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September 7, 2012

Local Government Energy Program
Energy Audit Final Report

East Amwell Township School

43 Wertsville Road
Ringoes, NJ 08551

Project Number: LGEA101

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EXECUTIVE SUMMARY

The East Amwell Township School is a single-story, 70,200 ft^2 pre-kindergarten to 8^{th} grade school, with a partial basement and inclusive of three additional modular trailers; two modular classroom trailers at 2,400 ft^2 each and one modular office trailer at 400 ft^2. The school is comprised of an original building built in 1938 and several additions in the decades following. The original 1938 building currently houses several classrooms, the cafeteria/stage, kitchen, nurse's office, and the boiler room located in the basement. Later additions that transformed the building occurred in 1956, 1964, 1978, 1989, and 1999. These additions included a gymnasium, media center, science laboratory, technology laboratory, music room, additional classrooms and a second mechanical room. Other major additions include two modular classroom trailers and one modular office unit. The following chart provides a comparison of the current building energy usage based on the period from March 2011 through February 2012 with the proposed energy usage resulting from the installation of recommended Energy Conservation Measures (ECMs) excluding any renewable energy:

Table 1: State of Building—Energy Usage

	Electric Usage (kWh/yr)	Gas Usage (therms/yr)	Current Annual Cost of Energy ($)	Site Energy Use Intensity (kBtu/sq ft /yr)	Source Energy Use Intensity (kBtu/sq ft /yr)	Joint Energy Consumption (MMBtu/yr)
Current	568,774	29,158	$112,902	69	136	4,857
Proposed	535,716	28,176	$106,308	66	129	4,646
Savings	33,059	982	$6,594*	3.0	7	211
% Savings	5.8%	3.4%	5.8%	4.3%	5.0%	4.3%
*Includes operation and maintenance savings						

SWA has entered energy information about the East Amwell Township School facility into the U.S. Environmental Protection Agency's (EPA) Energy Star Portfolio Manager Energy Benchmarking system. The ENERGY STAR Energy Performance Rating was calculated to be 56. The building has a Site Energy Utilization Intensity of 69 kBtu/sqft/yr compared to the National Median of 73 kBtu/sqft/yr, for similar schools.

Recommendations

Based on the current state of the building and its energy use, SWA recommends implementing the following Energy Conservation Measures:

Table 2: Energy Conservation Measure Recommendations

Measures	First Year Savings ($)	Simple Payback Period (Years)	Initial Investment	CO2 Savings (lbs/yr)
0-5 Year	$6,546	2.4	$15,658	69,444
5-10 Year	$48	8.2	$390	572
Total	$6,594	2.4	$16,048	70,016

In addition to these ECMs, SWA recommends the following Operation and Maintenance (O&M) measures that would contribute to reducing energy usage at low or no cost:

- Reduce the aquastat setpoint on the domestic hot water heater to 120-130°F, from its current temperature of 160°F
- Replace old motors with NEMA premium efficiency models
- Service steam traps
- Increase filter replacement frequency
- Install water-efficient fixtures and controls
- Inspect and replace cracked/ineffective caulk.
- Inspect and maintain sealants at all windows for airtight performance.
- Inspect and maintain weather-stripping around all exterior doors and roof hatches.
- Purchase Energy Star® appliances when new purchases are made
- Use smart electric power strips
- Create an energy educational program

There may be energy procurement opportunities for the East Amwell Township School to reduce annual utility costs. The School currently pays a competitive utility rate for electric and gas, but may be able to further reduce utility costs. SWA recommends further evaluation with energy suppliers, listed in Appendix F.

Environmental Benefits

SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 6 cars from the roads each year or is equivalent of planting 170 trees to absorb CO_2 from the atmosphere.

Energy Conservation Measure Implementation

SWA recommends that East Amwell Township School implement the following Energy Conservation Measures using an appropriate Incentive Program for reduced capital cost:

Recommended ECMs	Incentive Program (APPENDIX I for details)
Retrofit 3 refrigerated vending machines with VendingMiser Devices	N/A
Retrofit 58 T12 fixtures with electronic ballasts and T8 lamps	Direct Install, Smart Start
Upgrade 35 incandescent fixtures with compact fluorescent lamps (CFLs)	Direct Install, Smart Start
Retrofit 3 vending machines with SnackMiser Devices	N/A
Replace 1 fluorescent exit sign with an LED exit sign	Direct Install, Smart Start
Upgrade 37 lighting controls with occupancy sensors	Direct Install, Smart Start
Replace 1 gas-fired DHW heater with a condensing boiler	Smart Start
Install 2 daylight sensors	Direct Install, Smart Start

Appendix J contains an Energy Conservation Measures table

INTRODUCTION

Launched in 2008, the Local Government Energy Audit (LGEA) Program provides subsidized energy audits for municipal and local government-owned facilities, including offices, courtrooms, town halls, police and fire stations, sanitation buildings, transportation structures, schools and community centers. The Program will subsidize up to 100% of the cost of the audit. The Board of Public Utilities (BPUs) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

Steven Winter Associates, Inc. (SWA) is a 40-year-old architectural/engineering research and consulting firm, with specialized expertise in green technologies and procedures that improve the safety, performance, and cost effectiveness of buildings. SWA has a long-standing commitment to creating energy-efficient, cost-saving and resource-conserving buildings. As consultants on the built environment, SWA works closely with architects, developers, builders, and local, state, and federal agencies to develop and apply sustainable, 'whole building' strategies in a wide variety of building types: commercial, residential, educational and institutional.

SWA performed an energy audit and assessment for the East Amwell Township School at 43 Wertsville Road, Ringoes, NJ. The process of the audit included a facility visit on April 5th, 2012, benchmarking and energy bill analysis, assessment of existing conditions, energy conservation measures and other recommendations for improvements. The scope of work includes providing a summary of current building conditions, current operating costs, potential savings, and investment costs to achieve these savings. The facility description includes energy usage, occupancy profiles and current building systems along with a detailed inventory of building energy systems, recommendations for improvement and recommendations for energy purchasing and procurement strategies.

The goal of this Local Government Energy Audit is to provide sufficient information to the East Amwell Township Schools to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures.

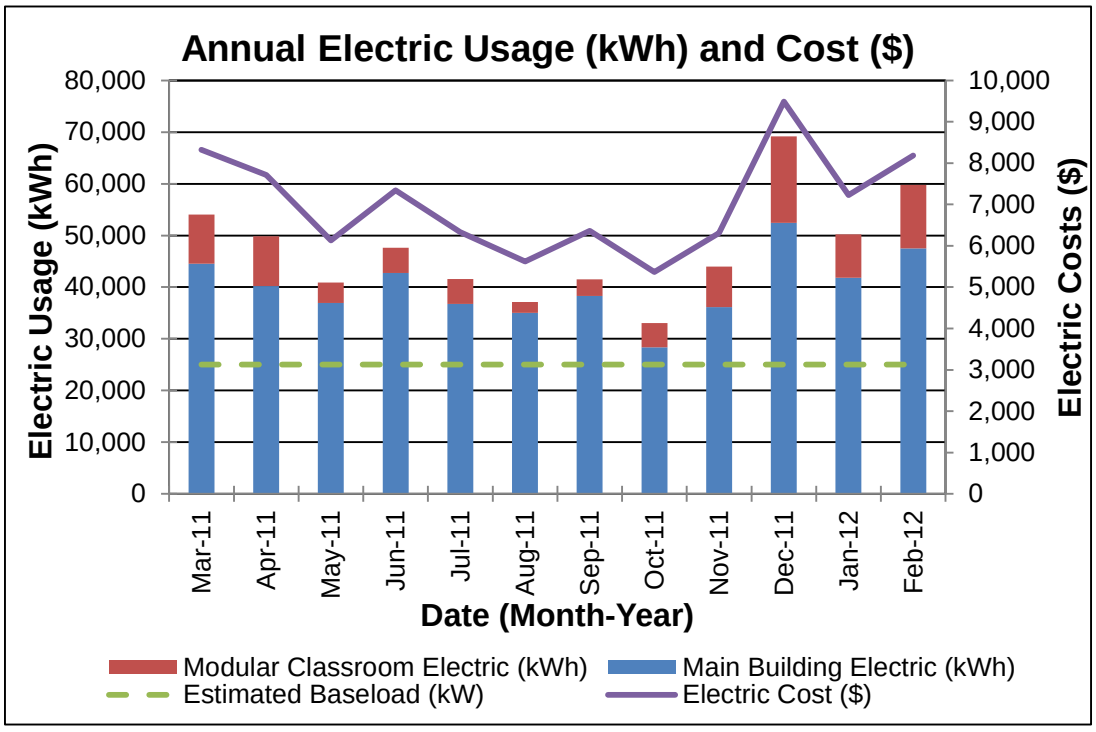
HISTORICAL ENERGY CONSUMPTION

Energy usage, load profile and cost analysis

SWA reviewed utility bills from March 2010 through February 2012 that were received from the utility companies supplying the School with electricity and natural gas. A 12 month period of analysis from March 2011 through February 2012 was used for all calculations and for purposes of benchmarking the building.

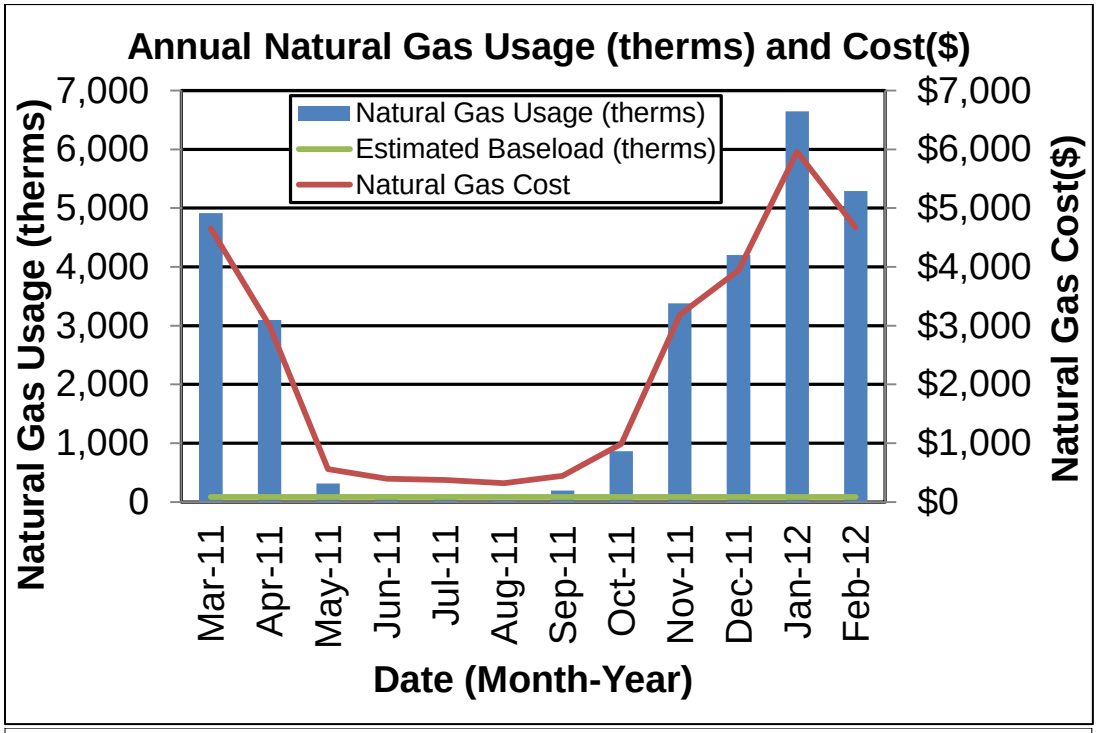
Electricity – The School is currently served by two electric meters. The two modular classroom trailers are on one meter. The remainder of the facility is on the other meter inclusive of the modular office building. The school purchases electricity from a third-party supplier which is currently South Jersey Electric. Jersey Central Power & Light (JCP&L) is responsible for electricity transmission and distribution. Electricity was purchased at an average aggregated rate of $0.148/kWh and the school consumed 568,774 kWh, or $84,399 of electricity, for the analyzed billing period. The annual monthly peak demand was 300 kW for the month of June, while the average monthly demand was 237 kW.

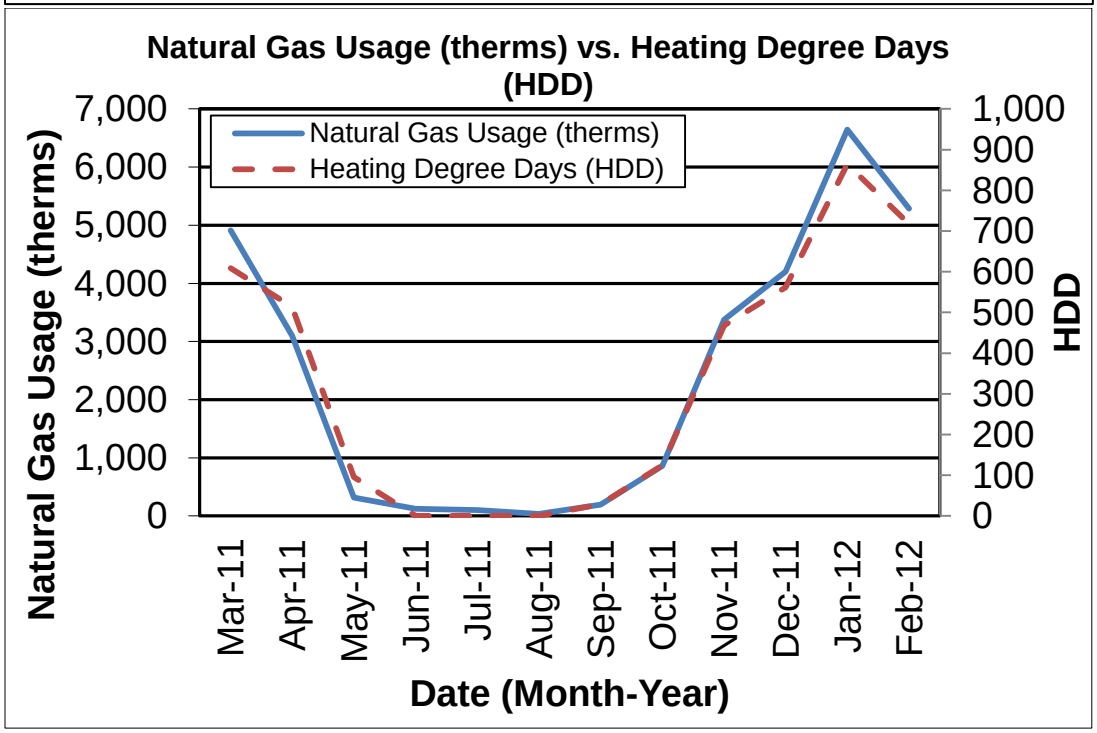
The chart below shows the monthly electric usage and costs. The dashed green line represents the approximate baseload or minimum electric usage required to operate the School. The baseline usage for the facility is approximately 25,000 kWh. The spike in electric usage in December is likely caused by an estimated meter reading. Estimated meter readings occur when the utility company is unable to read the meter.



Natural gas – The School is served by one natural gas meter and currently purchases natural gas from Elizabethtown Gas which is responsible for transmission and distribution and from Hess which acts as a third party energy supplier. Natural gas was purchased at an average aggregated rate of $0.978/therm and the school consumed 29,158 therms, or $28,502 of natural

gas, for the analyzed billing period. The chart below shows the monthly natural gas usage and costs. The green line represents the approximate baseload or minimum natural gas usage required to operate the School. The non-heating gas baseload for the School is approximately 458 therms. As expected, usage peaks in the winter months in conjunction with the operation of the gas-fired hot water heating boiler. The monthly natural gas costs also peak in the winter months in correlation with the increased natural gas usage.

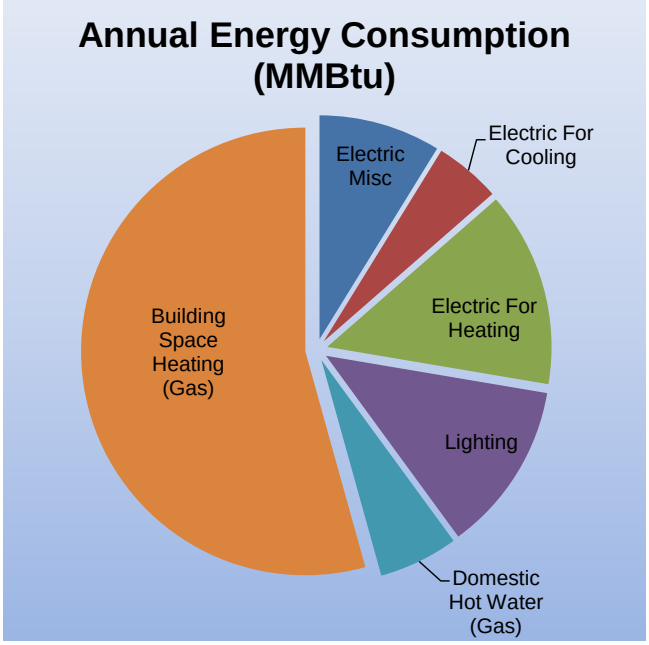


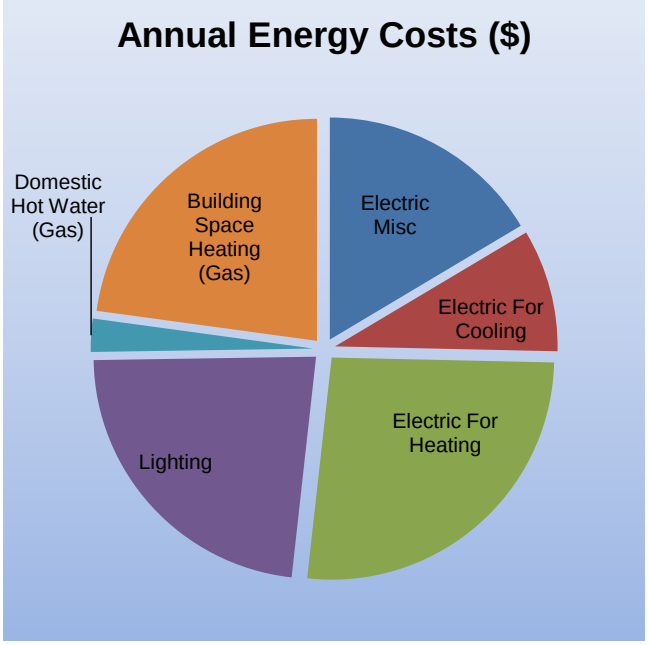


The chart above shows the monthly natural gas usage along with the heating degree days or HDD. Heating degree days is the difference of the average daily temperature and a base temperature of 65°F, on a particular day. The heating degree days are zero for the days when the average temperature exceeds the base temperature. As expected, the natural gas consumption profile follows a curve similar to the HDD curve.

The following graphs, pie charts, and table show energy use for East Amwell Township School based on utility bills for the analyzed billing period. Note: electrical cost at $43/MMBtu of energy is over 4 times as expensive as natural gas at $10/MMBtu

Annual Energy Consumption / Costs					
	MMBtu	**% MMBtu**	**$**	**% $**	**$/MMBtu**
Electric Misc	427	9%	$18,550	16%	43
Electric For Cooling	232	5%	$10,071	9%	43
Electric For Heating	686	14%	$29,812	26%	43
Lighting	597	12%	$25,966	23%	43
Domestic Hot Water (Gas)	278	6%	$2,719	2%	10
Building Space Heating (Gas)	2,638	54%	$25,784	23%	10
Totals	4,857	100%	$112,902	100%	
Total Electric Usage	1,941	40%	$84,399	75%	43
Total Gas Usage	2,916	60%	$28,502	25%	10
Totals	4,857	100%	$112,902	100%	



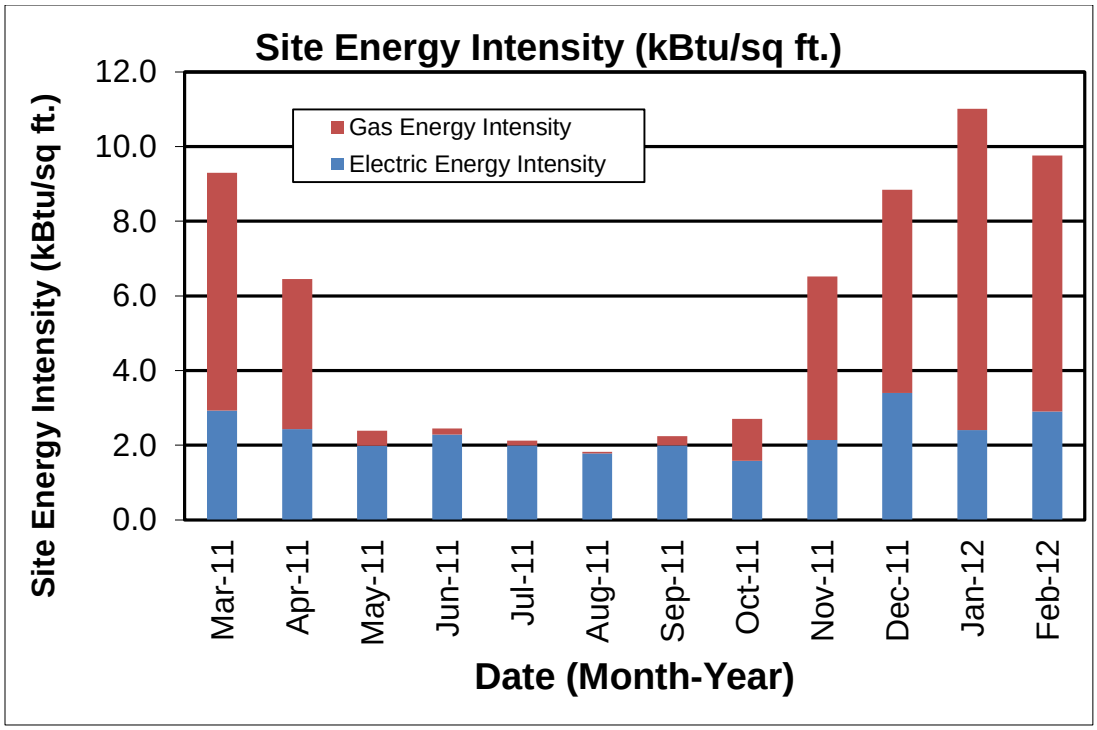


Energy Benchmarking

SWA has entered energy information about the School in the U.S. Environmental Protection Agency's (EPA) ENERGY STAR® Portfolio Manager energy benchmarking system. This school facility is categorized as a "K-12 School" space type. The ENERGY STAR® Portfolio Manager calculated the Energy Performance Rating to be 56. For reference, a score of 69 is required for LEED for Existing Buildings certification, and a score of 75 is required for ENERGY STAR® certification. The Site Energy Utilization Intensity (Site EUI) was calculated to be 69 kBtu/sqft/yr compared to the National Median of 73 kBtu/sqft/yr. See the ECM section for guidance on how to further reduce the building's energy intensity.

The ENERGY STAR® Portfolio Manager uses a national survey conducted by the U.S. Energy Information Administration (EIA). This national survey, known as the Commercial Building Energy Consumption Survey (CBECS), is conducted every four years, and gathers data on building characteristics and energy use from thousands of buildings across the United States. The Portfolio Manager software uses this data to create a database by building type. By entering the building parameters and utility data into the software, Portfolio Manager is able to generate a performance scale from 1-100 by comparing it to similar school buildings. This 100 point scale determines how well the building performs relative to other buildings across the country, regardless of climate and other differentiating factors.

The Site Energy Use Intensity (SEUI) is 69 kBtu/sqft/yr compared to the national median SEUI of a "K-12 School" building consuming 73 kBtu/sqft/yr. This is a 6% difference between the buildings intensity and the national median. See the recommendations presented in this report for guidance on how to improve the building's rating.



Per the LGEA program requirements, SWA has assisted the East Amwell Township School in creating an ENERGY STAR® Portfolio Manager account and sharing the school information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager account information with the East Amwell Township School (user name of "EastAmwell" with a password of "EastAmwell") and TRC Energy Services (user name of "TRC-LGEA").

Tariff analysis

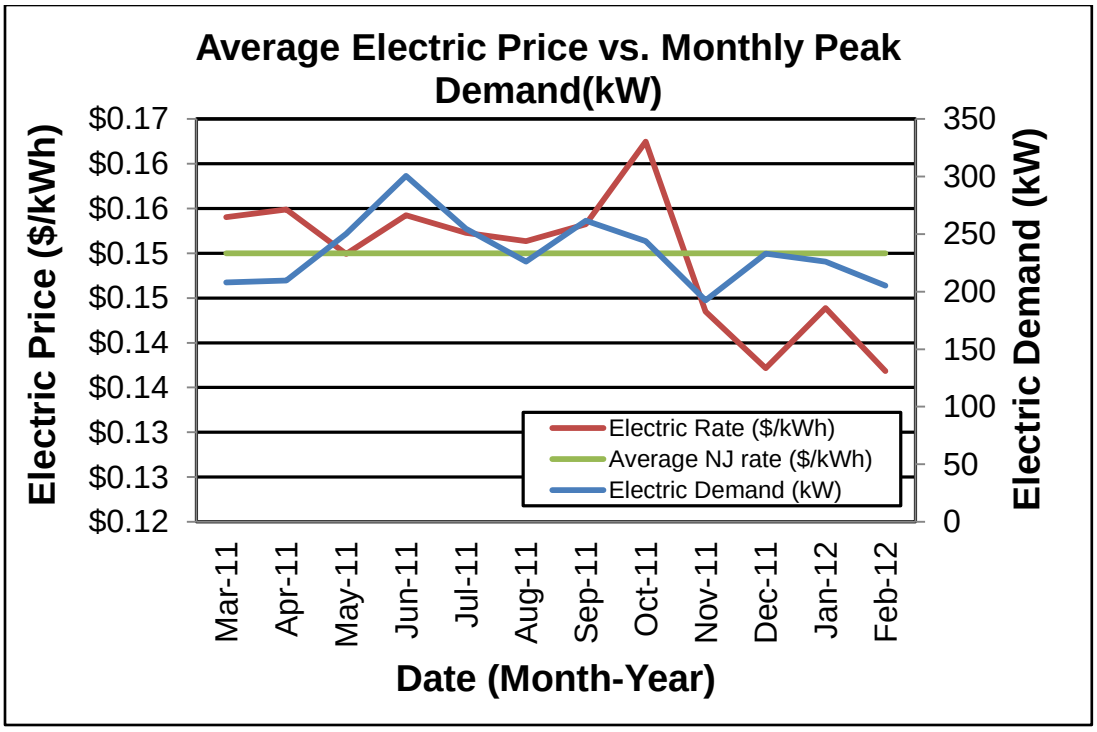
Tariff analysis can help determine if the school is paying the lowest rate possible for electric and gas service. Tariffs are typically assigned to buildings based on size and building type. Rate fluctuations are expected during periods of peak usage. Natural gas prices often increase during winter months since large volumes of natural gas is needed for heating equipment. Similarly, electricity prices often increase during the summer months when additional electricity is needed for cooling equipment.

As part of the utility bill analysis, SWA evaluated the current utility rates and tariffs for the East Amwell Township School. The School is currently paying a general service rate for natural gas including fixed costs such as meter reading charges. The electric use for the building is direct-metered and purchased at a general service rate with an additional charge for electrical demand factored into each monthly bill. The general service rate is a market-rate based on electric usage and electric demand. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year.

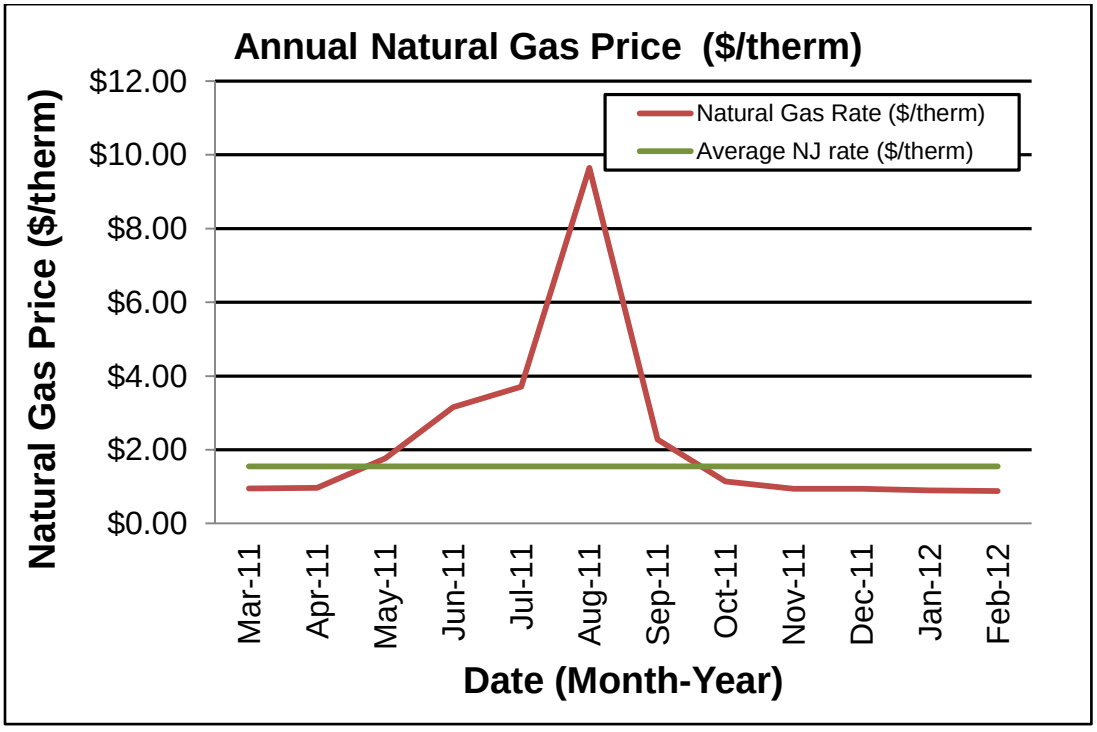
Energy Procurement strategies

Billing analysis was conducted using an average aggregated rate which is estimated based on the total cost divided by the total energy usage for each utility over a 12 month period. Average aggregated rates do not separate demand charges from usage, and instead provide a metric of inclusive cost per unit of energy. Average aggregated rates are used in order to equitably compare building utility rates to average utility rates throughout the state of New Jersey.

The average estimated NJ commercial utility rates for electric are $0.150/kWh, while the School pays a competitive rate of $0.148/kWh. The School annual electric utility costs are $917 lower, when compared to the average estimated NJ commercial utility rates. Electric bill analysis shows fluctuations up to 16% over the analyzed billing period. Electric rate fluctuations in the winter and spring can be attributed to a combination of demand charges, market rate changes and actual and estimated meter readings.



The average estimated NJ commercial utility rates for gas are $1.550/therm, while the School pays a rate of $0.978/therm. The School pays a competitive rate for natural gas compared to the NJ State average for commercial buildings. Natural gas bill analysis shows fluctuations over the analyzed billing period. Utility rate fluctuations in the spring and summer months may have been caused by a combination of low usage and the assessment of fixed fees and costs.



Preceding the expiration of any third-party supplier contract, SWA recommends that the School further explore opportunities of purchasing electricity and natural gas from other third-party suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for East Amwell Township Schools. Appendix F contains a complete list of third-party energy suppliers for the East Amwell Township service area.

EXISTING FACILITY AND SYSTEMS DESCRIPTION

This section gives an overview of the current state of the facility and systems. Please refer to the Proposed Further Recommendations section for recommendations for improvement.

Based on visits from SWA on Thursday, April 5th, 2012, the following data was collected and analyzed.

Building Characteristics

The East Amwell Township School is a single-story, 70,200 ft^2 pre-kindergarten to 8th grade school, with a partial basement and inclusive of three additional modular trailers; two modular classroom trailers at 2,400 ft^2 and one modular office trailer at 400 ft^2. The school is comprised of an original building built in 1938 and several additions in the decades following. The original 1938 building currently houses several classrooms, the cafeteria/stage, kitchen, nurse's office, and the boiler room located in the basement. Later additions that transformed the building occurred in 1956, 1964, 1978, 1989, and 1999. These additions included a gymnasium, media center, science laboratory, technology laboratory, music room, additional classrooms and a second mechanical room. Other major additions include the two modular classroom trailers and one modular office unit.

South Façade

Partial West Façade

Partial North Façade

Partial East Façade

Building Occupancy Profiles

Occupancy is approximately 448 students and 80 faculty members from 8:30 AM to 3:30 PM Monday through Friday. The school also hosts YMCA before care and after care, from 7:00 AM to 8:30 AM and 3:30 PM to 6:00 PM, respectively. Cleaning crews are in the building until 11:00 PM.

Building Envelope

Due to unfavorable weather conditions (min. 18 deg. F delta-T in/outside and no/low wind), no exterior envelope infrared (IR) images were taken during the field audit.

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

Exterior Walls

The exterior wall construction of the main building is mostly constructed of brick veneer, over concrete block with an unconfirmed level of detectable insulation. The 1956 addition is constructed of brick veneer with vinyl accents. The gymnasium is constructed of stucco over concrete block. The modular classroom trailers are constructed with a painted wood exterior, over a wood structure, with an unknown level of insulation. The interior is mostly painted concrete masonry units (CMU), painted brick and painted gypsum board. The original mechanical room still has an unfinished brick finish.

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

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall fair condition with only a few signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all facades.

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

Ground vegetation growing within the exterior walls indicates moisture in the wall and can contribute deteriorating bricks (L). Nesting in non-functional louvers may breed harmful insects (R).

Roof

The main building has various roof types from the various additions. The original 1938 section has as hip and valley type roof, over a wood structure with an asphalt shingle finish. It is unknown when it was last replaced. The roof above the 1956 addition is predominantly flat with no parapet, over steel decking and with a dark-colored EPDM finish. It is also unknown when this roof was last replaced. The 1964 addition roof is flat with no parapet, over a steel decking, and with a dark-colored EPDM finish. This roof was replaced in 1996. The 1978 addition roof is predominantly a low-pitch, open gable type roof, over a wood structure. This roof was replaced approximately two years ago. Lastly, the 1999 addition has a hip and valley roof, over a steel structure, with an asphalt shingle finish. This roof is original and has experienced leaks since it was installed.

The roof above the modular classroom trailers is flat with a dark-colored finish, over a wood structure. The modular office unit could not be verified at the time of the visit.

Note: Roof insulation levels could not be visually verified in the field and are based on similar building types during the time of construction.

Roofs, related flashing, gutters and downspouts were inspected during the field audit with limited access. They were reported to be in overall fair condition, with some signs of uncontrolled moisture, air-leakage or other energy-compromising issues on any roof areas.

The following specific roof problem spots were identified:

Prevalent roof nails may damage roof surfaces, and potentially clog roof drains (L). All roof surfaces have a dark finish (R).

Base

The building's base is composed of a slab-on-grade floor with a perimeter footing with concrete block foundation walls and no detectable slab edge/perimeter insulation, excluding the 1938 building. The 1938 building's base is composed of a below-grade basement with a slab floor, brick foundation walls and no detectable slab edge/perimeter insulation.

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

The building's base and its perimeter were inspected for signs of uncontrolled moisture or water presence and other energy-compromising issues. Overall the base was reported to be

in fair condition with a few signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues neither visible on the interior nor exterior.

Windows

The building contains several different types of windows.

1. Single-hung type windows with a wood frame, low-E coated double glazing with mini blinds built between each pane. The windows are located throughout the classrooms and offices in the 1938, 1956 and 1999 sections.

2. Single-hung type windows with a non-insulated aluminum frame, low-E coated double glazing with mini blinds built between each pane. The windows are located throughout the classrooms in the 1978 section.

3. Hopper type windows with a non-insulated aluminum frame, single-glazing and no low-E coating. The windows sit below fixed windows with similar glazing. The windows have interior venetian blinds, and are located in the 1964 section.

Windows, shading devices, sill, related flashing and caulking were inspected as far as accessibility allowed for signs of moisture, air-leakage, and other energy compromising issues. Overall, the windows were found to be in good condition with only a few signs of energy compromising issues.

The following specific window problems were identified:

Non-insulated metal frame with single-glazing provides poor insulation to the building(R)

Exterior doors

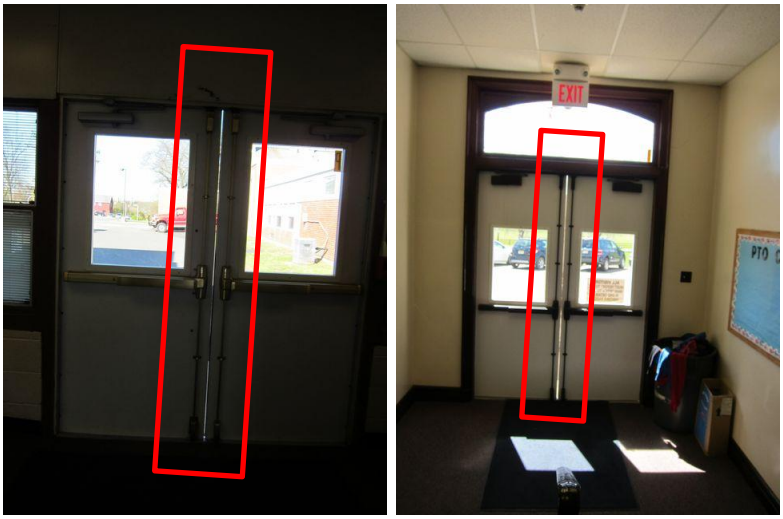
The building contains several different types of exterior doors:

1. Aluminum type doors with low-E, single glazing and a non-insulated aluminum door frame. This door is located all the entrances and emergency classroom exits.

2. Solid metal type exterior doors with a non-insulated metal frame. They are located in the mechanical rooms.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, the doors were found to be in poor condition with only a few signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific door problem spots were identified:



Deteriorating weather stripping allows conditioned air to escape (west corridor exit across the nurse's office – right and south entrance of the 1938 section – left)

No weather stripping on mechanical room exit (1938 basement exit)

Building air-tightness

Overall the field auditors found the building to not be adequately air-tight with numerous areas if suggested improvements, as described in more detail earlier in this section.

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

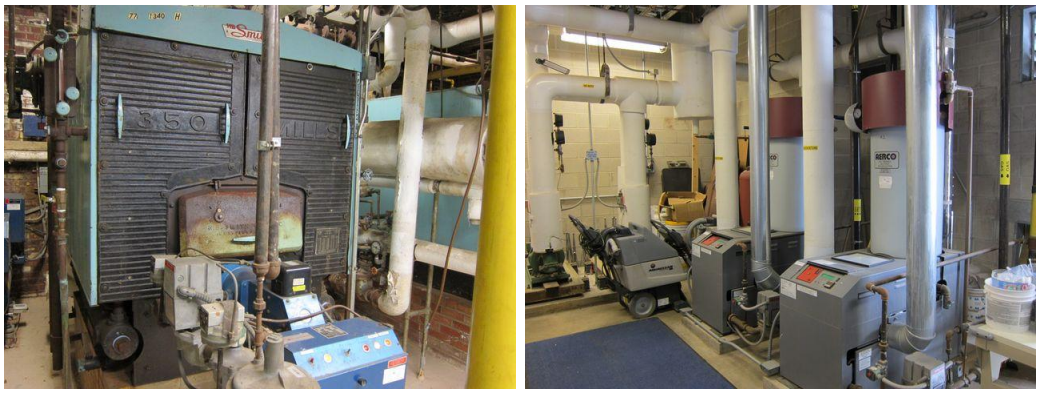
Mechanical Systems

Heating Ventilation Air Conditioning

Most spaces in the East Amwell Township School are mechanically ventilated, heated and cooled. The school has two separate mechanical rooms, each housing boilers, pumps, motors and controls. The heating, ventilating and air conditioning (HVAC) equipment is described below.

Equipment

Two cast iron steam boilers, located in the basement level of the original 1938 building, are used to provide heating to the entire school except for the 1999 addition. The 250 Mills H.B. Smith boiler was installed in 1964 and has a capacity of 962 lbs of steam per hour (lbs/hr). The 350 Mills boiler was installed in 1977 and has a capacity of 2,604 lbs/hr. The 1938 building is the only section heated via steam radiators. Steam generated by the boilers heats hot water via a shell and tube heat exchanger. Hot water is then delivered throughout the building to unit ventilators, unit heaters and fan coil units, in the newer additions excluding the 1999 addition and the modular units. The steam boilers were originally oil fired and later converted to burn natural gas. Hot water is delivered by two Bell and Gossett pumps. The pumps were not accessible at the time of the visit. One air handling unit, located above the gym storage, is dedicated to provide heating and ventilation for the gymnasium.



HB Smith steam boiler (R) and Aerco hot water boilers (L)

Cooling is provided by window mounted air conditioning (AC) units, except in the 1999 addition. The window AC units are located in most classrooms and offices. Cooling in the 1999 section is provided by air handling units, which are equipped with chilled water coils. Chilled water is produced by a York air cooled chiller, located outside of the 1999 section mechanical room. Two 10 HP constant speed pumps are used to distribute chilled water. A supplemental dx-split system is used to provide cooling to a computer room in the 1956 section.

Controls

Energy For America (EFA) controls the school's HVAC equipment. EFA remotely controls boiler temperature set points, scheduling, and sequencing, except for domestic hot water

(DHW) heating. DHW temperatures are set by an aquastat located on heater. EFA was contacted but was unwilling to provide actual operating protocols.

Domestic Hot Water

The building contains two gas fired and one electric domestic hot water (DHW) heaters. DHW is provided to the 1938 wing, at 160°F by a 240,000 BTU/HR, 84 gallon, gas-fired A.O. Smith water heater. This heater was installed in 1988 and is located in the 1938 wing boiler room. A 4,500 watt, 120 gallon, A.O. Smith Permaglass II, serves domestic hot water to the kitchen, and bathrooms throughout the main building, excluding the 1999 section. This heater was installed in 1988 and is located in the basement level maintenance office in the 1938 wing. The third water heater is located in the 1999 mechanical room and is original. This heater is a 199,000 BTU/HR, gas-fired A.O. Smith, serving the 1999 wing with 125°F water. Each water heater is controlled by a local aquastat.

Gas-fired and electric domestic hot water heaters located in the 1938 basement. DHW piping currently lacks insulation.

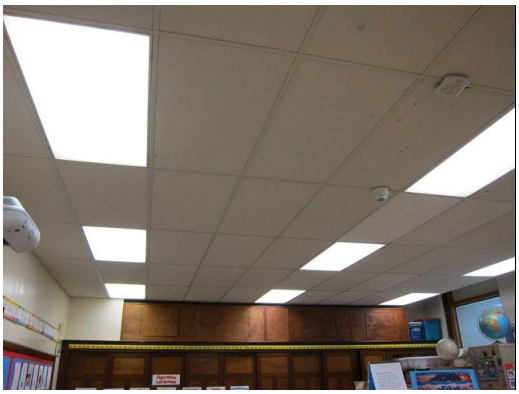
Domestic hot water heater located in the 1999 mechanical room

Electrical systems

Lighting

See attached lighting schedule in Appendix C for a complete inventory of lighting throughout the building including estimated power consumption and proposed lighting recommendations.

Interior lighting – The interior lighting is predominantly electronically ballasted T8 fluorescent lamped fixtures. The T8 lamped fixtures were installed in 1999 during the most recent addition. The hallways, classrooms and offices are illuminated using recessed and ceiling suspended T8 fixtures. The modular classroom trailers are still equipped with inefficient, linear T12 fluorescent lamped fixtures. These fixtures still use outdated magnetic ballast technology. Other areas, such as the modular office unit, are equipped with compact fluorescent lamps (CFLS) and incandescent flood lamps. The main buildings hallways used high pressure sodium fixtures to light up the hallways during after hours. No areas appeared to be vastly over-illuminated.




Typical interior T8 lighting)

Exit Lights - Exit signs were found to be LED types.

Typical LED exit signs

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be a combination of high pressure sodium and CFL fixtures. Exterior lighting is controlled by both photocells and timers.


Typical wall pack high pressure sodium fixtures.

Appliances and process

SWA conducted a general survey of larger, installed equipment. Appliances and other miscellaneous equipment account for a significant portion of electrical usage within the building. Typically, appliances are referred to as “plug-load” equipment, since they are not inherent to the building’s systems, but rather plug into an electrical outlet. Equipment such as process motors, computers, computer servers, radio and dispatch equipment, refrigerators, vending machines and printers all create an electrical load on the building that is hard to separate from the rest of the building’s energy usage based on utility analysis. Devices are available to power down such plug loads, providing energy savings.

Vending machines (L), and refrigerators (center and right)

Elevators

The building is a single-story structure; therefore there is no elevator prevalent.

Other electrical systems

There are currently no other significant energy-impacting electrical systems installed at the East Amwell Township School.

RENEWABLE AND DISTRIBUTED ENERGY MEASURES

Renewable energy is defined as any power source generated from sources which are naturally replenished, such as sunlight, wind and geothermal. Technology for renewable energy is improving and the cost of installation is decreasing due to both demand and the availability of government-sponsored funding. Renewable energy reduces the need for using either electricity or fossil fuel, therefore lowering costs by reducing the amount of energy purchased from the utility company. Solar photovoltaic panels and wind turbines use natural resources to generate electricity. Geothermal systems offset the thermal loads in a building by using water stored in the ground as either a heat sink or heat source. Cogeneration or Combined Heat and Power (CHP) allows for heat recovery during electricity generation.

Existing systems

Currently there are no renewable energy systems installed in the building.

Evaluated Systems

Solar Photovoltaic

Photovoltaic panels convert light energy received from the sun into a usable form of electricity. Panels can be connected into arrays and mounted directly onto building roofs, as well as installed onto built canopies over areas such as parking lots, building roofs or other open areas. Electricity generated from photovoltaic panels is generally sold back to the utility company through a net meter. Net-metering allows the utility to record the amount of electricity generated in order to pay credits to the consumer that can offset usage and demand costs on the electric bill. In addition to generation credits, there are incentives available called Solar Renewable Energy Credits (SRECs) that are subsidized by the state government. Specifically, the New Jersey State government pays a market-rate SREC to facilities that generate electricity in an effort to meet state-wide renewable energy requirements.

According the facility staff, the school is in the process of installing a 460 kW solar field. The PV panels are to be installed adjacent to the existing modular trailers, across an open field. The East Amwell Township School may be able eligible for solar incentives for up to 30 kW.

Solar Thermal Collectors

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

Wind

The School is not a good candidate for wind power generation due to insufficient wind conditions in this area of New Jersey.

Geothermal

The School is not a good candidate for geothermal installation since it would require replacement of the entire existing HVAC system, as well as extensive installation of geothermal wells and pumping equipment.

Combined Heat and Power

The School is not a good candidate for CHP installation and would not be cost-effective due to the size and operations of the building. Typically, CHP is best suited for buildings with a constant electrical baseload to accommodate the electricity generated, as well as a means for using waste heat generated. Additionally, the seasonal occupancy schedule of the School is not well suited for a CHP installation.

PROPOSED ENERGY CONSERVATION MEASURES

Energy Conservation Measures (ECMs) are recommendations determined for the building based on improvements over current building conditions. ECMs have been determined for the building based on installed cost, as well as energy and cost-savings opportunities.

Capital Improvements are recommendations for the building that may not be cost-effective at the current time, but that could yield a significant long-term payback. Capital improvements may also constitute equipment that is currently being operated beyond its useful lifetime. These recommendations should typically be considered as part of a long-term capital improvement plan. Capital improvements should be considered if additional funds are made available, or if the installed costs can be shared with other improvements, such as major building renovations.

Recommendations: Energy Conservation Measures

#	Energy Conservation Measures
ECM 1	**Retrofit 3 refrigerated vending machines with VendingMiser™ Devices**
ECM 2	**Retrofit 58 T12 fixtures with electronic ballasts and T8 lamps**
ECM 3	**Upgrade 35 Incandescent fixtures with Compact Fluorescent Lamps (CFLs)**
ECM 4	**Retrofit 3 vending machines with SnackMiser™ Devices**
ECM 5	**Replace 1 Fluorescent Exit Sign With an LED Exit Sign**
ECM 6	**Upgrade 37 Lighting Controls with Occupancy Sensors**
ECM 7	**Replace 1 standard efficiency natural gas DHW heater with an Energy Star Natural Gas Condensing Boiler**
ECM 8	**Install 2 Daylight Sensors**

In order to clearly present the overall energy opportunities for the building and ease the decision of which ECM to implement, SWA calculated each ECM independently and did not incorporate slight/potential overlaps between some of the listed ECMs (i.e. lighting change influence on heating/cooling.

ECM #1: Retrofit 3 refrigerated vending machines with VendingMiser™ Devices

The school currently has several beverage and snack vending machines which are located in the hallways and in the multi-purpose room. VendingMiser devices are available for conserving energy used by beverage vending machines and coolers. Purchasing new machines is not necessary to reduce operating costs and greenhouse gas emissions. When equipped with the VendingMiser devices, refrigerated beverage vending machines use less energy and are comparable in daily energy performance to new ENERGY STAR qualified machines. VendingMiser devices incorporate innovative energy-saving technology into small plug-and-play devices that installs in minutes, either on the wall or on the vending machine. Vending miser devices use a Passive Infrared Sensor (PIR) to: Power down the machine when the surrounding area is vacant; Monitor the room's temperature; Automatically repower the cooling system at one- to three-hour intervals, independent of sales; ensure the product stays cold. The school should request permission to install the devices if the machines are leased.

Installation cost:

Estimated installed cost: $597 (includes $60 of labor)
Source of cost estimate: www.usatech.com and established costs

Economics:

net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
$597	5,616	0	0	0.3	$0	$831	12	$9,974	0.7	1,571%	131%	139%	$7,344	10,055

Assumptions: SWA calculated the savings for this measure using measurements taken on the day of the field visit and using the billing analysis. SWA determined energy savings based on modeling calculator found at www.usatech.com or http://www.usatech.com/energy_management/energy_calculator.php. See APPENDIX D for savings calculations.

Rebates/financial incentives: This project does not qualify for a rebate or other financial incentive at this time.

Please see APPENDIX I for more information on Incentive Programs.

ECM #2: Retrofit 58 T12 fixtures with electronic ballasts and T8 lamps

During the field audit, SWA completed a building lighting inventory (see Appendix C). The existing lighting contains inefficient T12 fluorescent fixtures with magnetic ballasts. SWA recommends replacing each existing fixture with more efficient, T8 fluorescent fixtures with electronic ballasts. T8 fixtures with electronic ballasts provide equivalent or better light output while reducing energy consumption by 30% when compared to T12 fixtures with magnetic ballasts. T8 fixtures also provide better lumens for less wattage when compared to incandescent, halogen and Metal Halide fixtures. The labor for the recommended installations is evaluated using prevailing electrical contractor wages. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:

Estimated installed cost: $2,160 (includes $1,512 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

Economics:

net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
$2,160	12,226	3	0	0.6	$589	$2,411	15	$36,159	0.9	1,574%	105%	112%	$25,393	21,890

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

Rebates/financial incentives:

- NJ Clean Energy – Direct Install program (Up to 70% of installed costs)
- NJ Clean Energy – SmartStart program – T8 fixtures with electronic ballasts ($10 per fixture – Maximum incentive amount is $580

Please see APPENDIX I for more information on Incentive Programs.

ECM #3: Upgrade 35 Incandescent fixtures with Compact Fluorescent Lamps (CFLs)

The building is equipped with fixtures containing inefficient incandescent lamps. SWA recommends that each incandescent lamp be replaced with a more efficient Compact Fluorescent Lamp (CFL). CFLs are capable of providing equivalent or better light output while using less power when compared to incandescent, halogen and Metal Halide fixtures. CFL bulbs produce the same lumen output with less wattage than incandescent bulbs and last up to five times longer. The labor for the recommended installations is evaluated using prevailing electrical contractor wages. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:

Estimated installed cost: $339 (includes $140 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

Economics:

net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
$339	1,532	0	0	0.1	$64	$293	5	$1,463	1.2	331%	66%	82%	$962	2,744

Assumptions: SWA calculated the savings for this measure using measurements taken on the day of the field visit and using the billing analysis. SWA also assumed 2 hours/day to replace aging burnt out lamps.

Rebates/financial incentives:

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

Please see APPENDIX I for more information on Incentive Programs.

ECM #4: Retrofit (3) vending machines with SnackMiser™ Devices

SnackMiser devices are now available for conserving energy used by vending machines. Purchasing newer equipment is not necessary to reduce operating costs and greenhouse gas emissions. When equipped with the snack miser devices, vending machines use less energy and are comparable in daily energy performance to new ENERGY STAR qualified machines. SnackMiser devices can be used on snack vending machines to achieve maximum energy savings that result in reduced operating costs and decreased greenhouse gas emissions with existing machines. Snack vending miser devices also use a Passive Infrared Sensor (PIR) to determine if there is anyone within 25 feet of the machine. It waits for 15 minutes of vacancy, then powers down the machine. If a customer approaches the machine while powered down, the snacks vending miser will sense the presence and immediately power up. The school should request permission to install the devices if the machines are leased.

Installation cost:

Estimated installed cost: $540 (includes $60 of labor)
Source of cost estimate: www.usatech.com and established costs

Economics:

net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
$540	1,348	0	0	0.1	$0	$199	12	$2,394	2.7	343%	29%	36%	$1,378	2,414

Assumptions: SWA calculated the savings for this measure using measurements taken on the day of the field visit and using the billing analysis. SWA assumes energy savings based on modeling calculator found at www.usatech.com or http://www.usatech.com/energy_management/energy_calculator.php. See APPENDIX D for savings calculations.

Rebates/financial incentives:

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

Please see APPENDIX I for more information on Incentive Programs.

ECM#5: Replace 1 Fluorescent Exit Sign with an LED Exit Sign

SWA observed that the building contains one fluorescent Exit sign. SWA recommends replacing this with an LED type. Replacing existing Exit signs with LED Exit signs can result in lower kilowatt-hour consumption, as well as lower maintenance costs. Since Exit signs operate 24 hours per day, they can consume large amounts of energy. Older Exit signs require frequent maintenance due to the short life span of the lamps they contain. LED Exit sign last at least 10 years. In addition, LED Exit signs are usually brighter than comparable incandescent or fluorescent signs, and have a greater contrast with their background due to the monochromatic nature of the light that LEDs emit.

Installation cost:

Estimated installed cost: $141 (includes $72 of labor)
Source of cost estimate: RS Means, Published and established costs, NJ Clean Energy Program

Economics:

net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
$141	241	0	0	0.0	$5	$41	15	$609	3.5	333%	22%	28%	$327	431

Assumptions: SWA calculated the savings for this measure using measurements taken on the day of the field visit and using the billing analysis. Replace the existing 15 watt fluorescent sign with a 5 watt LED equivalent.

Rebates/financial incentives:

- NJ Clean Energy – Smart Start - $20 per fixture – Maximum incentive amount is $20.
- NJ Clean Energy – Direct Install (Up to 70% of installed cost)

Please see APPENDIX I for more information on Incentive Programs.

ECM #6: Upgrade 37 Lighting Controls with Occupancy Sensors

The building contains several areas that could benefit from the installation of occupancy sensors. These areas consisted of various classrooms, bathrooms and offices that are used sporadically throughout the day and could show energy savings by having the lights turn off after a period of no occupancy. Typically, occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion is detected within a set time period. Advanced ultrasonic lighting sensors include sound detection as a means to controlling lighting operation.

Installation cost:

Estimated installed cost: $7,400 (includes $2,220 of labor)
Source of cost estimate: RS Means, Published and established costs, NJ Clean Energy Program

Economics:

net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
$7,400	11,776	2	0	0.6	$0	$1,755	15	$26,319	4.2	256%	17%	23%	$12,836	21,085

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

Rebates/financial incentives:

- NJ Clean Energy – SmartStart – Wall-mounted occupancy sensors ($20 per occupancy sensor) – Maximum incentive amount is $740

Please see APPENDIX I for more information on Incentive Programs.

ECM #7: Replace 1 standard efficiency natural gas DHW heater with an Energy Star Natural Gas Condensing Boiler

The school currently uses a natural gas heater, in the 1938 wing, which produces domestic hot water (DHW). The existing heater is an inefficient atmospheric type with a cartridge-type circulating pump. The expected service life of a DHW heater is 10-13 years. The associated pump appears to be operating adequately and has fractional horsepower, so replacement would not yield significant energy savings.

New energy-efficient gas-fired storage water heaters are a good, cost-effective replacement option for old water heaters. They have higher levels of insulation around the tank and one-way valves where pipes connect to the tank, substantially reducing standby heat loss. Newer super-efficient "condensing" and "near-condensing" gas water heaters save much more energy compared to traditional models. For safety as well as energy efficiency, fuel-burning water heaters should be installed with sealed combustion ("direct-vented" or "power-vented). Sealed combustion means that outside air is brought in directly to the water heater and exhaust gases are vented directly outside, keeping combustion totally separate from the house air. SWA recommends replacing the old inefficient water heater with a similar sized new energy efficient condensing boiler.

Installation cost:

Estimated installed cost: $4,961 (includes $1,985 of labor)
Source of cost estimate: RS Means

Economics:

net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
$4,481	0	0	771	1.1	$50	$804	12	$9,644	5.6	94%	8%	12%	$2,853	8,499

Assumptions: SWA assumed an efficiency of 75% of the existing domestic hot water heater, and 90% for the condensing boiler.

Rebates/financial incentives:

NJ Clean Energy – SmartStart – Gas-fired water heaters > 50 gallons ($1.00 - $2.00 per MBH)
Or up to $480 for a 240 MBH water heater

Please see APPENDIX I for more information on Incentive Programs.

ECM #8: Install 2 Daylight Sensors

At the time of the visit SWA found two areas that could benefit from the installation of daylight dimming controls; the vestibule in the 1999 section and the media center skylight. Daylight sensors are a type of lighting control that automatically maintain a specified light level based on the amount of daylight coming into the building. As daylight increases, the light fixtures are dimmed thus reducing electric consumption. The use of daylight controls help maintain a minimum required light level, without over lighting a space or area. SWA recommends installing daylight sensors in areas that use light fixtures and building openings (i.e. windows) to illuminate the space. Such spaces include vestibules and perimeter offices.

Installation cost:

Estimated installed cost: $390 (includes $120 of labor)
Source of cost estimate: RS Means, Published and established costs, NJ Clean Energy Program

Economics:

net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
$390	320	0	0	0.0	$0	$48	15	$714	8.2	83%	6%	9%	$165	572

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. Existing light fixtures are assumed to have dimming capabilities.

Rebates/financial incentives:

- NJ Clean Energy – Smart Start - $25 per fixture – Maximum incentive amount is $50.

Please see APPENDIX I for more information on Incentive Programs.

Proposed Further Recommendations

Capital Improvements

Capital improvements are recommendations for the building that may not be cost-effective at the current time, but that could yield a significant long-term payback. These recommendations should typically be considered as part of a long-term capital improvement plan. Capital improvements should be considered if additional funds are made available. SWA recommends the following capital improvements for the East Amwell Township School.

- Replace the original boilers located in the 1938 wing mechanical room with newer efficient models. The existing boilers are original and have reached their end of life. SWA estimates a replacement cost of $74,567, including removing the old boilers, and replacing them with similar sized boilers with higher efficiencies. The boiler replacements have an estimated annual savings of $2,686 or a simple payback of 24.9 years.

- Replace all windows with ENERGY STAR certified windows. ENERGY STAR certified windows provide improved insulation and reduced thermal heat gain. SWA estimates $155,047 to replace all the single-hung, fixed and hopper type windows in the main building. A detailed building energy model would be required to calculate energy and cost savings.

Operations and Maintenance

Operations and Maintenance measures consist of low/no cost measures that are within the capability of the current building staff to handle. These measures typically require little investment, and they yield a short payback period. These measures may address equipment settings or staff operations that, when addressed will reduce energy consumption or costs.

- Reduce domestic hot water set point. The current temperature set point for the gas-fired boiler in the 1938 wing is 160°F. This temperature is a health and safety risk as it can scald the skin of a student. Additionally the boiler consumes more natural gas to maintain a higher water temperature. SWA recommends reducing the aquastat set point between 120°F and 130°F to prevent scalding and reduce natural gas consumption. This measure can be completed by building maintenance at no cost.

- Service steam traps – Assure that all steam traps are functioning as intended. Overtime steam traps fail, thus blocking flow and/or causing an imbalance in the steam system. Routine maintenance or servicing helps to identify faulty steam traps, or potential deficiencies in the system, and provides an opportunity to repair or replace the faulty traps. The steam trap servicing can be conducted by in-house maintenance with a short payback.

- Increase filter replacement frequency for air handling units – AHU filters are reportedly changed once a year. Dirty filters reduce air flow, which increases static pressure and ultimately increases electric consumption. SWA recommends replacing dirty filters more frequently which would prevent significant static pressure increases and maintain good air quality. This measure can be conducted by in-house maintenance staff with little investment, and yield a short payback.

- Return kitchen make-up fan to operable condition – According to facility operators, the kitchen makeup air fan is not used, as it blows debris into the space. Exhaust fans in the kitchen,

freezer room and office pull condition air from surrounding spaces (i.e. the multi-purpose room and corridors), to meet comfort requirements. This process wastes energy as conditioned air is exhausted from the building, increasing the demand for conditioned air. By returning the kitchen makeup fan to operable condition, the kitchen will receive makeup air from the dedicated fan and will not pull pre-conditioned air from surrounding spaces. This measure can be conducted by in-house maintenance staff with little investment, and yield a short payback.

- Replace motors with NEMA premium efficiency models – SWA observed several motors that were not NEMA premium efficiency models and are beyond their useful lifetime. Since these motors have been maintained well, SWA recommends replacing them with high efficiency models as part of routine O&M the next time that they fail. This measure can be conducted by in-house maintenance staff.

- Install water-efficient fixtures and controls – 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 reduce energy consumption for water heating, while also decreasing water/sewer bills. This measure can be conducted by in-house maintenance staff with little investment, and yield a short payback.

- Inspect and replace cracked/ineffective caulk. This measure can be conducted by in-house maintenance staff with little investment, and yield a short payback.

- Inspect and maintain sealants at all windows for airtight performance. This measure can be conducted by in-house maintenance staff with little investment, and yield a short payback.

- Inspect and maintain weather-stripping around all exterior doors and roof hatches. This measure can be conducted by in-house maintenance staff with little investment, and yield a short payback.

- SWA recommends that the building considers purchasing the most energy-efficient equipment, including ENERGY STAR® labeled appliances, when equipment is installed or replaced. ENERGY STAR® appliances meet stricter standards compared to standard appliances. Stricter standards include exceeding Federal minimum efficiencies and reduced environmental impact. More information can be found in the “Products” section of the ENERGY STAR® website at: http://www.energystar.gov.

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

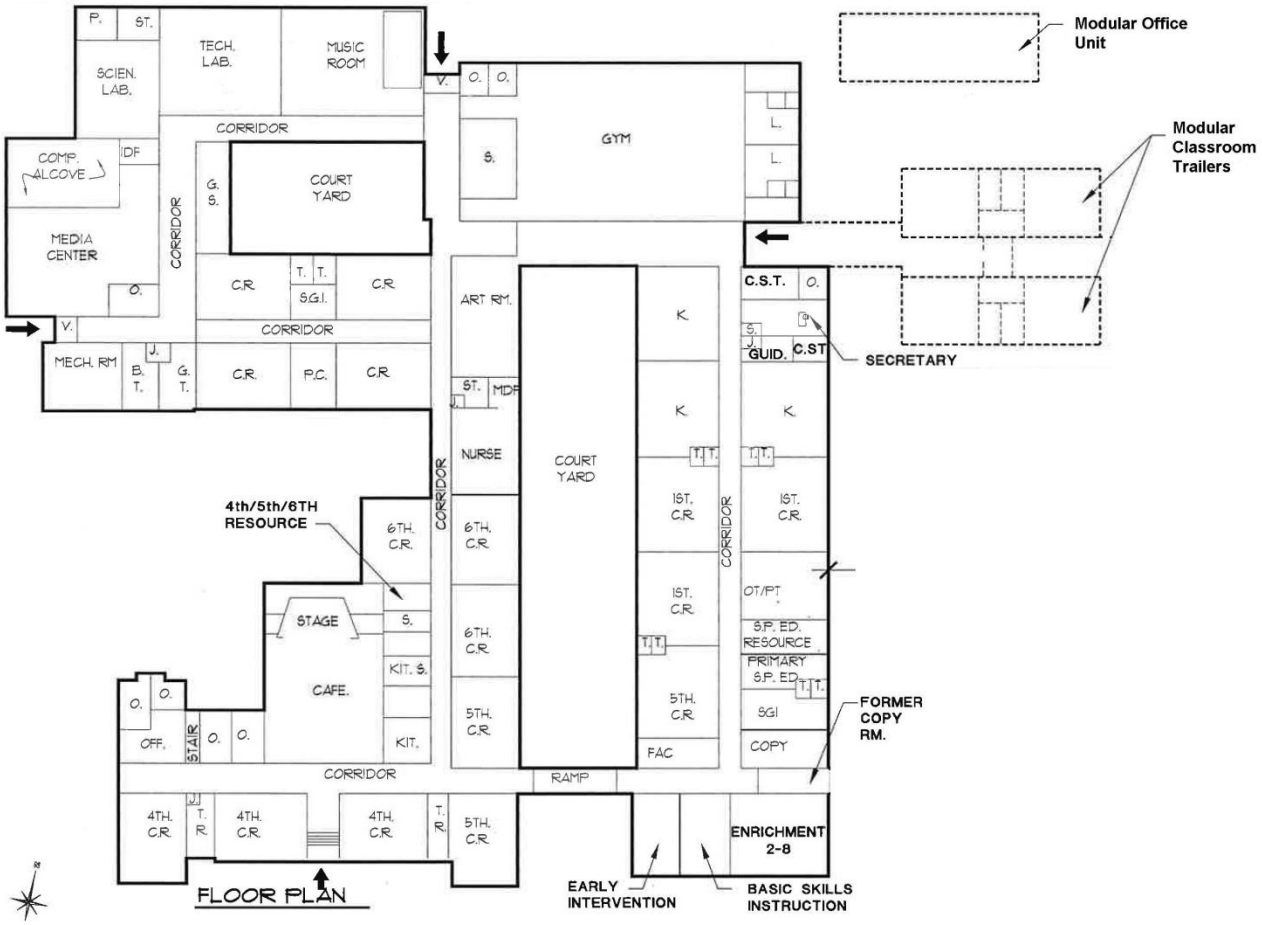
- Create an energy educational program - that teaches students and professionals how to minimize energy use. An educational program may be incorporated into school curricula to increase students’ environmental awareness. The U.S. Department of Energy offers free information for hosting energy efficiency educational programs and plans. For more information please visit: http://www1.eere.energy.gov/education/.

APPENDIX A: EQUIPMENT LIST

Building System	Description	Model #	Fuel	Location	Space Served	Date Installed	Expected Useful Lifetime (Years)	Estimated Remaining Useful Life %
Heating	PowerFlameBurner, 3/4 HP, 3.03 MBH Max., Boiler #1	PowerFlameBurner, Model #C2-C-20B, Serial #619048719	Natural Gas	Boiler Room	1938 Wing	1988	25	4%
Heating	PowerFlameBurner, 3/4 HP, 3.03 MBH Max., Boiler #2	PowerFlameBurner, Model #C2-C-15, Serial #939048718	Natural Gas	Boiler Room	1938 Wing	1988	25	4%
Heating	Baldor Three phase motor, 3450 RPM, 3/4 HP, NEMA Eff. 74%	Baldor, Cat. #VM3111, Serial #W9-88	Electricity	Boiler Room	1938 Wing	1988	20	0%
Heating	Baldor Three phase motor, 3450 RPM, 1/2 HP, NEMA Eff. 68%	Baldor, Cat. #M310, Serial #W769	Electricity	Boiler Room	1938 Wing	1988	20	0%
Heating	H.B Smith 350 Mills Steam Boiler, Object Capacity 2064 LBS/HR, SV Capacity 6322 LBS/HR	Serial #HSB05445	Natural Gas	Boiler Room	1938 Wing	1977	25	0%
Heating	H.B. Smith 250 Mills Steam Boiler, Object Capacity 962 LBS/HR, SV Capacity 1900 LBS/HR	Serial #HSB05444	Natural Gas	Boiler Room	1938 Wing	1964	25	0%
Pneumatics	Quincy Compressor, 2 motors	Quincy, Model #0000706D, Serial #5039090	Electricity	Boiler Room	1938 Wing	1988	20	0%
Pneumatics	MagneTek Compressor Motor, 1725 RPM, 3 phase, Motor #1	Magnatek, Serial #BM4-282	Electricity	Boiler Room	1938 Wing	1988	20	0%
Domestic Hot Water	A.O. Smith, 240000 BTU/HR, 84 gal.	Model #BT 251A 880, Serial #LB90-0008315-880	Natural Gas	Boiler Room	1938 Wing	1988	10	0%
Domestic Hot Water	A.O. Smith, 4500 watts, 120 gal.	Model # PEW 120 780, Serial #760-8-73-31817	Electricity	Maintenance Office	Kitchen, Office	1988	10	0%
Heating	Wagner Induction Motor, 1750 RPM, 5 HP	Model #154 13883 400	Electricity	Boiler Room	1938 Wing	1988	20	0%
Domestic Hot Water	Grundfos Circulating Pump, 2 HP, 3496 max. RPM,	Model C, P/N: 96402882, PC: 0850	Electricity	Boiler Room	1938 Wing	2008	20	80%
Heating	Armstrong Pump #1	N/A	Electricity	Boiler Room	N/A	N/A	N/A	N/A
Heating	Aerco Gas Fired Boiler, B-1, 1,000,000 BTU/HR, 23 gallons	Serial #G-98-850	Natural Gas	New Mechanical Room	1999 Addition	1998	20	30%
Heating	Aerco Gas Fired Boiler, B-2, 1,000,000 BTU/HR, 23 gallons	Serial #G-98-849	Natural Gas	New Mechanical Room	1999 Addition	1998	20	30%
Heating	Baldor Hot Water Pump Motor, 5 HP, 1740 RPM, 87.5% NEMA Nom. Eff.	Cat. No. M3218T, Serial #F898	Electricity	New Mechanical Room	1999 Addition	1998	20	30%
Heating	Baldor Hot Water Pump Motor, 5 HP, 1740 RPM, 87.5% NEMA Nom. Eff.	Cat. No. M3218T, Serial #F898	Electricity	New Mechanical Room	1999 Addition	1998	20	30%
Domestic Hot Water	A.O. Smith Hot Water Heater, 199,000 BTU/HR, 140 gallons	Model #BTP-140-199	Natural Gas	New Mechanical Room	1999 Addition	1998	20	30%
Domestic Hot Water	ADAMS Power gas burner, 255,000 max. BTU/HR	Model # G2SD 3-52CC, Serial #9813119	Natural Gas	New Mechanical Room	1999 Addition	1998	20	30%
Cooling	York Liquid Chiller, R-22 Refrigerant, 1 Compressor, 1 condenser fan, 3 HP,	Model #YCAZ88DB3-28PA, Serial #RNGM7229AA	Electricity	Outside of New Mechanical Room	1999 Addition	1998	20	30%
Cooling	Trane, T-12,	Serial #77H22154	Electricity	Lofted Mechanical Space above Gym Storage	Gymnasium	1988	15	0%
Cooling	Dayton, Fan Motor, 5 HP, 1750 RPM, 90.2 NEMA Nom. Eff.	Model #5M297	Electricity	Lofted Mechanical Space above Gym Storage	Gymnasium	1999	20	35%
Pneumatics	Dayton, Compressor Motor, 1/2 HP, 1725 RPM,	Model #2N103R	Electricity	Lofted Mechanical Space above Gym Storage	Gymnasium	1988	20	0%
Heating	Bell & Gossett Pump Motor	N/A	Electricity	Lofted Mechanical Space above Gym Storage	Gymnasium	2011	20	95%
Heating/ Cooling	Marvair, ModPacII, Vertical Wall Mount Air Conditioner	N/A	Electricity	Modular Office Trailer Exterior	Modular Office Trailer	2000	15	20%
Heating/ Cooling	Marvair, ModPacII, Vertical Wall Mount Air Conditioner	N/A	Electricity	Modular Classroom Trailer Exterior	Modular ClassroomTrailer	1999	15	13%
Heating/ Cooling	Marvair, ModPacII, Vertical Wall Mount Air Conditioner	N/A	Electricity	Modular Classroom Trailer Exterior	Modular ClassroomTrailer	1999	15	13%

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.

Appendix B: School Floor Plan



Appendix C: Lighting Study

Location			Existing Fixture Information												Retrofit Information												Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
1	1	Classroom (1)	Recessed Parabolic	E	4'T8	12	3	32	OS	8	200	15	1,332	2,131	N/A	Recessed Parabolic	4'T8	E	OS	12	3	32	8	200	15	1332	2131	0	0	0
2	1	Classroom (2)	Recessed Parabolic	E	4'T8	12	3	32	OS	8	200	15	1,332	2,131	N/A	Recessed Parabolic	4'T8	E	OS	12	3	32	8	200	15	1332	2131	0	0	0
3	1	Classroom (3)	Recessed Parabolic	E	4'T8	12	3	32	OS	8	200	15	1,332	2,131	N/A	Recessed Parabolic	4'T8	E	OS	12	3	32	8	200	15	1332	2131	0	0	0
4	1	Classroom (4)	Recessed Parabolic	E	4'T8	12	3	32	OS	8	200	15	1,332	2,131	N/A	Recessed Parabolic	4'T8	E	OS	12	3	32	8	200	15	1332	2131	0	0	0
5	1	Classroom (5)	Recessed Parabolic	E	4'T8	4	3	32	OS	8	200	15	444	710	N/A	Recessed Parabolic	4'T8	E	OS	4	3	32	8	200	15	444	710	0	0	0
6	1	Classroom (6)	Recessed Parabolic	E	4'T8	4	3	32	OS	8	200	15	444	710	N/A	Recessed Parabolic	4'T8	E	OS	4	3	32	8	200	15	444	710	0	0	0
7	1	Classroom (7)	Recessed Parabolic	E	4'T8	4	3	32	OS	8	200	15	444	710	N/A	Recessed Parabolic	4'T8	E	OS	4	3	32	8	200	15	444	710	0	0	0
8	1	Classroom (8)	Recessed Parabolic	E	4'T8	4	3	32	OS	8	200	15	444	710	N/A	Recessed Parabolic	4'T8	E	OS	4	3	32	8	200	15	444	710	0	0	0
9	1	Office	Recessed Parabolic	E	4'T8	2	2	32	OS	8	240	10	148	284	N/A	Recessed Parabolic	4'T8	E	OS	2	2	32	8	240	10	148	284	0	0	0
10	1	Bathroom	Ceiling Mounted	E	4'T8	1	2	32	Sw	4	240	10	74	71	C	Ceiling Mounted	4'T8	E	OSCM	1	2	32	0	240	10	74	0	0	71	71
11	1	Office	Recessed Parabolic	E	4'T8	2	2	32	OS	8	240	10	148	284	N/A	Recessed Parabolic	4'T8	E	OS	2	2	32	8	240	10	148	284	0	0	0
12	1	Cafeteria	Ceiling Mounted	E	4'T8	24	3	32	Sw	8	240	15	2,664	5,115	N/A	Ceiling Mounted	4'T8	E	Sw	24	3	32	8	240	15	2664	5115	0	0	0
13	1	Cafeteria	Exit Sign	S	LED	4	1	5	N	24	365	1	22	193	N/A	Exit Sign	LED	S	N	4	1	5	24	365	1	22	193	0	0	0
14	1	Stage	Ceiling Mounted	E	4'T8	2	2	32	Sw	2	200	10	148	59	N/A	Ceiling Mounted	4'T8	E	Sw	2	2	32	2	200	10	148	59	0	0	0
15	1	Stage	Ceiling Mounted	E	4'T8	2	2	32	Sw	2	200	10	148	59	N/A	Ceiling Mounted	4'T8	E	Sw	2	2	32	2	200	10	148	59	0	0	0
16	1	Kitchen	Recessed Parabolic	E	4'T8	9	2	32	Sw	8	200	10	666	1,066	N/A	Recessed Parabolic	4'T8	E	Sw	9	2	32	8	200	10	666	1066	0	0	0
17	1	Kitchen	Recessed Parabolic	E	4'T8	4	2	32	Sw	8	200	10	296	474	N/A	Recessed Parabolic	4'T8	E	Sw	4	2	32	8	200	10	296	474	0	0	0
18	1	Kitchen	Recessed Parabolic	E	4'T8	2	2	32	Sw	8	200	10	148	237	C	Recessed Parabolic	4'T8	E	OS	2	2	32	6	200	10	148	178	0	59	59
19	1	Kitchen	Recessed Parabolic	E	4'T8	1	2	32	Sw	8	200	10	74	118	C	Recessed Parabolic	4'T8	E	OS	1	2	32	6	200	10	74	89	0	30	30
20	1	Corridor	Recessed Parabolic	E	4'T8	10	2	32	Sw	12	240	10	740	2,131	N/A	Recessed Parabolic	4'T8	E	Sw	10	2	32	12	240	10	740	2131	0	0	0
21	1	Corridor	Exit Sign	S	LED	2	1	5	N	24	365	1	11	96	N/A	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	0	0	0
22	1	Corridor	Exit Sign	E	Fl.	1	2	15	N	24	365	3	33	289	LEDex	Exit Sign	LED	E	N	1	1	5	24	365	1	6	48	241	0	241
23	1	Faculty Room	Ceiling Suspended	E	4'T8	12	2	32	Sw	8	200	10	888	1,421	C	Ceiling Suspended	4'T8	E	OS	12	2	32	6	200	10	888	1066	0	355	355
24	1	Classroom (16)	Recessed Parabolic	E	4'T8	18	2	32	Sw	8	200	10	1,332	2,131	C	Recessed Parabolic	4'T8	E	OS	18	2	32	6	200	10	1332	1598	0	533	533
25	1	Classroom (18)	Recessed Parabolic	E	4'T8	18	2	32	Sw	8	200	10	1,332	2,131	C	Recessed Parabolic	4'T8	E	OS	18	2	32	6	200	10	1332	1598	0	533	533
26	1	Classroom (20)	Recessed Parabolic	E	4'T8	18	2	32	Sw	8	200	10	1,332	2,131	C	Recessed Parabolic	4'T8	E	OS	18	2	32	6	200	10	1332	1598	0	533	533
27	1	Classroom (22)	Recessed Parabolic	E	4'T8	18	2	32	Sw	8	200	10	1,332	2,131	C	Recessed Parabolic	4'T8	E	OS	18	2	32	6	200	10	1332	1598	0	533	533
28	1	Classroom (24)	Recessed Parabolic	E	4'T8	24	2	32	OS	8	200	10	1,776	2,842	N/A	Recessed Parabolic	4'T8	E	OS	24	2	32	8	200	10	1776	2842	0	0	0
29	1	Early Intervention	Recessed Parabolic	E	4'T8	18	2	32	Sw	8	240	10	1,332	2,557	C	Recessed Parabolic	4'T8	E	OS	18	2	32	6	240	10	1332	1918	0	639	639
30	1	Enrichment	Ceiling Suspended	E	4'T8	18	2	32	Sw	8	240	10	1,332	2,557	C	Ceiling Suspended	4'T8	E	OS	18	2	32	6	240	10	1332	1918	0	639	639
31	1	Copy Room	Ceiling Mounted	E	4'T8	2	2	32	Sw	8	200	10	148	237	C	Ceiling Mounted	4'T8	E	OS	2	2	32	6	200	10	148	178	0	59	59
32	1	Classroom (15)	Ceiling Mounted	E	4'T8	18	2	32	Sw	8	240	10	1,332	2,557	C	Ceiling Mounted	4'T8	E	OS	18	2	32	6	240	10	1332	1918	0	639	639
33	1	Classroom (17A)	Ceiling Suspended	E	4'T8	18	2	32	Sw	8	240	10	1,332	2,557	C	Ceiling Suspended	4'T8	E	OS	18	2	32	6	240	10	1332	1918	0	639	639
34	1	Classroom (17)	Ceiling Suspended	E	4'T8	18	2	32	Sw	8	240	10	1,332	2,557	C	Ceiling Suspended	4'T8	E	OS	18	2	32	6	240	10	1332	1918	0	639	639
35	1	Classroom (19)	Ceiling Suspended	E	4'T8	18	2	32	Sw	8	240	10	1,332	2,557	C	Ceiling Suspended	4'T8	E	OS	18	2	32	6	240	10	1332	1918	0	639	639
36	1	Classroom (21)	Ceiling Suspended	E	4'T8	18	2	32	Sw	8	240	10	1,332	2,557	C	Ceiling Suspended	4'T8	E	OS	18	2	32	6	240	10	1332	1918	0	639	639
37	1	Guidance	Recessed Parabolic	E	4'T8	3	3	32	Sw	8	240	15	333	639	C	Recessed Parabolic	4'T8	E	OS	3	3	32	6	240	15	333	480	0	160	160
38	1	C.S.T.	Recessed Parabolic	E	4'T8	2	3	32	Sw	8	240	15	222	426	C	Recessed Parabolic	4'T8	E	OS	2	3	32	6	240	15	222	320	0	107	107
39	1	C.S.T.	Recessed Parabolic	E	4'T8	3	3	32	Sw	8	240	15	333	639	C	Recessed Parabolic	4'T8	E	OS	3	3	32	6	240	15	333	480	0	160	160
40	1	Office	Recessed Parabolic	E	4'T8	2	3	32	Sw	8	240	15	222	426	C	Recessed Parabolic	4'T8	E	OS	2	3	32	6	240	15	222	320	0	107	107
41	1	Secretary	Recessed Parabolic	E	4'T8	4	2	32	Sw	8	240	10	296	568	N/A	Recessed Parabolic	4'T8	E	Sw	4	2	32	8	240	10	296	568	0	0	0
42	1	Storage Closet	Recessed	S	CFL	1	3	13	Sw	1	200	0	39	8	N/A	Recessed	CFL	S	Sw	1	3	13	1	200	0	39	8	0	0	0
43	1	Janitor's Closet	Recessed	S	CFL	1	3	13	Sw	2	240	0	39	19	N/A	Recessed	CFL	S	Sw	1	3	13	2	240	0	39	19	0	0	0
44	1	Classroom Toilet	Recessed	S	CFL	1	2	13	Sw	4	200	0	26	21	C	Recessed	CFL	S	OS	1	2	13	3	200	0	26	16	0	5	5
45	1	Classroom Toilet	Recessed	S	CFL	1	2	13	Sw	4	200	0	26	21	C	Recessed	CFL	S	OS	1	2	13	3	200	0	26	16	0	5	5
46	1	Classroom Toilet	Recessed	S	CFL	1	2	13	Sw	4	200	0	26	21	C	Recessed	CFL	S	OS	1	2	13	3	200	0	26	16	0	5	5
47	1	Classroom Toilet	Recessed	S	CFL	1	2	13	Sw	4	200	0	26	21	C	Recessed	CFL	S	OS	1	2	13	3	200	0	26	16	0	5	5
48	1	Classroom Toilet	Recessed	S	CFL	1	2	13	Sw	4	200	0	26	21	C	Recessed	CFL	S	OS	1	2	13	3	200	0	26	16	0	5	5
49	1	Classroom Toilet	Recessed	S	CFL	1	2	13	Sw	4	200	0	26	21	C	Recessed	CFL	S	OS	1	2	13	3	200	0	26	16	0	5	5
50	1	Classroom Toilet	Recessed	S	CFL	1	2	13	Sw	4	200	0	26	21	C	Recessed	CFL	S	OS	1	2	13	3	200	0	26	16	0	5	5
51	1	Classroom Toilet	Recessed	S	CFL	1	2	13	Sw	4	200	0	26	21	C	Recessed	CFL	S	OS	1	2	13	3	200	0	26	16	0	5	5
52	1	Corridor	Ceiling Mounted	E	4'T8	3	2	32	Sw	12	240	10	222	639	N/A	Ceiling Mounted	4'T8	E	Sw	3	2	32	12	240	10	222	639	0	0	0
53	1	Corridor	Ceiling Mounted	E	4'T8	4	2	32	Sw	12	240	10	296	852	N/A	Ceiling Mounted	4'T8	E	Sw	4	2	32	12	240	10	296	852	0	0	0
54	1	Corridor	Ceiling Mounted	E	4'T8	7	2	32	Sw	12	240	10	518	1,492	N/A	Ceiling Mounted	4'T8	E	Sw	7	2	32	12	240	10	518	1492	0	0	0
55	1	Corridor	Ceiling Mounted	E	4'T8	10	2	32	Sw	12	240	10	740	2,131	N/A	Ceiling Mounted	4'T8	E	Sw	10	2	32	12	240	10	740	2131	0	0	0
56	1	Bookroom	Recessed Parabolic	E	4'T8	4	2	32	Sw	2	200	10	296	118	N/A	Recessed Parabolic	4'T8	E	Sw	4	2	32	2	200	10	296	118	0	0	0
57	1	Corridor	Recessed Parabolic	E	4'T8	6	2	32	Sw	12	240	10	444	1,279	N/A	Recessed Parabolic	4'T8	E	Sw	6	2	32	12	240	10	444	1279	0	0	0
58	1	Corridor	Recessed Parabolic	E	4'T8	7	2	32	Sw	12	240	10	518	1,492	N/A	Recessed Parabolic	4'T8	E	Sw	7	2	32	12	240	10	518	1492	0	0	0
59	1	Classroom (9)	Recessed Parabolic	E	4'T8	20	2	32	OS	8	200	10	1,480	2,368	N/A	Recessed Parabolic	4'T8	E	OS	20	2	32	8	200	10	1480	2368	0	0	0
60	1	Classroom (10)	Recessed Parabolic	E	4'T8	20	2	32	OS	8	200	10	1,480	2,368	N/A	Recessed Parabolic	4'T8	E	OS	20	2	32	8	200	10	1480	2368	0	0	0
61	1	Classroom (11)	Recessed Parabolic	E	4'T8	20	2	32	OS	8	200	10	1,480	2,368	N/A	Recessed Parabolic	4'T8	E	OS	20	2	32	8	200	10	1480	2368	0	0	0
62	1	Classroom (12)	Recessed Parabolic	E	4'T8	20	2	32	OS	8	200	10	1,480	2,368	N/A	Recessed Parabolic	4'T8	E	OS	20	2	32	8	200	10	1480	2368	0	0	0
63	1	P.C.	Recessed Parabolic	E	4'T8	6	4	32	Sw	8	200	20	888	1,421	N/A	Recessed Parabolic	4'T8	E	Sw	6	4	32	8	200	20	888	1421	0	0	0
64	1	S.G.I.	Ceiling Mounted	E	4'T8	6	2	32	Sw	8	200	10	444	710	N/A	Ceiling Mounted	4'T8	E	Sw	6	2	32	8	200	10	444	710	0	0	0
65	1	Bathroom	Ceiling Mounted	S	CFL	1	2	13	Sw	8	200	0	26	42	C	Ceiling Mounted	CFL	S	OSCM	1	2	13	0	200	0	26	0	0	42	42
66	1	Bathroom	Ceiling Mounted	S	CFL	1	2	13	Sw	8	200	0	26	42	C	Ceiling Mounted	CFL	S	OSCM	1	2	13	0	200	0	26	0	0	42	42
67	1	Corridor	Ceiling Mounted	E	4'T8	5	2	32	Sw	12	240	10	370	1,066	N/A	Ceiling Mounted	4'T8	E	Sw	5	2	32	12	240	10	370	1066	0	0	0
68	1	Bathroom Girls	Recessed Parabolic	E	4'T8	3	2	32	Sw	8	240	10	222	426	C	Recessed Parabolic	4'T8	E	OSCM	3	2	32	0	240	10	222	0	0	426	426
69	1	Bathroom Boys	Recessed Parabolic	E	4'T8	3	2	32	Sw	8	240	10	222	426	C	Recessed Parabolic	4'T8	E	OSCM	3	2	32	0	240	10	222	0	0	426	426
70	1	Janitor's Closet	Recessed Parabolic	E	4'T8	1	2	32	Sw	2	240	10	74	36	N/A	Recessed Parabolic	4'T8	E	Sw	1	2	32	2	240	10	74	36	0	0	0

Location			Existing Fixture Information												Retrofit Information												Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
71	1	Corridor	Recessed Parabolic	E	4'T8	5	2	32	Sw	12	240	10	370	1,066	N/A	Recessed Parabolic	4'T8	E	Sw	5	2	32	12	240	10	370	1066	0	0	0
72	1	Vestibule	Recessed Parabolic	E	4'T8	1	2	32	Sw	12	240	10	74	213	C	Recessed Parabolic	4'T8	E	DL	1	2	32	9	240	10	74	160	0	53	53
73	1	Corridor	Exit Sign	S	LED	1	1	5	N	24	365	1	6	48	N/A	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	0	0	0
74	1	Mechanical Rm	Ceiling Suspended	E	4'T8	7	2	32	Sw	8	240	10	518	995	N/A	Ceiling Suspended	4'T8	E	Sw	7	2	32	8	240	10	518	995	0	0	0
75	1	Corridor	Exit Sign	S	LED	2	1	5	N	24	365	1	11	96	N/A	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	0	0	0
76	1	Media Center	Ceiling Suspended	E	4'T8	10	3	32	Sw	8	200	15	1,110	1,776	N/A	Ceiling Suspended	4'T8	E	Sw	10	3	32	8	200	15	1110	1776	0	0	0
77	1	Media Center	Ceiling Suspended	E	4'T8	10	3	32	Sw	8	200	15	1,110	1,776	N/A	Ceiling Suspended	4'T8	E	Sw	10	3	32	8	200	15	1110	1776	0	0	0
78	1	Media Center	Ceiling Suspended	E	4'T8	10	3	32	Sw	8	200	15	1,110	1,776	N/A	Ceiling Suspended	4'T8	E	Sw	10	3	32	8	200	15	1110	1776	0	0	0
79	1	Media Center	Ceiling Suspended	E	4'T8	10	3	32	Sw	8	200	15	1,110	1,776	N/A	Ceiling Suspended	4'T8	E	Sw	10	3	32	8	200	15	1110	1776	0	0	0
80	1	Media Center	Ceiling Suspended	E	4'T8	10	3	32	Sw	8	200	15	1,110	1,776	N/A	Ceiling Suspended	4'T8	E	Sw	10	3	32	8	200	15	1110	1776	0	0	0
81	1	Media Center	Ceiling Suspended	E	4'T8	20	3	32	Sw	8	200	15	2,220	3,552	N/A	Ceiling Suspended	4'T8	E	Sw	20	3	32	8	200	15	2220	3552	0	0	0
82	1	Media Center	Ceiling Suspended	E	4'T8	6	3	32	Sw	8	200	15	666	1,066	C	Ceiling Suspended	4'T8	E	DL	6	3	32	6	200	15	666	799	0	266	266
83	1	Computer Alcove	Ceiling Suspended	E	4'T8	32	3	32	Sw	8	200	15	3,552	5,683	C	Ceiling Suspended	4'T8	E	OS	32	3	32	6	200	15	3552	4262	0	1421	1421
84	1	Media Center Office	Recessed Parabolic	E	4'T8	6	3	32	Sw	8	200	15	666	1,066	C	Recessed Parabolic	4'T8	E	OS	6	3	32	6	200	15	666	799	0	266	266
85	1	Corridor	Recessed Parabolic	E	4'T8	7	3	32	Sw	12	240	15	777	2,238	N/A	Recessed Parabolic	4'T8	E	Sw	7	3	32	12	240	15	777	2238	0	0	0
86	1	Corridor	Exit Sign	S	LED	2	1	5	N	24	365	1	11	96	N/A	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	0	0	0
87	1	IDF	Recessed Parabolic	E	4'T8	2	2	32	Sw	2	240	10	148	71	N/A	Recessed Parabolic	4'T8	E	Sw	2	2	32	2	240	10	148	71	0	0	0
88	1	Science Lab	Ceiling Suspended	E	4'T8	24	3	32	Sw	8	240	15	2,664	5,115	N/A	Ceiling Suspended	4'T8	E	Sw	24	3	32	8	240	15	2664	5115	0	0	0
89	1	Science Lab Storage	Recessed Parabolic	E	4'T8	4	3	32	Sw	8	240	15	444	852	N/A	Recessed Parabolic	4'T8	E	Sw	4	3	32	8	240	15	444	852	0	0	0
90	1	Science Lab Storage	Recessed Parabolic	E	4'T8	4	2	32	Sw	8	240	10	296	568	N/A	Recessed Parabolic	4'T8	E	Sw	4	2	32	8	240	10	296	568	0	0	0
91	1	Tech. Lab.	Recessed Parabolic	E	4'T8	30	3	32	Sw	8	180	15	3,330	4,795	N/A	Recessed Parabolic	4'T8	E	Sw	30	3	32	8	180	15	3330	4795	0	0	0
92	1	Tech. Lab.	Exit Sign	S	LED	2	1	5	N	24	365	1	11	96	N/A	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	0	0	0
93	1	Music Room	Recessed Parabolic	E	4'T8	24	3	32	Sw	8	200	15	2,664	4,262	C	Recessed Parabolic	4'T8	E	OS	24	3	32	6	200	15	2664	3197	0	1066	1066
94	1	Corridor	Recessed Parabolic	E	4'T8	9	2	32	Sw	12	240	10	666	1,918	N/A	Recessed Parabolic	4'T8	E	Sw	9	2	32	12	240	10	666	1918	0	0	0
95	1	Corridor	Exit Sign	S	LED	2	1	5	N	24	365	1	11	96	N/A	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	0	0	0
96	1	Storage	Ceiling Suspended	E	4'T8	5	2	32	Sw	2	240	10	370	178	N/A	Ceiling Suspended	4'T8	E	Sw	5	2	32	2	240	10	370	178	0	0	0
97	1	Mechanical Rm	Exit Sign	S	LED	2	1	5	N	24	365	1	11	96	N/A	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	0	0	0
98	1	Corridor	Recessed Parabolic	E	4'T8	4	2	32	Sw	12	240	10	296	852	N/A	Recessed Parabolic	4'T8	E	Sw	4	2	32	12	240	10	296	852	0	0	0
99	1	Corridor	Exit Sign	S	LED	2	1	5	N	24	365	1	11	96	N/A	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	0	0	0
100	1	Vestibule	Recessed Parabolic	E	4'T8	1	2	32	Sw	12	240	10	74	213	N/A	Recessed Parabolic	4'T8	E	Sw	1	2	32	12	240	10	74	213	0	0	0
101	1	Office	Recessed Parabolic	E	4'T8	2	2	32	Sw	8	240	10	148	284	C	Recessed Parabolic	4'T8	E	OS	2	2	32	6	240	10	148	213	0	71	71
102	1	Office	Recessed Parabolic	E	4'T8	2	2	32	Sw	8	240	10	148	284	C	Recessed Parabolic	4'T8	E	OS	2	2	32	6	240	10	148	213	0	71	71
103	1	Corridor	Recessed Parabolic	E	4'T8	2	2	32	Sw	12	240	10	148	426	N/A	Recessed Parabolic	4'T8	E	Sw	2	2	32	12	240	10	148	426	0	0	0
104	1	Corridor	Exit Sign	S	LED	1	1	5	N	24	365	1	6	48	N/A	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	0	0	0
105	1	Storage Rm	Recessed Parabolic	E	4'T8	9	2	32	Sw	2	240	10	666	320	N/A	Recessed Parabolic	4'T8	E	Sw	9	2	32	2	240	10	666	320	0	0	0
106	1	Mechanical Bulkhead	Recessed Parabolic	E	4'T8	10	2	32	Sw	1	240	10	740	178	N/A	Recessed Parabolic	4'T8	E	Sw	10	2	32	1	240	10	740	178	0	0	0
107	1	Gymnasium Entrance	Recessed Parabolic	E	4'T8	1	2	32	Sw	8	240	10	74	142	N/A	Recessed Parabolic	4'T8	E	Sw	1	2	32	8	240	10	74	142	0	0	0
108	1	Trophycase	Recessed Parabolic	E	3'T8	3	1	25	Sw	12	240	3	84	242	N/A	Recessed Parabolic	3'T8	E	Sw	3	1	25	12	240	3	84	242	0	0	0
109	1	Gymnasium	Recessed Parabolic	E	Induction	18	1	100	Sw	8	240	10	1,980	3,802	N/A	Recessed Parabolic	Induction	E	Sw	18	1	100	8	240	10	1980	3802	0	0	0
110	1	Gymnasium	Exit Sign	S	LED	1	1	5	N	24	365	1	6	48	N/A	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	0	0	0
111	1	Corridor-Office	Recessed Parabolic	E	4'T8	12	2	32	Sw	8	240	10	888	1,705	N/A	Recessed Parabolic	4'T8	E	Sw	12	2	32	8	240	10	888	1705	0	0	0
112	1	Corridor-Office	Exit Sign	S	LED	2	1	5	N	24	365	1	11	96	N/A	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	0	0	0
113	1	Locker Room Boys	Recessed Parabolic	E	4'T8	5	2	32	Sw	8	200	10	370	592	C	Recessed Parabolic	4'T8	E	OSCM	5	2	32	0	200	10	370	0	0	592	592
114	1	Locker Room Girls	Recessed Parabolic	E	4'T8	5	2	32	Sw	8	200	10	370	592	C	Recessed Parabolic	4'T8	E	OSCM	5	2	32	0	200	10	370	0	0	592	592
115	1	Locker Room Boys	Exit Sign	S	LED	1	1	5	N	24	365	1	6	48	N/A	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	0	0	0
116	1	Bathroom Boys	Recessed Parabolic	E	4'T8	2	2	32	Sw	8	200	10	148	237	N/A	Recessed Parabolic	4'T8	E	Sw	2	2	32	8	200	10	148	237	0	0	0
117	1	Bathroom Girls	Recessed Parabolic	E	4'T8	2	2	32	Sw	8	200	10	148	237	N/A	Recessed Parabolic	4'T8	E	Sw	2	2	32	8	200	10	148	237	0	0	0
118	1	Modular Office Unit	Recessed	S	CFL	6	1	25	Sw	8	240	0	150	288	C	Recessed	CFL	S	OS	6	1	25	6	240	0	150	216	0	72	72
119	1	Modular Office Unit	Recessed	S	CFL	2	1	25	Sw	8	240	0	50	96	N/A	Recessed	CFL	S	Sw	2	1	25	8	240	0	50	96	0	0	0
120	1	Modular Office Unit	Recessed	S	CFL	2	1	25	Sw	8	240	0	50	96	N/A	Recessed	CFL	S	Sw	2	1	25	8	240	0	50	96	0	0	0
121	1	Modular Office Unit	Recessed	S	Inc	3	1	60	Sw	8	240	0	180	346	CFL	Recessed	CFL	S	Sw	3	1	20	8	240	0	60	115	230	0	230
122	1	Modular Office Unit	Recessed	S	Inc	6	1	75	Sw	8	240	0	450	864	CFL	Recessed	CFL	S	Sw	6	1	25	8	240	0	150	288	576	0	576
123	1	Modular Office Unit	Exit Sign	S	LED	3	1	5	N	24	365	1	17	145	N/A	Exit Sign	LED	S	N	3	1	5	24	365	1	17	145	0	0	0
124	1	Modular Office Unit Exterior	Wall Mounted	S	Inc	2	1	75	Sw	12	365	0	150	657	CFL	Wall Mounted	CFL	S	Sw	2	1	25	12	365	0	50	219	438	0	438
125	1	Modular Classroom (25)	Recessed Parabolic	M	4'T12	13	4	34	Sw	12	200	41	2,298	5,516	T8 Kit	Recessed Parabolic	4'T8	E	Sw	13	3	25	12	200	12	1127	2706	2811	0	2811
126	1	Modular Classroom (26)	Recessed Parabolic	M	4'T12	13	4	34	Sw	12	200	41	2,298	5,516	T8 Kit	Recessed Parabolic	4'T8	E	Sw	13	3	25	12	200	12	1127	2706	2811	0	2811
127	1	Modular Classroom (27)	Recessed Parabolic	M	4'T12	13	4	34	Sw	12	200	41	2,298	5,516	T8 Kit	Recessed Parabolic	4'T8	E	Sw	13	3	25	12	200	12	1127	2706	2811	0	2811
128	1	Modular Classroom (28)	Recessed Parabolic	M	4'T12	13	4	34	Sw	12	200	41	2,298	5,516	T8 Kit	Recessed Parabolic	4'T8	E	Sw	13	3	25	12	200	12	1127	2706	2811	0	2811
129	1	Modular Classroom (28)	Exit Sign	S	LED	2	1	5	N	24	365	1	11	96	N/A	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	0	0	0
130	1	Modular Classroom (27)	Exit Sign	S	LED	2	1	5	N	24	365	1	11	96	N/A	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	0	0	0
131	1	Modular Classroom (26)	Exit Sign	S	LED	2	1	5	N	24	365	1	11	96	N/A	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	0	0	0
132	1	Modular Classroom (25)	Exit Sign	S	LED	2	1	5	N	24	365	1	11	96	N/A	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	0	0	0
133	1	Bathroom (25)	Recessed Parabolic	M	4'T12	1	4	34	Sw	8	365	41	177	516	T8 Kit	Recessed Parabolic	4'T8	E	Sw	1	3	25	8	365	12	87	253	263	0	263
134	1	Bathroom (26)	Recessed Parabolic	M	4'T12	1	4	34	Sw	8	200	41	177	283	T8 Kit	Recessed Parabolic	4'T8	E	Sw	1	3	25	8	200	12	87	139	144	0	144
135	1	Bathroom (27)	Recessed Parabolic	M	4'T12	1	4	34	Sw	8	200	41	177	283	T8 Kit	Recessed Parabolic	4'T8	E	Sw	1	3	25	8	200	12	87	139	144	0	144
136	1	Bathroom (28)	Recessed Parabolic	M	4'T12	1	4	34	Sw	8	200	41	177	283	T8 Kit	Recessed Parabolic	4'T8	E	Sw	1	3	25	8	200	12	87	139	144	0	144
137	1	Modular Classroom Trailer	Recessed Parabolic	M	4'T12	1	4	34	Sw	8	200	41	177	283	T8 Kit	Recessed Parabolic	4'T8	E	Sw	1	3	25	8	200	12	87	139	144	0	144
138	1	Modular Classroom Trailer	Recessed Parabolic	M	4'T12	1	4	34	Sw	8	200	41	177	283	T8 Kit	Recessed Parabolic	4'T8	E	Sw	1	3	25	8	200	12	87	139	144	0	144
139	1	Nurse	Recessed Parabolic	E	4'T8	10	3	32	Sw	8	200	15	1,110	1,776	N/A	Recessed Parabolic	4'T8	E	Sw	10	3	32	8	200	15	1110	1776	0	0	0
140	1	Nurse	Recessed Parabolic	E	2'T8	4	2	17	Sw	8	200	4	152	243	N/A	Recessed Parabolic	2'T8	E	Sw	4	2	17	8	200	4	152	243	0	0	0

Location			Existing Fixture Information												Retrofit Information												Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
141	1	Nurse	Recessed Parabolic	E	2'T8	1	3	17	Sw	8	200	6	57	91	N/A	Recessed Parabolic	2'T8	E	Sw	1	3	17	8	200	6	57	91	0	0	0
142	1	Art Room	Ceiling Mounted	E	4'T8	18	3	32	Sw	8	200	15	1,998	3,197	C	Ceiling Mounted	4'T8	E	OS	18	3	32	6	200	15	1998	2398	0	799	799
143	1	Office	Recessed Parabolic	E	4'T8	2	2	32	Sw	8	200	10	148	237	C	Recessed Parabolic	4'T8	E	OS	2	2	32	6	200	10	148	178	0	59	59
144	1	Office	Recessed Parabolic	E	4'T8	3	2	32	Sw	8	200	10	222	355	C	Recessed Parabolic	4'T8	E	OS	3	2	32	6	200	10	222	266	0	89	89
145	1	Office	Recessed Parabolic	E	4'T8	6	2	32	Sw	8	200	10	444	710	C	Recessed Parabolic	4'T8	E	OS	6	2	32	6	200	10	444	533	0	178	178
146	1	Boiler Rm	Ceiling Suspended	E	4'T8	6	2	32	Sw	2	200	10	444	178	N/A	Ceiling Suspended	4'T8	E	Sw	6	2	32	2	200	10	444	178	0	0	0
147	1	Storage	Ceiling Mounted	E	4'T8	1	1	32	Sw	2	200	5	37	15	N/A	Ceiling Mounted	4'T8	E	Sw	1	1	32	2	200	5	37	15	0	0	0
148	1	Storage	Ceiling Mounted	E	4'T8	1	2	32	Sw	2	200	10	74	30	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	2	200	10	74	30	0	0	0
149	1	Storage	Ceiling Suspended	E	4'T8	1	4	32	Sw	2	200	20	148	59	N/A	Ceiling Suspended	4'T8	E	Sw	1	4	32	2	200	20	148	59	0	0	0
150	1	Art Room	Track	S	Inc	24	1	75	Sw	8	30	0	1,800	432	CFL	Track	CFL	S	Sw	24	1	25	8	30	0	600	144	288	0	288
151	1	Kiln Room	Ceiling Mounted	E	4'T8	2	3	32	Sw	8	200	15	222	355	N/A	Ceiling Mounted	4'T8	E	Sw	2	3	32	8	200	15	222	355	0	0	0
152	Ext	Exterior	Wallpack	E	HPS	26	1	70	PC	12	365	14	2,184	9,566	PSMH	Wallpack	PSMH	E	PC	26	1	50	12	365	10	1560	6833	2733	0	2733
Totals:						1,064	332	4,358				1,612	94,547	174,911						1,064	321	4,048			1,315	86,951	143,893	16,732	14,286	31,019
Rows Highlighed Yellow Indicate an Energy Conservation Measure is recommended for that space																														

Proposed Lighting Summary Table			
Total Gross Floor Area (SF)	70,200		
Average Power Cost ($/kWh)	0.1480		
Exterior Lighting	**Existing**	**Proposed**	**Savings**
Exterior Annual Consumption (kWh)	9,566	6,833	**2,733**
Exterior Power (watts)	2,184	1,560	**624**
Total Interior Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	165,345	137,060	**28,286**
Lighting Power (watts)	92,363	85,391	**6,972**
Lighting Power Density (watts/SF)	1.32	1.22	**0.10**
Estimated Cost of Fixture Replacement ($)	17,125		
Estimated Cost of Controls Improvements ($)	7,790		
Total Consumption Cost Savings ($)	**5,019**		

LEGEND			
Lamp Type		**Controls**	
CFL	Compact Fluorescent	T	Autom. Timer
Inc	Incadescent	BL	Bi-Level
LED	Light Emitting Diode	Ct	Contact
MH	Metal Halide	M	Daylight & Motion
MV	Mercury Vapor	DLSw	Daylight & Switch
PSMH	Pulse Start Metal Halide	DL	Daylight Sensor
HPS	High Pressure Sodium	DSw	Delay Switch
LPS	Low Pressure Sodium	D	Dimmer
Fl	Fluorescent	MS	Motion Sensor
4'T8	4 Feet long T8 Linear Lamp	MSw	Motion& Switch
4'T8 U-shaped	4 Feet long T8 U-shaped Lamp	N	None
4'T5	4 Feet long T5 Linear Lamp	OS	Occupancy Sensor
Ballast Type		OSCM	Occupancy Sensor Ceiling Mounted
E	Electronic	PC	Photocell
M	Magnetic	Sw	Switch
S	Self		

APPENDIX D: EnergyMisers

EnergyMisers

VendingMiser® CoolerMiser™ SnackMiser™ PlugMiser™ VM2iQ® CM2iQ®

Savings Calculator

Please replace the default values in the table below with your location's unique information and then click on the "calculate savings" button.
Note: To calculate for CoolerMiser, use the equivalent VendingMiser results. To calculate for PlugMiser, use the equivalent SnackMiser results.

Energy Costs ($0.000 per kWh)	.148
Facility Occupied Hours per Week	60
Number of Cold Drink Vending Machines	3
Number of Non-refrigerated Snack Machines	3
Power Requirements of Cold Drink Machine (Watts; 400 typical)	400
Power Requirements of Snack Machine (Watts; 80 typical)	80
VendingMiser® VM150 Price (for cold drink machines)	$199.00
SnackMiser™ SM150 Price (for snack machines)	$180.00

Calculate Savings!

Results of your location's projected savings with VendingMiser® installed:

COLD DRINK MACHINES	Current	Projected	Total Savings	% Savings
kWh	10483	4867	5616	54%
Cost of Operation	$1,551.51	$720.35	$831.17	54%

SNACK MACHINES	Current	Projected	Total Savings	% Savings
kWh	2097	749	1348	64%
Cost of Operation	$310.30	$110.82	$199.48	64%

Location's Total Annual Savings

	Current	Projected	Total Savings	% Savings
kWh	12580	5616	6964	55%
Cost of Operation	$1,861.82	$831.17	$1,030.65	55%

Total Project Cost	Break Even (Months)
$1,137	13.24

Estimated Five Year Savings on ALL Machines = $5,153.24

Estimated Five Year Return on Investment = 353%

APPENDIX E: UPCOMING EQUIPMENT PHASEOUTS

LIGHTING:

- As of **July 1, 2010** magnetic ballasts most commonly used for the operation of T12 lamps are no longer being produced for commercial and industrial applications.

- As of **January 1, 2012** 100 watt incandescent bulbs have been phased out in accordance with the Energy Independence and Security Act of 2007.

- Starting **July 2012** many non energy saver model T12 lamps will be phased out of production.

- As of **January 1, 2013** 75 watt incandescent bulbs will be phased out in accordance with the Energy Independence and Security Act of 2007.

- As of **January 1, 2014** 60 and 40 watt incandescent bulbs will be phased out in accordance with the Energy Independence and Security Act of 2007.

- Energy Independence and Security Act of 2007 incandescent lamp phase-out exclusions:
  1. Appliance lamp (e.g. refrigerator or oven light)
  2. Black light lamp
  3. Bug lamp
  4. Colored lamp
  5. Infrared lamp
  6. Left-hand thread lamp
  7. Marine lamp
  8. Marine signal service lamp
  9. Mine service lamp
  10. Plant light lamp
  11. Reflector lamp
  12. Rough service lamp
  13. Shatter-resistant lamp (including a shatter-proof lamp and a shatter-protected lamp)
  14. Sign service lamp
  15. Silver bowl lamp
  16. Showcase lamp
  17. 3-way incandescent lamp
  18. Traffic signal lamp
  19. Vibration service lamp
  20. Globe shaped “G” lamp (as defined in ANSI C78.20-2003 and C79.1-2002 with a diameter of 5 inches or more
  21. T shape lamp (as defined in ANSI C78.20-2003 and C79.1-2002) and that uses not more than 40 watts or has a length of more than 10 inches
  22. A B, BA, CA, F, G16-1/2, G-25, G30, S, or M-14 lamp (as defined in ANSI C79.1-2002 and ANSI C78.20-2003) of 40 watts or less
  23. Candelabra incandescent and other lights not having a medium Edison screw base.

- When installing compact fluorescent lamps (CFLs), be advised that they contain a very small amount of mercury sealed within the glass tubing and EPA guidelines concerning

cleanup and safe disposal of compact fluorescent light bulbs should be followed. Additionally, all lamps to be disposed should be recycled in accordance with EPA guidelines through state or local government collection or exchange programs instead.

HCFC (Hydro chlorofluorocarbons):

- As of **January 1, 2010,** no production and no importing of R-142b and R-22, except for use in equipment manufactured before January 1, 2010, in accordance with adherence to the Montreal Protocol.

- As of **January 1, 2015,** No production and no importing of any HCFCs, except for use as refrigerants in equipment manufactured before January 1, 2010.

- As of **January 1, 2020** No production and no importing of R-142b and R-22.

APPENDIX F: THIRD PARTY ENERGY SUPPLIERS

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

Third Party Electric Suppliers for JCPL Service Territory	Telephone & Web Site
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 300 Madison Avenue Morristown, NJ 07926	(800) 977-0500 www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 www.glacialenergy.com
Integrys Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integrysenergy.com
Liberty Power Delaware, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com
Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(800) 363-7499 www.libertypowercorp.com
Pepco Energy Services, Inc. 112 Main St. Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com

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 Elizabethtown Gas Co. 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
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
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 www.glacialenergy.com
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	(800) 724-1880 www.intelligentenergy.org
Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724	(877) 750-7046 www.metromediaenergy.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
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
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	(800) 557-1121 www.woodruffenergy.com

APPENDIX G: GLOSSARY AND METHOD OF CALCULATIONS

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

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

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

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

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

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

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

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

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

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

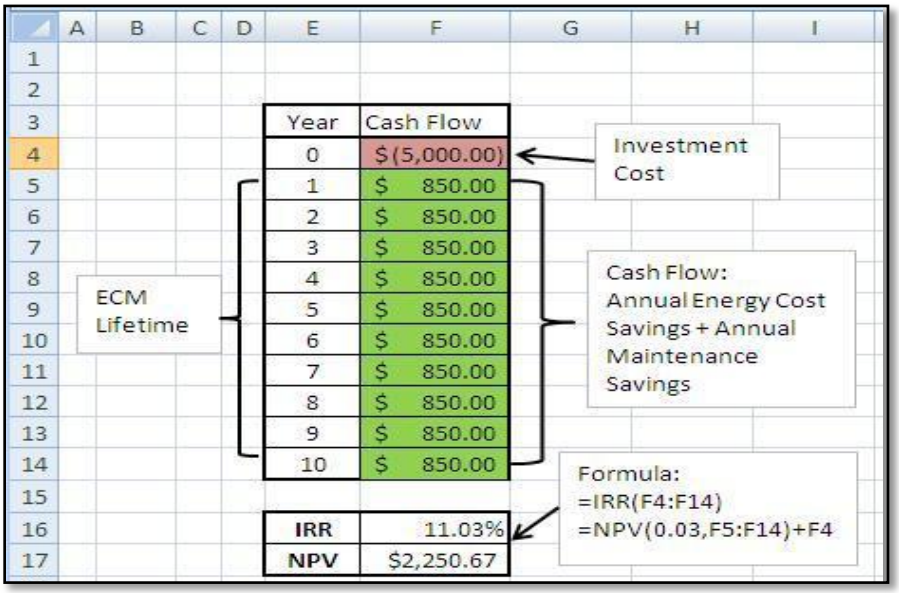
Calculation References

Term	Definition
ECM	Energy Conservation Measure
AOCS	Annual Operating Cost Savings
AECS	Annual Energy Cost Savings
LOCS*	Lifetime Operating Cost Savings
LECS	Lifetime Energy Cost Savings
LCS	Lifetime Cost Savings
NPV	Net Present Value
IRR	Internal Rate of Return
DR	Discount Rate
Net ECM Cost	Total ECM Cost – Incentive
LECS	AECS X ECM Lifetime
AOCS	LOCS / ECM Lifetime
LCS	LOCS+LECS
Simple Payback	Net ECM Cost / (AECS + AOCS)
Lifetime ROI	(LECS + LOCS – Net ECM Cost) / Net ECM Cost
Annual ROI	(Lifetime ROI / Lifetime) = [(AECS + OCS) / Net ECM Cost – (1 / Lifetime)]

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

Excel NPV and IRR Calculation

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



Solar PV ECM Calculation

There are several components to the calculation:

Costs:	Material of PV system including panels, mounting and net-metering + Labor
Energy Savings:	Reduction of kWh electric cost for life of panel, 25 years Solar Renewable Energy Credits (SRECs) – Market-rate incentive. Calculations assume $608/Megawatt hour consumed per year for a maximum of 15 years; added to annual energy cost savings for a period of 15 years. (Megawatt hour used is rounded to nearest 1,000 kWh)
Assumptions:	A Solar Pathfinder device is used to analyze site shading for the building and determine maximum amount of full load operation based on available sunlight. When the Solar Pathfinder device is not implemented, amount of full load operation based on available sunlight is assumed to be 1,180 hours in New Jersey.

Total lifetime PV energy cost savings =
kWh produced by panel * [$/kWh cost * 25 years + $608/Megawatt hour /1000 * 15 years]

ECM and Equipment Lifetimes

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

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

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

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

New Jersey Clean Energy Program Commercial Equipment Life Span

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

APPENDIX H: STATEMENT OF ENERGY PERFORMANCE FROM ENERGY STAR®

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
East Amwell Township School

Building ID: 3117791
For 12-month Period Ending: January 31, 2012[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: May 15, 2012

Facility	Facility Owner	Primary Contact for this Facility
East Amwell Township School 43 Wertsville Road Ringoes, NJ 08551	N/A	N/A

Year Built: 1938
Gross Floor Area (ft²): 70,200

Energy Performance Rating[2] (1-100) 56

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	1,940,829
Natural Gas (kBtu)[4]	2,915,751
Total Energy (kBtu)	4,856,580

Energy Intensity[4]	
Site (kBtu/ft²/yr)	69
Source (kBtu/ft²/yr)	136

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	430

Electric Distribution Utility
Jersey Central Power & Light Co [FirstEnergy Corp]

National Median Comparison	
National Median Site EUI	73
National Median Source EUI	144
% Difference from National Median Source EUI	-6%
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[5] **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. Values represent energy intensity, annualized to a 12 month period.
5. 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

APPENDIX I: INCENTIVE PROGRAMS

New Jersey Clean Energy Pay for Performance

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

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

Energy Provider Incentives

- **South Jersey Gas** - Offers financing up to $100,000 on the customer's portion of project cost through private lender. In addition to available financing, it provides matching incentive on gas P4P incentives #2 and #3 up to $100,000 (not to exceed total project cost).

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

Direct Install 2011 Program*

Direct Install is a division of the New Jersey Clean Energy Programs' Smart Start Buildings. It is a turn-key program for small to mid-sized facilities to aid in upgrading equipment to more efficient types. It is designed to cut overall energy costs by upgrading lighting, HVAC, and other equipment with energy efficient alternatives. The program pays **up to 70%** of the retrofit costs, including equipment cost and installation costs. Each project is limited to $75,000 in incentives.

Eligibility:

- Existing small and mid-sized commercial and industrial facilities with peak electrical demand **below 150 kW** within 12 months of applying (the 150 kW peak demand threshold has been waived for local government entities who receive and utilize their Energy Efficiency and Conservation Block Grant in conjunction with Direct Install)
- Must be located in New Jersey
- Must be served by one of the state's public, regulated or natural gas companies

Energy Provider Incentives

- **South Jersey Gas** – Program offers financing up to $25,000 on customer's 40% portion of the project and combines financing rate based on portion of the project devoted to gas

and electric measures. All gas measures financed at 0%, all electric measures financed at normal rate. Does not offer financing on projects that only include electric measures.
- **Atlantic City Electric –** Provides a free audit, and additional incentives up to 20% of the current incentive up to a maximum of $5,000 per customer.

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

Smart Start

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

There are a number of improvement options for commercial, industrial, institutional, government, and agricultural projects throughout New Jersey. Alternatives are designed to enhance quality while building in energy efficiency to save money. Project categories included in this program are New Construction and Additions, Renovations, Remodeling and Equipment Replacement.

Energy Provider Incentives
- **South Jersey Gas –** Program to finance projects up to $25,000 not covered by incentive
- **New Jersey Natural Gas** – Will match SSB incentives on gas equipment
  PSE&G - Provides funding for site-specific uses of emerging technology. The incentives are determined on a case by case basis.

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

Renewable Energy Incentive Program*

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

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

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

Combined Heat and Power (CHP)

Energy Provider Incentives

- South Jersey Gas - Provides additional incentive of $1.00/watt up to $1,000,000 on top of NJCEP incentive.

Utility Sponsored Programs

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

Energy Efficiency and Conservation Block Grant Rebate Program

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

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

Other Federal and State Sponsored Programs

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

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

APPENDIX J: ENERGY CONSERVATION MEASURES

ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1	Retrofit 3 refrigerated vending machines with VendingMiser™ devices	597	none at this time	597	5,616	0	0	0.3	0	831	12	9,974	0.7	1,571	131	139	7,344	10,055
2	58 New T8 fixtures to be installed with incentives	2,740	580	2,160	12,226	3	0	0.6	589	2,411	15	36,159	0.9	1,574	105	112	25,393	21,890
3	Upgrade (35) Incandescent to CFL	339	none at this time	339	1,532	0	0	0.1	64	293	5	1,463	1.2	331	66	82	962	2,744
4	Retrofit 3 vending machines with SnackMiser™ devices	540	none at this time	540	1,348	0	0	0.1	0	199	12	2,394	2.7	343	29	36	1,378	2,414
5	Replace 1 incandescent/fluorescent Exit sign with LED type	151	10	141	241	0	0	0.0	5	41	15	609	3.5	333	22	28	327	431
6	Install 37 occupancy sensors	8,140	740	7,400	11,776	2	0	0.6	0	1,755	15	26,319	4.2	256	17	23	12,836	21,085
7	Replace (1) Standard Efficiency Natural Gas DHW Heater with an Energy Star Natural Gas Condensing Type	4,961	480	4,481	0	0	771	1.1	50	804	12	9,644	5.6	94	8	12	2,853	8,499
8	Install 2 motion sensors	440	50	390	320	0	0	0.0	0	48	15	714	8.2	83	6	9	165	572

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

APPENDIX K: METHOD OF ANALYSIS

Assumptions and tools

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

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.