 437-7872 www.hess.com	**ConEdison Solutions** Cherry Tree, Corporate Center 535 State Highway 38 Cherry Hill, NJ 08002 (888) 665-0955 www.conedsolutions.com
Credit Suisse, (USA) Inc. 700 College Road East Princeton, NJ 08450 212-538-3124 www.creditsuisse.com	**Sprague Energy Corp.** 12 Ridge Road Chatham Township NJ 07928 (800) 225-1560 www.spragueenergy.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 08057 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** 545 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 888-53-Metro www.metroenergy.com
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 088327 800-375-1277 www.mxenergy.com	**NATGASCO (Mitchell Supreme)** 532 Freeman Street Orange, NJ 07050 800-840-4GAS www.natgasco.com	**Pepco Energy Services, Inc.** 112 Main Street Lebanon, NJ 08833 800-363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road - Office 105 Cherry Hill, NJ 08002 800-281-2000 www.pplenergyplus.com	**Sempra Energy Solutions** The Mac-Cali Building 581 Main Street, 8th fl. Woodbridge, NJ 07095 877-273-6772 800-2 SEMPRA www.semprasolutions.com	**South Jersey Energy Company** One South Jersey Plaza, Route 54 Folsom, NJ 08037 800-756-3749 www.sjindustries.com/sje.htm
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928 800-225-1560 www.spragueenergy.com	**Stuyvesant Energy LLC** 10 West Ivy Lane, Suite 4 Englewood, NJ 07631 800-646-6457 www.stuyfuel.com	**Woodruff Energy** 73 Water Street Bridgeton, NJ 08302 800-557-1121 www.woodruffenergy.com