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July 17, 2009

Local Government Energy Program
Energy audit report

For

Hamilton Board of Education
Morgan Elementary School
Hamilton, NJ 08619

Project Number: LGEA01

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INTRODUCTION

On April 13th, 14th, 15th and 16th, 2009, Steven Winter Associates, Inc. (SWA) performed energy audits and assessments of 12 elementary schools within the Hamilton School District located in Hamilton, NJ. Current conditions and energy-related information were collected in order to analyze and facilitate the implementation of energy conservation measures for the building.

The following twelve elementary schools were evaluated under this energy audit: Greenwood, Klockner, Kuser, Lalor, Langtree, Mercerville, Morgan, Robinson, Sayen, Sunnybrae, Yardville, and Yardville Heights. The original construction date, type, and building area of each school vary, since the buildings were constructed to accommodate school district expansion over the years. Construction of the original 12 buildings was undertaken between 1908 and 1966, with additions or modular classroom units added between 1922 and 1995. Floor area ranges from 27,750 square feet up to 51,813 square feet. Typical occupancy includes 300 Kindergarten through fifth grade students and 30 teachers and staff.

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

The present report is for Morgan Elementary School only.

Morgan Elementary School was built in 1957 with additions built in 1989. The school consists of 34,434 square feet of conditioned space. There are approximately 300 students in grades Kindergarten through fifth grade and about 37 staff people. The building is operated on weekday schedule from 6:30 am to 5:30 pm, about 55 hours a week.

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

EXECUTIVE SUMMARY

This document contains the energy audit report for Morgan Elementary School located at 38 Stamford Rd, Hamilton, NJ 08619. Morgan Elementary is a one story building. Based on the field visit performed by Steven Winter Associates (SWA) staff on April 13th, 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 the most recent full year of data collected (September 2007 through September 2008), Morgan Elementary School building consumed approximately 281,120 kwh or $41,914 worth of electricity and 18,339 therms or $28,425 worth of natural gas. For purposes of this report, an average gas cost of $1.55/therm was assumed. This unit price represents typical local costs for both consumption and transportation of natural gas. With electricity and gas combined, the building consumed 2,793 MMBtu of energy at a total cost of $70,340.

SWA benchmarked Morgan Elementary School using the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The Portfolio Manager generated a benchmark score of 24 for the building, when compared to a national average. The benchmark rating is based on the facility's source energy use, level of business activity, and geographical location. The Portfolio Manager is also capable of generating a site energy use intensity number using 2008 as a baseline year.

In order to compare commercial buildings equitably, the *Portfolio Manager* ratings convey the consumption of each type of energy in a single common unit. The EPA uses source energy to represent the total amount of raw fuel required to operate the building. The site energy use intensity for Morgan Elementary School building is 78 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 September 2007 through September 2008 baseline to track the changes in energy consumption associated with energy improvements.

SWA recommends a total of 3 Energy Conservation Measures (ECMs) for Morgan Elementary School. The total investment cost for these ECMs is **$125,936**. SWA estimates a first year savings of **$6,177** with a simple payback of **20.4 years**. SWA also estimates that Morgan Elementary School will be able to reduce their carbon footprint by **63,184 lbs of CO2 annually.**

There are various incentives that Morgan Elementary School could apply for that could also help lower the cost of installing the ECMs. SWA recommends that Morgan Elementary School applies 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.

When pursuing incentives through the SmartStart program, SWA encourages building managers to contact the program provider to obtain more detailed information on the program guidelines and request pre-approval for all planned upgrades. At the time of this report, high-efficiency, gas-fired boilers with a capacity between 1500 – 4000 MBH may be eligible for an incentive of $1.00 per MBH. Larger equipment may qualify for a custom incentive package. When replacing gas-fired water heaters, consider upgrading to high-efficiency equipment. Water heaters that are 50 gallons and larger may be eligible for an incentive of $1.00-$2.00 per MBH. Incentives are also available for the installation of occupancy sensors and dimming controls. Incentives for lighting controls vary and are based on the quantity and type of controls installed.

For further information on both custom and prescriptive incentives, please visit:

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/equipment-incentives/equi

The New Jersey Clean Energy website also provides information on incentives for renewable energy. Visit the website to download a copy of the Renewable Energy Incentive Program (REIP) Guidebook. Incentives include up to $1.00 per watt for eligible photovoltaic projects.

Hamilton Board of Education should become familiar with New Jersey Clean Energy programs aimed specifically at schools if they are considering building new facilities or doing major renovations. For further information about specific program information, please visit:
http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/school-construction/about

The following table summarizes the proposed Energy Conservation Measures (ECM) and their economical relevance.

SCOPE OF WORK – SUMMARY TABLE

ECM Table without Incentives

		Installed Cost		1st year energy savings									Lifetime		
ECM#	ECM description	Estimated $	Source	Electric Savings (kWh)	Unit	Natural Gas Savings (therms)	Unit	Demand	Unit	$ Savings/year	SPP	LoM	Cost Savings	ROI	Annual Carbon Reduction (lbs of CO2)
1	Hot water boiler replacement	$ 96,333	RSMeans	0	kWh	1,187	therms	0.0	kW	$ 1,840	52.4	30	$ 35,147	-2.1%	13,084
2	Upgrade existing lighting	$ 29,345	RSMeans	25,553	kWh	-	therms	2.9	kW	$ 3,961	7.4	20	$ 79,214	8.5%	45,753
3	Vending Miser	$ 258	RSMeans	2,428	kWh	-	therms	0.0	kW	$ 376	0.7	10	$ 3,763	135.9%	4,347
Total	**Total Scope of Work**	**$ 125,936**	**-**	**27,981**	**-**	**1,187**		**2.9**	**-**	**$ 6,177**	**20.4**		**$ 118,125**		**63,184**

Definitions:

SPP: Simple Payback (years)
LoM: Life of Measure (years)
ROI: Return on Investment (%)

Assumptions:

Discount rate:	3.2%	per DOE FEMP guidelines	Average Electric Rate =	0.155	$/kWh	Carbon Dioxide per unit Electriciy =	1.7905 lbs of CO2/kWh
Energy price escalation rate:	0%	per DOE FEMP guidelines	Average Natural Gas Rate =	1.55	$/therm	Carbon Dioxide per unit Nat.l Gas =	11.023 lbs of CO2/therm

1. HISTORIC ENERGY CONSUMPTION

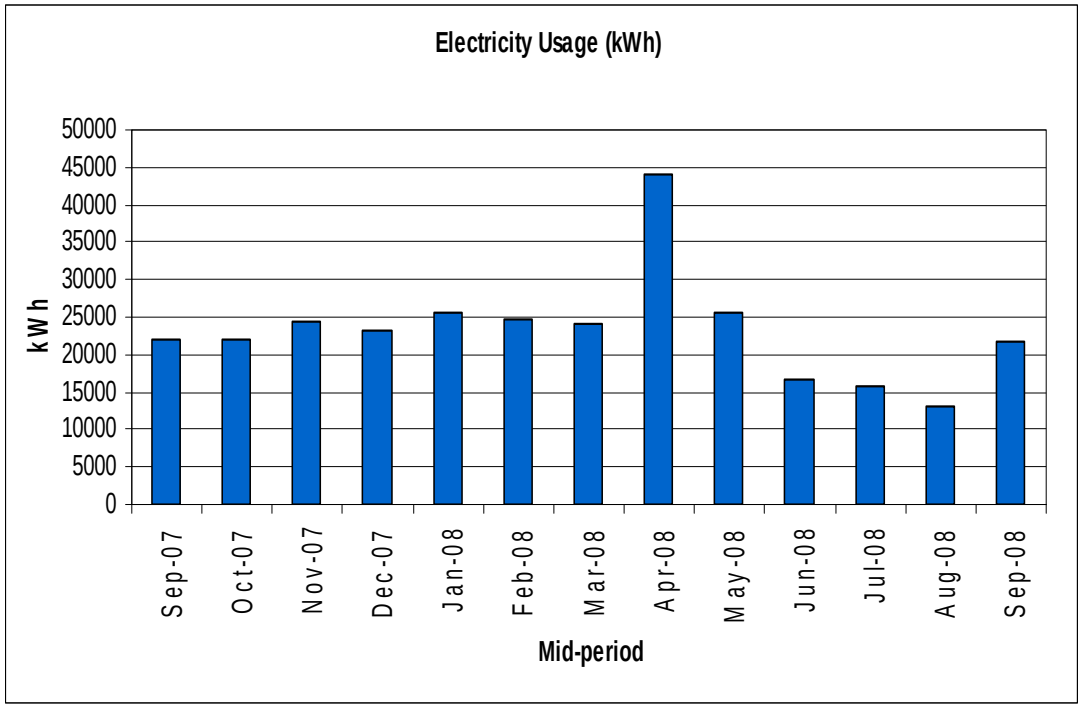
1.1. Energy usage and cost analysis

SWA received and analyzed utility bills from September 2006 through September 2008 that were received from the Hamilton Board of Education.

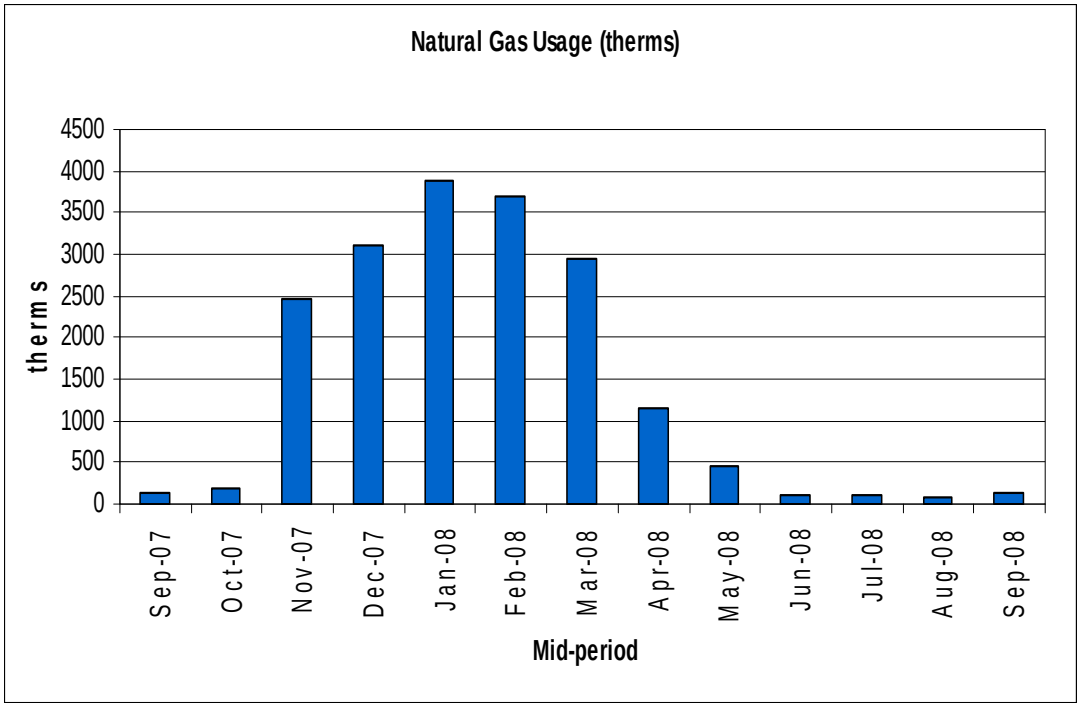
Electricity – Morgan Elementary School has one electric meter for incoming electricity supply. The building purchases electricity from PSE&G at **an average aggregated rate of $.158kWh** based on September 2007 through September 2008 electric bills. The building purchased **approximately 281,120 kWh or $41,914 worth of electricity based on the specified 12 months of utility bills.** Based on the same time period, the building also has **an average monthly demand of 79.2 kW and monthly peak demand of 84.8 kW.**

Natural Gas – Morgan Elementary School has one gas meter for incoming natural gas from PSE&G. Between September 2007 and September 2008, the **average aggregated rate for natural gas consumption was $0.56/therm.** The building purchased **approximately 18,339 therms or $28,425 worth of natural gas in the September 2007 to September 2008 period.** To account for the additional costs associated with transportation and delivery fees, an average total gas rate of $1.55 per therm was assumed in this report.

The following chart shows electricity usage for the Morgan Elementary School based on utility bills for the year 2008.



The following chart shows the natural gas usage for Morgan Elementary School base on utility bills for the year September 2007 to September 2008.



In the above chart, the natural gas usage follows a heating trend as expected. During the summer it is clear that the natural gas usage is very minimal which reflects that heat is not being used and the DHW load is minimal.

1.2. Utility rate

Morgan Elementary School currently buys electricity and gas from PSE&G at the FTLV general service rate (or MD rate). The FTLV general service is s typical rate where customers pay for natural gas based on usage and electricity based on usage with the addition of an electrical charge demand. Morgan Elementary School uses account #17 62 754 379 52, at the service address of 38 Stamford Rd, Hamilton, NJ 08619 for the building electric and gas. Electricity for the building was billed at an average rate of **$0.158/kWh.** As previously noted, a typical regional average gas unit price of **$1.55/therm** was assumed in this report to address both the consumption and transportation costs of the fuel.

1.3. Energy benchmarking

Morgan 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 performance score generated for the building is 24. SWA recommends that the Morgan Elementary School Board of Education maintain the Portfolio Manager account at the link below. As the account is maintained, SWA can share the Morgan Elementary School facility and allow future data to be added and tracked using the benchmarking tool.

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

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Morgan Elementary

Building ID: 1760079
For 12-month Period Ending: August 31, 2008[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: June 26, 2009

Facility
Morgan Elementary
38 Stamford Rd
Trenton, NJ 08619

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1957
Gross Floor Area (ft²): 34,434

Energy Performance Rating[2] (1-100) 24

Site Energy Use Summary[3]

Natural Gas (kBtu)[4]	1,738,933
Electricity (kBtu)	962,475
Total Energy (kBtu)	2,701,408

Energy Intensity[5]

Site (kBtu/ft²/yr)	78
Source (kBtu/ft²/yr)	146

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	239

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

National Average Comparison

National Average Site EUI	62
National Average Source EUI	116
% Difference from National Average Source EUI	26%
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.

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**

Certifying Professional
N/A

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Natural Gas usage 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 Morgan Elementary School, located at 38 Stamford Road in Hamilton, New Jersey was built in 1957 and was originally approximately 17,878 square feet consisting of one story slab on grade. In 1989 an addition totaling 16,556 square feet was built. The building today is comprised of 34,434 square feet of conditioned space that includes approximately twenty classrooms, 4 offices, a faculty break room, a library, a music room, a large multi-purpose room that serves as gymnasium, theatre and cafeteria with an adjacent kitchen, and various storage areas and rest rooms. The building is built of concrete masonry units and brick. The exterior is a light shade red brick that is attractive, well pointed, and generally well maintained.

2.2. Building occupancy profiles

Morgan is one of seventeen elementary schools in the Hamilton Township School District. It provides kindergarten through fifth grade education. There is a student enrollment of approximately 400, with a staff of approximately 40 full and part time faculty and employees including teachers, administrative, maintenance, educational assistants and lunchroom/playground assistants. According to maintenance staff the building is occupied for approximately 10 hours each weekday from September through June.

2.3. Building envelope

2.3.1. Exterior walls

The exterior walls of the building consist of concrete masonry unit structure with a light red face brick exterior facade. There is no evidence of any insulation in the exterior walls and maintenance staff could not recall ever seeing any wall insulation.

Adding insulation to this type of wall construction is difficult and not cost effective. If any portion of the building is renovated or improved as part of a capital improvement plan, it may be possible to installation on the interior side of the walls during construction.

2.3.2. Roof

The roof of Morgan School is a flat/low slope throughout. It has a rubber roofing membrane throughout. The feel of the roof indicates that there is some rigid board insulation below the membrane but without any building plans, it is difficult to confirm the existence of roof insulation without physically damaging the roof membrane. The maintenance superintendent has never seen any insulation.

SWA evaluated installing roof insulation but the high cost of removing the roofing membrane to install rigid board roof insulation is too expensive and cannot be justified by the estimated energy savings. If in the future, there is a need to replace the flat section roofing membrane, at least two inches of a polyisocyanurate, or similar high R-value (R-value is a standard measure of a material's resistance to heat loss) rigid board insulation should be installed before the new membrane is applied.

2.3.3. Base

The Morgan School's base is a five-inch concrete slab-on-grade. There were no reported problems with water penetration or moisture. There is no evidence of any perimeter insulation around the slab or under the slab. Excavation to install additional slab insulation is expensive and would not be cost-effective as a single measure. However, if the perimeter of the building is ever excavated to repair or replace drainage protections, installing two inches of a rigid foam board insulation should be considered.

2.3.4. Windows

The windows at the Morgan School are aluminum frame with dual glazing. The windows appear to be in very good condition and measurements indicated that the interior surfaces of the windows were less than 9 degrees cooler than the ambient temperature of the classroom at the coolest part of the glass, which is not unusual and reflects a satisfactory level of insulating quality. As a maintenance practice, the weather-stripping on all windows should be inspected and all missing or deteriorated sections should be repaired or replaced.

2.3.5. Exterior doors

The exterior doors of the building are in very good condition for the most part. They are metal clad, insulated doors many of which have a small wire glass insert. Exterior doors can be a major source of heat loss in general and SWA recommends checking the weather-stripping of each door on a regular basis and replacing any broken seals immediately. Tight seals around the door will help ensure that the building is kept sealed and insulated over time. This will help ensure that the building stays tight and will prevent unconditioned air from infiltrating the interior.

2.3.6. Building air tightness

Based upon visual inspection, the building seemed to be reasonably well-sealed. The doors and the windows fit properly and were well sealed. There did not appear to be any through-wall or through-roof penetrations that were not properly sealed.

As a general maintenance practice, any holes or penetrations in the building should be sealed to prevent the loss of conditioned air. All plumbing, wiring, HVAC or ductwork penetrations should be sealed with foam or caulk. All other building penetrations, including fans, air conditioners, pipe, wire, or HVAC penetrations throughout the building should be sealed. Any asbestos-like-material should be removed from the premises before energy efficient upgrades are conducted, such as air sealing or adding insulation.

Any asbestos-like-material should be removed from the premises before energy efficient upgrades are conducted, such as air sealing or adding insulation, which may have an effect on air quality within the building.

2.4. HVAC systems

2.4.1. Heating

The school is served by three hot water boilers. These boilers supply hot water to floor mounted unit ventilators in each classroom. The heating capacity of each unit ventilators ranges from 60-100 Mbtu. Each unit ventilator has unit-mounted controls that provide adjustment of both the hot water valve and the fan. The building is served by pneumatic

controls. Boiler On/Off operation can be controlled remotely by an Automated Logic panel located in the mechanical room. See the Equipment Inventory Table for further details.

Asbestos was observed on the piping and equipment in the mechanical room. Although this assessment focuses on energy-efficiency, the health and safety concerns associated with asbestos should be noted. Asbestos abatement is primarily a safety issue and is not directly associated with a cost payback. However, the existence of asbestos very often impacts the ability of building operators to perform routine maintenance procedures without undertaking appropriate safety measures and incurring associated costs.

As a result of asbestos, the efficiency of building systems often suffers from lack of routine maintenance. During the course of this assessment, appropriate safety precautions were taken with regards to the presence of asbestos. In some cases, this prevented SWA from completing a more thorough investigation of the existing systems and equipment. To protect the welfare of students and staff, SWA recommends that asbestos abatement be addressed prior to undertaking any other significant investments in capital improvements.

2.4.2. Cooling

There were numerous window air conditioner units observed throughout the building. SWA recommends replacing older model units with Energy Star window air conditioners, sized proportionally for the room, with an EER of 12 or better.

2.4.3. Ventilation

The floor-mounted unit ventilators in each classroom have an outdoor air duct through the exterior wall that delivers air to the rear of the unit. Exterior louvers allow air to be drawn into the unit ventilator and heated within the space. When the unit ventilator fan is operating, the fresh air is distributed to the room. In addition, the classrooms have operable windows to provide ventilation during the summer months.

Dedicated exhaust is provided for the kitchen and baths to remove odors.

2.4.4. Domestic Hot Water

Domestic Hot Water for the building is provided by an A.O. Smith natural gas-fired hot water storage tank. The storage tank has a capacity of 60 gallons of storage and an intput of 80 MBtuh. This standard efficiency equipment has an efficiency rating of approximately 78%.

It is not cost-effective to replace the existing water heating equipment with higher efficiency equipment. However, higher efficiency water heating equipment will save energy and should be strongly considered upon replacement of the equipment. Energy saving appliances bearing the ENERGY STAR label should be selected to ensure efficiency performance. Incentives may be available to offset any added costs for the installed equipment.

More efficient water-consuming fixtures and appliances save both energy and money through reduced energy consumption for water heating, as well decreased water and sewer bills. SWA recommends adding controlled on/off timers on all lavatory faucets to reduce domestic hot water demand and save water. Building staff can also easily install faucet aerators and/or low-flow fixtures to reduce hot water consumption. In addition, routine maintenance practices that identify and quickly address water leaks are a low-cost way to save water and energy.

2.5. Electrical systems

2.5.1. Lighting

Interior Lighting – Much of the interior lighting in the Morgan Elementary School building still uses older T12 fluorescent fixtures with magnetic ballasts. There are approximately 142 T12 fixtures that are still in use and still use magnetic ballasts. There are also approximately 63 incandescent fixtures that should be upgraded to Compact Fluorescent Lighting (CFLs). SWA recommends replacing any magnetic ballast with electronic ballasts and all T12 fluorescent bulbs with T8 fluorescent bulbs. Replacing the magnetic ballasts alone will result in a 15-20% savings per light fixture and replacing T12 bulbs with T8 bulbs will result in an additional 10-15% savings per light fixture. SWA recommends replacing incandescent bulbs with compact fluorescent bulbs. SWA also recommends taking advantage of lighting on different switches and use only lighting needed in classrooms. See the lighting schedule attached in the Appendix A for complete lighting retrofit details.

SWA recommends taking advantage of lighting on different switches and use only lighting needed in classrooms.

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. During the time of our visit (spring break week) shades were half drawn throughout the school. 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.

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 315kwh/hr. 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: 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

Currently, there are two different vending machines located in faculty lounge at Morgan Elementary School. Vending machines contain display lighting to remain lit 24/7, which wastes large amounts of energy over time. SWA recommends installing a technology called VendingMiser that uses passive infrared technology to sense motion and turn off the display lighting when no motion is detected for a set period of time.

Computers left on in classrooms 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 classrooms use approximately 3-5 watts of electricity when turned off. SWA recommends all computers and all classrooms 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.

Educating both students and staff is a great way for schools to save energy while raising awareness about the importance of energy-efficiency. Prizes and challenges can be used to get classes involved in finding creative ways to reduce and monitor energy usage throughout the school. There are many free resources available to help Students, Parents, and School Administrators incorporate energy into school curricula and every day activities.

2.5.3. Elevators

There are no elevators at Morgan Elementary School.

2.5.4. Other electrical systems

There are currently no other electrical systems in the building.

3. EQUIPMENT LIST

Building System	Description	Make/ Model	Fuel	Space served	Estimated Remaining useful life %
Heating	(3) Hot Water Boilers, 102 HP each	HB Smith	Natural Gas	Building	0%
Distribution System	Floor mounted Unit ventilators/radiators with unit-mounted adjustable valve and fan controls	Nesbitt	Hot Water	Each Classroom	Varies
Cooling	No Central Cooling				
Ventilation	Outdoor Intake in Unit Ventilators, Exhaust for kitchens and baths.				
Domestic Hot Water	Tank-type Water Heater, 60 gallon, 80 Mbtuh	A.O. Smith	Natural Gas	Building	10%
Lighting	See details appendix A	-	-	-	-

Note:

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

4. ENERGY CONSERVATION MEASURES

Based on the assessment of this building, SWA has separated the investment opportunities into three categories of recommendations:

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

- Asbestos Abatement – As noted previously, asbestos was observed in the buildings and is considered a health and safety hazard. In addition, the existence of asbestos impacts the ability of the building operations staff to conduct routine maintenance without incurring additional costs associated with proper safety measures. Regardless of the recommendations adopted to upgrade the energy-efficiency of the facility, SWA recommends asbestos abatement by licensed asbestos contractors as the first priority.

Category II Recommendations: Operations and Maintenance

- Pipe Insulation – The energy efficiency of the heating plant and distribution system can be improved by repairing and/or replacing damaged pipe insulation. This recommendation can easily be undertaken by maintenance personal for minimal cost. However, the existence of asbestos impacts the cost associated with this recommendation. For this reason, asbestos abatement has been identified as a high priority investment.
- Controls Optimization – Is is SWA's understanding that the existing Automated Logic Control panel is used to remotely control on/off boiler operation for all buildings by the District Facility Manager. This panel can be optimized and/or expanded to either shut down or reset the boilers based on outdoor temperature. This may require additional sensors and programming by a Controls professional. However, utilization of the existing equipment makes this a relatively simple and cost-effective recommendation.
- Weather Stripping/Air Sealing - SWA observed that exterior door weather-stripping 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 frame. 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-effect 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-consuming fixtures and appliances will save both energy and money through reduced energy consumption for water heating, while also decreasing water and sewer bills.
- 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
1	Replace Existing Hot Water Boilers: Upgrade the existing hot water boilers with new, higher efficiency hot water boilers. This recommendation includes optimization of existing remote boiler controls, new local boiler controls, and increased pipe insulation. Implementation of this recommendation will require professional design assistance and asbestos abatement.
2	Lighting Upgrade; See appendix A for entire lighting retrofit schedule.
3	Install Vending Miser technology

ECM#1: *Replace Existing Hot Water Boilers*

Description:

The existing hot water boilers have been reasonably well-maintained but they are inefficient relative to newer technology and they have reached the end of their useful life. The recommendation provided here cannot be cost justified by energy savings alone. However, the age and condition of the equipment warrant attention and this recommendation is intended to provide guidance to help the building management staff prioritize upgrades within the facility.

The existing equipment is approximately 75% efficient. To improve heating plant energy performance, SWA recommends replacement of the existing boilers with new boilers that have an efficiency of 82% or better. Boiler capacity should be properly sized. The insulation on all boiler piping within the mechanical room and any accessible distribution piping should be replaced during this retrofit. As part of this upgrade, a local boiler control should be installed to provide outdoor reset of the supply water temperature and boiler sequencing. The existing Automated Logic Control panel should also be optimized to provide improved control during remote operation. This may require the installation of local temperature sensors and programming by a controls contractor to update the system.

Before proceeding with implementation of this recommendation, it will be necessary to abate the asbestos in the mechanical room. Asbestos abatement is outside the scope of this assessment and the cost estimates provided do not include pricing associated with abatement. This recommendation will also require professional design assistance to determine the appropriate equipment and configuration. Costs associated with design have not been included in the estimate provided in this report.

Pneumatic controls are used to regulate the heating system throughout the building, which primarily includes floor-mounted unit ventilators that are quite old. Although there is an opportunity to improve comfort and energy performance by upgrading the building controls and the distribution system, the impact on the building operations negates the cost-effectiveness of this recommendation.

Installation cost:

Estimated installed cost: $96,333
Source of cost estimate: RS *Means*

Economics:

1st year energy savings					SPP	LoM	lifetime		Annual Carbon Reduction (lbs of CO2)	
usage	unit	demand	unit	$ savings/yr			cost savings	ROI		
1,187	therm	0.0	-	$ 1,840	52.4	30	$ 35,147	-2.1%	13,084	

Assumptions: SWA calculated the savings for this measure using information collected during the field visit and analysis of historical utility consumption information. SWA estimated the natural gas usage associated with heating only and assumed that this measure will save 7% of the heating usage. Pricing is based on removal of all existing boilers and replacement with an equal number of boilers.

Rebates/financial incentives:

This measure may qualify for an incentive of $1.00 per MBH of boiler capacity. Required boiler capacity will be determined by the design professional.

Options for funding ECM:
Additional information may be found on the NJ Clean Energy website.

ECM#2: *Lighting Upgrade*

Description:

Most of the lighting at Morgan Elementary School is older and consists of older T12 fluorescent lighting with magnetic ballasts. There are approximately 142 fluorescent fixtures that still use T12 fluorescent bulbs with magnetic ballasts. Morgan Elementary School also contains approximately 63 incandescent bulbs that should be replaced with CFLs. For a complete existing and retrofit lighting schedule, please see Appendix A.

Installation cost:

Estimated installed cost: $29,345
Source of cost estimate: RS *Means*

Economics:

1st year energy savings					SPP	LoM	lifetime		Annual Carbon Reduction (lbs of CO2)
usage	unit	demand	unit	$ savings			cost savings	ROI	
25,553	kWh	2.9	kW	$ 3,961	7.4	20	$ 79,214	8.5%	45,753

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

Rebates/financial incentives:

NJ Clean Energy – Prescriptive Lighting Incentive, Incentive based on installing T5 or T8 lamps with electronic ballasts in existing facilities ($10-$30 per fixture, depending on quantity of lamps).

Options for funding ECM:

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

ECM#3: *Install VendingMiser technology*

Description:

There are currently two vending machines located in the faculty lounge at Langtree Elementary School. These vending machines use excessive lighting for display that remains on 24/7. SWA recommends installing VendingMiser devices that act as an occupancy sensor to turn off the display lighting of these machines when no lighting is necessary.

Installation cost:

Estimated installed cost: $258
Source of cost estimate: RS *Means*

Economics:

1st year energy savings					SPP	LoM	lifetime		Annual Carbon Reduction (lbs of CO2)
usage	unit	demand	unit	$ savings/yr			cost savings	ROI	
2,428	kWh	0.0	kW	$ 376	0.7	10	$ 3,763	135.9%	4,347

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

Rebates/financial incentives:

There are currently no incentives available for this measure at this time.

Options for funding ECM:

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

5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES

5.1. Existing systems

There are currently no existing renewable energy systems.

5.2. Solar Photovoltaic

Photovoltaic (PV) technology would not be cost beneficial to this project since there is such little electric demand. Also, the school is not in session during the summer when photovoltaic panels would be most beneficial.

5.3. Solar Thermal Collectors

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

5.4. Combined Heat and Power

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

5.5. Geothermal

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

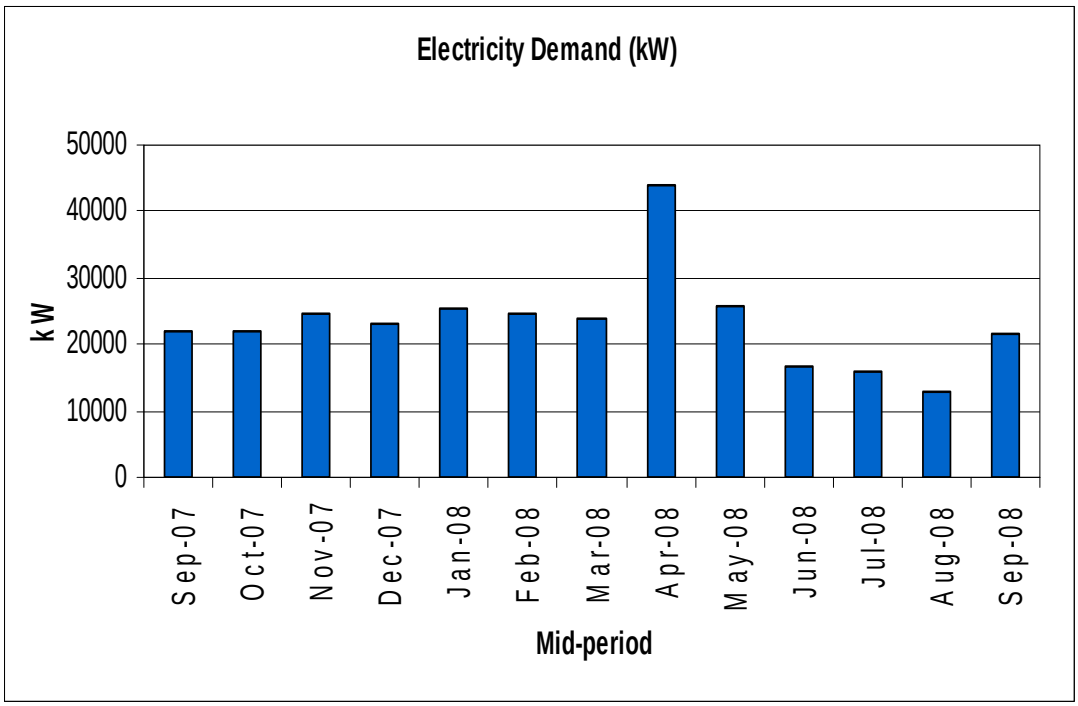
5.6. Wind

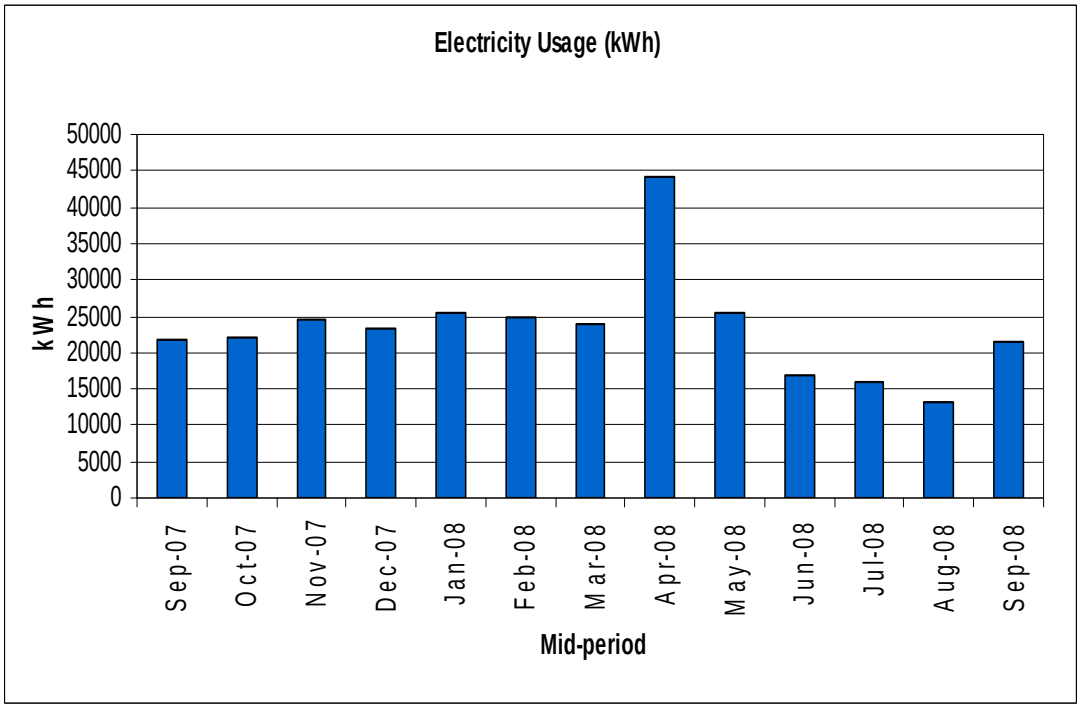
Wind power production is not appropriate for this location because required land is not available for the wind turbine. Also, the available wind energy resource is very low.

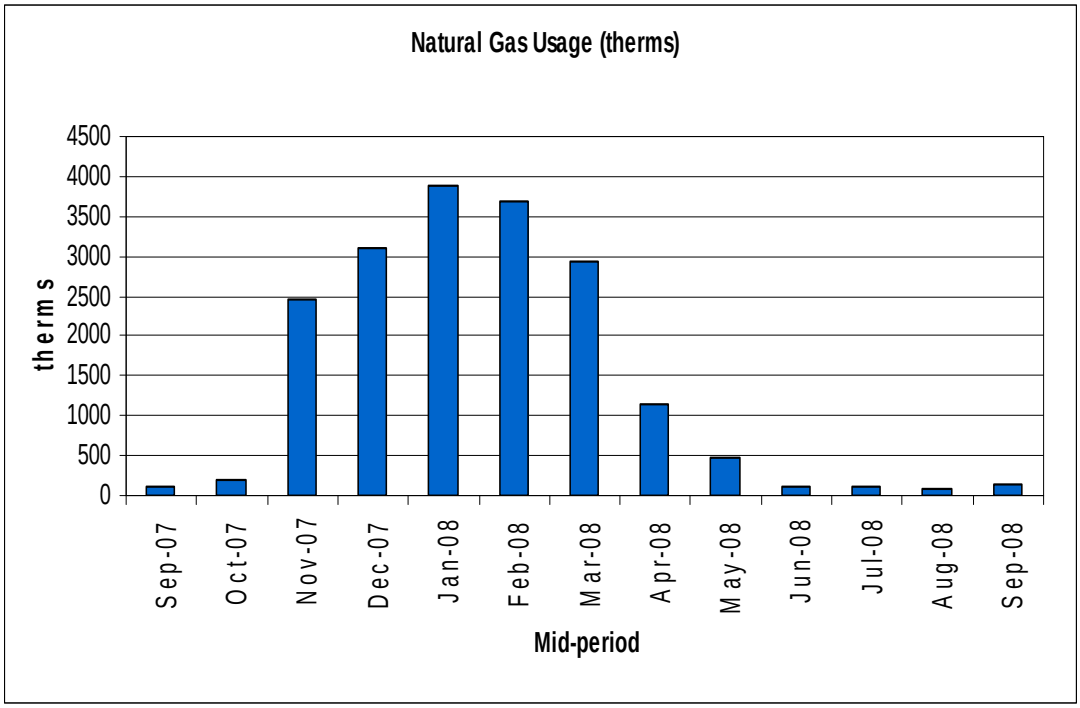
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Load profiles

The average electrical peak demand for the previous year was 79.4 kW and the maximum peak demand was 84.8 kW. The electric and gas load profiles for this project are presented in the following charts. The first chart shows electric demand (in kW) for the previous 12 months and the other two charts show electric and gas usage (in kWh), respectively.


Electricity Demand (kW)
50000
40000
30000
20000
10000
0
kW
Sep-07
Oct-07
Nov-07
Dec-07
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Mid-period


Electricity Usage (kWh)
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
kWh
Sep-07
Oct-07
Nov-07
Dec-07
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Mid-period



6.2. Tariff analysis

The school currently buys electricity and gas from PSE&G at the FTLV rate. FTLV is a typical rate structure where customers pay for natural gas based on usage and electricity based on usage with the addition of an electrical demand charge. The FTLV rate is appropriate for this building. No information on gas transportation charges was provided for this analysis.

6.3. Energy Procurement strategies

Billing analysis shows price fluctuations of over 20% over the course of the year for the building electrical and natural gas accounts. Customers that have a large variation in monthly billing rates can often reduce the costs associated with energy procurement by selecting a third party energy supplier. Contact the NJ Energy Choice Program for further information on Energy Services Companies (ESCOs) that can act as third party energy suppliers. Purchasing electricity from an ESCO can reduce electric rate fluctuation and ultimately reduce the annual cost of energy for the school. Appendix C contains a complete list of third party energy suppliers.

The building would not be eligible for enrollment in a Demand Response Program because the minimum electric demand each month does not greatly exceed 50 kW, which is the typical threshold for considering this option.

7. METHOD OF ANALYSIS

7.1. Assumptions and methods

Energy modeling method:	Spreadsheet-based calculation methods
Cost estimates:	RS Means 2009 (Facilities Maintenance & Repair Cost Data) RS Means 2009 (Building Construction Cost Data) RS Means 2009 (Mechanical Cost Data) Note: 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

Existing Lighting Conditions																		Proposed Lighting Improvements									
#	School	Building	Level/Floor	Location in Building	Measured Lighting Level in Footcandles	Bulb #	Fixture	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts/Lamp	Hrs/Day	Energy Use (Watt hours/day)	Controls	Daylighting possible?	Total Power (Watts)	Bulb #	Fixture	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts/ Lamp	Hrs/Day	Energy Use (Watt hours/day)	Total Power (Wt)
1	Morgan	1989	Main Level	Kindergarten #24	57	4 F32T8	4' linear T8	Electronic	15	4	Fluorescent	32	8	15360	SP Switches	Yes	1920	4 F32T8	4' linear T8	Electronic	15	4	Fluorescent	32	8	15360	1920
2	Morgan	1989	Main Level	Kindergarten #24 Toilet	40	1 INC60	60w bulb	-	1	1	Incandescent	60	2	120	Switch	No	60	20 W CFL	CFL	-	1	1	Fluorescent	20	2	40	20
3	Morgan	1957	Main Level	Kindergarten #23	58	4 F32T8	4' linear T8	Electronic	16	4	Fluorescent	32	8	16384	Switch	Yes	2048	4 F32T8	4' linear T8	Electronic	16	4	Fluorescent	32	8	16384	2048
4	Morgan	1957	Main Level	Kindergarten #23 Toilet	40	1 INC60	60w bulb	-	1	1	Incandescent	60	2	120	Switch	No	60	20 W CFL	CFL	-	1	1	Fluorescent	20	2	40	20
5	Morgan	1989	Main Level	Kindergarten #22	58	2 F96T12	4' linear T12	Magnetic	12	2	Fluorescent	40	8	640	SP Switches	Yes	960	2 F32T8	4' linear T8	Electronic	12	2	Fluorescent	32	8	512	768
6	Morgan	1989	Main Level	Kindergarten #22	58	2 F40T12	4' linear T12	Magnetic	3	2	Fluorescent	40	8	640	SP Switches	Yes	240	2 F32T8	4' linear T8	Electronic	3	2	Fluorescent	32	8	512	192
7	Morgan	1989	Main Level	Kindergarten #22 Toilet	40	1 INC60	60w bulb	-	1	1	Incandescent	60	2	120	Switch	No	60	1 CF14	CFL	-	1	1	Fluorescent	14	2	28	14
8	Morgan	1989	Main Level	Faculty Room	56	4 F32T8	4' linear T8	Electronic	4	4	Fluorescent	32	8	4096	SP Switch	Yes	512	4 F32T8	4' linear T8	Electronic	4	4	Fluorescent	32	8	1024	512
9	Morgan	1989	Main Level	Office	48	4 F32T8	4' linear T8	Electronic	4	4	Fluorescent	32	8	4096	SP Switch	No	512	4 F32T8	4' linear T8	Electronic	4	4	Fluorescent	32	8	1024	512
10	Morgan	1989	Main Level	Principal Office	52	4 F32T8	4' linear T8	Electronic	2	4	Fluorescent	32	8	2048	SP Switch	Yes	256	4 F32T8	4' linear T8	Electronic	2	4	Fluorescent	32	8	1024	256
11	Morgan	1957	Main Level	Office Storage	45	2 F32T8	2' linear T8	Electronic	5	2	Fluorescent	32	2	640	SP Switch	No	320	2 F32T8	2' linear T8	Electronic	5	2	Fluorescent	32	2	128	320
12	Morgan	1957	Main Level	Faculty Restroom Mens	45	F32T8	4' linear T8	Electronic	2	2	Fluorescent	32	8	1024	Switch	No	128	F32T8	4' linear T8	Electronic	2	2	Fluorescent	32	8	512	128
13	Morgan	1957	Main Level	Faculty Restroom Womens	45	F32T8	4' linear T8	Electronic	2	2	Fluorescent	32	8	1024	Switch	No	128	F32T8	4' linear T8	Electronic	2	2	Fluorescent	32	8	512	128
14	Morgan	1957	Main Level	Girls' Restroom	39	F32T8	4' linear T8	Electronic	2	2	Fluorescent	32	8	1024	Switch	No	128	F32T8	4' linear T8	Electronic	2	2	Fluorescent	32	8	512	128
15	Morgan	1957	Main Level	Boys' Restroom	39	F32T8	4' linear T8	Electronic	2	2	Fluorescent	32	8	1024	Switch	No	128	F32T8	4' linear T8	Electronic	2	2	Fluorescent	32	8	512	128
16	Morgan	1957	Main Level	Janitor Closet		1 INC40	40w bulb	-	1	1	Incandescent	40	8	320	SP Switch	No	40	20 W CFL	CFL	-	1	1	Fluorescent	20	8	160	20
17	Morgan	1957	Main Level	Special Ed #2	57	4 F32T8	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	SP Switches	Yes	1536	4 F32T8	4' linear T8	Electronic	12	4	Fluorescent	32	8	1024	1536
18	Morgan	1957	Main Level	5th Grade #4	56	4 F32T8	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	SP Switches	Yes	1536	4 F32T8	4' linear T8	Electronic	12	4	Fluorescent	32	8	1024	1536
19	Morgan	1957	Main Level	5th Grade #5	56	4 F32T8	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	SP Switches	Yes	1536	4 F32T8	4' linear T8	Electronic	12	4	Fluorescent	32	8	1024	1536
20	Morgan	1957	Main Level	5th Grade #12	58	4 F32T8	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	SP Switches	Yes	1536	4 F32T8	4' linear T8	Electronic	12	4	Fluorescent	32	8	1024	1536
21	Morgan	1957	Main Level	Special Ed #10	57	4 F32T8	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	SP Switches	No	1536	4 F32T8	4' linear T8	Electronic	12	4	Fluorescent	32	8	1024	1536
22	Morgan	1989	Main Level	Music Room		2 F32T8	2' linear T8	Electronic	6	2	Fluorescent	32	8	3072	SP Switches	No	384	2 F32T8	2' linear T8	Electronic	6	2	Fluorescent	32	8	512	384
23	Morgan	1989	Main Level	Music Room		4 F32T8	4' linear T8	Electronic	24	4	Fluorescent	32	8	24576	SP Switches	No	3072	4 F32T8	4' linear T8	Electronic	24	4	Fluorescent	32	8	1024	3072
24	Morgan	1989	Main Level	Music Storage Room		2 F32T8	2' linear T8	Electronic	1	2	Fluorescent	32	2	128	SP Switches	No	64	2 F32T8	2' linear T8	Electronic	1	2	Fluorescent	32	2	128	64
25	Morgan	1957	Main Level	Kitchen		2 F32T8	2' linear T8	Electronic	11	2	Fluorescent	32	8	6632	Switch	No	704	2 F32T8	2' linear T8	Electronic	11	2	Fluorescent	32	8	512	704
26	Morgan	1957	Main Level	Multi Purpose	50	1 incs500	500w bulb	-	12	1	Incandescent	500	8	4000	SP Switch	Yes	6000	MH150	MH Halide ***	Electronic	12	1	Fluorescent	150	8	1200	1800
27	Morgan	1957	Main Level	2nd Grade #7	55	2 F96T12	4' linear T12	Magnetic	18	2	Fluorescent	40	8	640	SP Switches	Yes	1440	2 F32T	4' linear T8	Electronic	18	2	Fluorescent	32	8	512	1152
28	Morgan	1957	Main Level	Stage		1 incs60 PAR	60w bulb	-	40	1	Incandescent	60	2	120	SP Switches	No	2400	1 CF13 PAR	PAR CFL	-	40	1	Fluorescent	13	2	26	520
29	Morgan	1957	Main Level	Stage		1 incs150	150w bulb	-	2	1	Incandescent	150	2	300	SP Switches	No	300	1 CF23**	CFL	-	2	1	Fluorescent	23	2	46	46
30	Morgan	1957	Main Level	Stage		1 incs150 PAR	150w bulb	-	6	1	Incandescent	150	2	300	SP Switches	No	900	1 CF23 PAR**	PAR CFL	-	6	1	Fluorescent	23	2	46	138
31	Morgan	1957	Main Level	Long Corridor	51	4 F48T12	4' linear T12	Electronic	18	4	Fluorescent	40	11	1760	SP Switch		2880	4 F32T8	4' linear T8	Electronic	18	4	Fluorescent	32	11	1408	2304
32	Morgan	1957	Main Level	2nd Grade #7	55	F48T12		Magnetic	18	2	Fluorescent	60	8	17280	SP Switches	Yes	2160	F48T12		Magnetic	18	2	Fluorescent	60	8	17280	1728
33	Morgan	1957	Main Level	2nd Grade #7 Toilet	8.5	CFLT4	Circleline	Magnetic	1	3	CFL	13	2	78	Switch	No	39	1 FC10-HO	Circleline	Electronic	1	1	Fluorescent	30	2	60	30
34	Morgan	1957	Main Level	2nd Grade #9	56	2 F96T12	8' Linear T12	Electronic	9	2	Fluorescent	60	8	960	SP Switches	Yes	1080	2 F59 T8	8' Linear T8	Electronic	9	2	Fluorescent	48	8	768	864
35	Morgan	1957	Main Level	2nd Grade #9 Toilet	8.5	CFLT4	Circleline	Magnetic	1	3	CFL	13	2	78	Switch	No	39	1 FC12-HO	Circleline	Electronic	1	1	Fluorescent	13	2	26	13
36	Morgan	1957	Main Level	2nd Grade #11	56	2 F96T12	8' Linear T12	Electronic	9	2	Fluorescent	60	8	960	SP Switches	Yes	1080	2 F59 T8	8' Linear T8	Electronic	9	2	Fluorescent	48	8	768	864
37	Morgan	1957	Main Level	2nd Grade #11 Toilet	8.5	CFLT4	Circleline	Magnetic	1	3	CFL	13	2	78	Switch	No	39	1 FC12-HO	Circleline	Electronic	1	1	Fluorescent	30	2	60	30
38	Morgan	1957	Main Level	1st Grade #1	57	2 F96T12	8' Linear T12	Electronic	9	2	Fluorescent	60	8	960	SP Switches	Yes	1080	2 F59 T8	8' Linear T8	Electronic	9	2	Fluorescent	48	8	768	864
39	Morgan	1957	Main Level	1st Grade #1 Toilet	5.6	CFLT4	Circleline	Magnetic	1	2	CFL	13	2	52	Switch	No	26	1 FC12-HO	Circleline	Electronic	1	1	Fluorescent	13	2	26	13
40	Morgan	1957	Main Level	1st Grade #5	57	2 F96T12	8' Linear T12	Electronic	9	2	Fluorescent	60	8	960	SP Switches	Yes	1080	2 F59 T8	8' Linear T8	Electronic	9	2	Fluorescent	48	8	768	864
41	Morgan	1957	Main Level	1st Grade #3 Toilet	3.7	CFLT4	Circleline	Magnetic	1	3	CFL	13	2	78	Switch	No	39	1 FC12-HO	Circleline	Electronic	1	1	Metal Halide	30	2	60	30
42	Morgan	1957	Main Level	1st Grade #5	57	2 F96T12	8' Linear T12	Electronic	9	2	Fluorescent	60	8	960	SP Switches	Yes	1080	2 F59 T8	8' Linear T8	Electronic	9	2	Fluorescent	48	8	768	864
43	Morgan	1957	Main Level	1st Grade #5 Toilet	57	2 F96T12	8' Linear T12	Electronic	9	2	Fluorescent	60	2	240	SP Switches	No	1080	2 F59 T8	8' Linear T8	Electronic	9	2	Fluorescent	48	2	192	864
44	Morgan	1989	Main Level	Library/Stor. Rm	30	2 F32T8	2' linear T8	Electronic	4	2	Fluorescent	32	2	512	Switch	No	256	2 F32T8	2' linear T8	Electronic	4	2	Fluorescent	32	2	512	256
45	Morgan	1989	Main Level	Library Office & Workroom	75	4 F32T8	4' linear T8	Electronic	4	4	Fluorescent	32	8	4096	Switch	No	512	4 F32T8	4' linear T8	Electronic	4	4	Fluorescent	32	8	4096	512
46	Morgan	1989	Main Level	Library	58	4 F32T8	4' linear T8	Electronic	28	4	Fluorescent	32	8	28672	5 @ SP	Yes	3584	4 F32T8	4' linear T8	Electronic	28	4	Fluorescent	32	8	28672	3584
47	Morgan	1989	Main Level	ACT. RM		3 F32T8	2' linear T8	Electronic	4	3	Fluorescent	32	8	3072	SP Switch	Yes	384	3 F32T8	2' linear T8	Electronic	4	4	Fluorescent	32	8	4096	512
48	Morgan	1989	Main Level	4th Grade #13	56	4 F32T8	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	SP Switches	Yes	1536	4 F32T8	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	1536
49	Morgan	1989	Main Level	4th Grade #13 Toilet	8.5	CFLT4	Circleline	Magnetic	1	3	CFL	13	2	78	Switch	No	39	1 FC12-HO	Circleline	Electronic	1	1	Fluorescent	13	2	26	13
50	Morgan	1989	Main Level	4th Grade #15	56	4 F32T8	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	SP Switches	Yes	1536	4 F32T8	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	1536
51	Morgan	1989	Main Level	4th Grade #15 Toilet	8.5	CFLT4	Circleline	Magnetic	1	3	CFL	13	2	78	Switch	No	39	1 FC12-HO	Circleline	Electronic	1	1	Fluorescent	13	2	26	13
52	Morgan	1989	Main Level	4th Grade #17	55	4 F32T8	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	SP Switches	Yes	1536	4 F32T8	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	1536
53	Morgan	1989	Main Level	4th Grade #17 Toilet	8.5	CFLT4	Circleline	Magnetic	1	3	CFL	13	2	78	Switch	No	39	1 FC12-HO	Circleline	Electronic	1	1	Fluorescent	13	2	26	13
54	Morgan	1989	Main Level	3rd Grade #23	59	4 F32T8	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	SP Switches	Yes	1536	4 F32T8	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	1536
55	Morgan	1989	Main Level	3rd Grade #23 Toilet	8.5	CFLT4	Circleline	Magnetic	1	3	CFL	13	2	78	Switch	No	39	1 FC12-HO	Circleline	Electronic	1	1	Fluorescent	13	2	26	13
56	Morgan	1989	Main Level	3rd Grade #21	60	4 F32T8	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	SP Switches	Yes	1536	4 F32T8	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	1536
57	Morgan	1989	Main Level	3rd Grade #21 Toilet	8.5	CFLT4	Circleline	Magnetic	1	3	CFL	13	2	78	Switch	No	39	1 FC12-HO	Circleline	Electronic	1	1	Fluorescent	13	2	26	13
58	Morgan	1989	Main Level	3rd Grade #19	58	4 F32T8	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	SP Switches	Yes	1536	4 F32T8	4' linear T8	Electronic	12	4	Fluorescent	32	8	12288	1536
59	Morgan	1989	Main Level	3rd Grade #19 Toilet	8.5	CFLT4	Circleline	Magnetic	1	3	CFL	13	2	78	Switch	No	39	1 FC12-HO	Circleline	Electronic	1	1	Fluorescent	13	2	26	13
60	Morgan	1989	Main Level	Resource Rm		4 F32T8	4' linear T8	Electronic	6	4	Fluorescent	32	8	6144	SP Switch	Yes	768	4 F32T8	4' linear T8	Electronic	6	4	Fluorescent	32	8	6144	768
61	Morgan	1989	Main Level	Guidance Office		4 F32T8	4' linear T8	Electronic	4	4	Fluorescent	32	8	4096	SP Switch	Yes	512	4 F32T8	4' linear T8	Electronic	4	4	Fluorescent	32	8	4096	512
62	Morgan	1989	Main Level	Long Corridor	50	FO 17 T8		Electronic	7	1	Fluorescent	17	11	187	SP Switch	No	119	FO 17 T8		Electronic	7	7	Fluorescent	17	11	1309	833
63	Morgan	1989	Main Level	Short Corridor	52	4 F48T12	4' linear T12	Magnetic	12	4	Fluorescent	40	11	1760	SP Switch	No	1920	4 F32T8	4' linear T8	Electronic	12	4	Fluorescent	32	11	1408	1536
64	Morgan	1989	Main Level	Corridors	49	2 F32T8	2' linear T8	Electronic	11	2	Fluorescent	32	11	704	SP Switch	No	704	2 F32T8	2' linear T8	Electronic	11	22	Fluorescent	32	11	7744	7744

** Colored CFLs for stage lighting are available from www.blakeboys.com

*** Please note that Metal Halide lamps should be pulse start with electronic ballast.

Totals		
Existing Usage (kWh/year)		77,457
Proposed Usage (kWh/year)		51,904
Existing Est. Cost ($/year)	$	12,702.99
Proposed Est. Cost ($/year)	$	8,512.30
Total kWh Savings		25,553
Total $ Savings	$	4,190.68

Existing Lighting Total Power (Watts)	60366	Watts
Existing Lighting Power Density (W/sqft)	1.75	W/sqft
Proposed Lighting Total Power (Watts)	37557	Watts
Proposed Lighting Power Density (W/sqft)	1.67	W/sqft

Appendix B: Third Party Energy Suppliers (ESCOs)

Third Party Electric Suppliers for PSEG Service Territory	Telephone & Web Site
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
American Powernet Management, LP 437 North Grove St. Berlin, NJ 08009	(877) 977-2636 www.americanpowernet.com
BOC Energy Services, Inc. 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.boc.com
Commerce Energy, Inc. 4400 Route 9 South, Suite 100 Freehold, NJ 07728	(800) 665-8457 www.commerceenergy.com
ConEdison Solutions 535 State Highway 38 Cherry Hill, NJ 08002	(888) 665-0955 www.conedsolutions.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.newenergy.com
Credit Suisse, (USA) Inc. 700 College Road East East Princeton, NJ 08450	(212) 547-2722 www.creditsuisses.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
FirstEnergy Solutions 300 Madison Avenue Morriston, NJ 07962	(800) 977-0500 www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 www.glacialenergy.com
Integrys Energy Services, Inc. 99 Wood Ave South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integrysenergy.com
Liberty Power Delaware, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com
Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com
Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 www.spragueenergy.com
Strategic Energy, LLC 55 Madison Avenue, Suite 400 Morristown, NJ 07960	(888) 925-9115 www.sel.com
Suez Energy Resources NA, Inc. 333 Thornall Street, 6th Floor Edison, NJ 08837	(888) 644-1014 www.suezenergyresources.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com

Third Party Gas Suppliers for PSEG Service Territory	Telephone & Web Site
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109	(800) 628-9427 www.cooperativenet.com
Direct Energy Services, LLC 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 www.retail.dom.com
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 www.gesc.com
UGI Energy Services, Inc. 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 Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
Hudson Energy Services, LLC 545 Route 17 South Ridgewood, NJ 07450	(877) 483-7669 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	(877) 797-8786 www.systrumenergy.com
Metro Energy Group, LLC 14 Washington Place Hackensack, NJ 07601	(888) 536-3876 www.metroenergy.com
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 08837	(800) 375-1277 www.mxenergy.com
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	(800) 840-4427 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 Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
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