Steven Winter Associates, Inc.
Building Systems Consultants
www.swinter.com

293 Route 18, Suite 330
East Brunswick, NJ 08816

Telephone (866) 676-1972
Facsimile (203) 852-0741

September 18, 2010

Local Government Energy Program
Energy Audit Final Report

Freehold Regional High School District

Marlboro High School
95 North Main Street
Marlboro, NJ 07746

Project Number: LGEA65

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EXECUTIVE SUMMARY

The Freehold RHSD (Regional High School District) Marlboro High School is a two-story building, with a partial basement, comprising a total conditioned floor area of 264,000 square feet. The original structure was built in the 1968, with additions/alternations completed in 1986 and 2000. The following chart provides an overview of current energy usage in the building based on the analysis period of March 2009 through February 2010:

Table 1: State of Building—Energy Usage

	Electric Usage, kWh/yr	Gas Usage, therms/yr	Other fuel usage	Current Annual Cost of Energy, $	Site Energy Use Intensity, kBtu/sq ft yr	Joint Energy Consumption, MMBtu/yr
Current	2,757,196	142,751	N/A	646,256	90.0	23,683
Proposed	2,603,340	122,176	N/A	585,004	80.2	21,100
Savings	153,856	20,575	N/A	61,252*	9.8	2,583
% Savings	6%	14%	N/A	9%	11%	11%
Renewables	237,840	Includes SRECs		178,827	3.1	812
*Includes operation and maintenance savings						

There may be energy procurement opportunities for the Freehold RHSD Marlboro High School to reduce annual utility costs, which are $11,509 higher, when compared to the average estimated NJ commercial utility rates.

SWA has also entered energy information about the Marlboro High School in the U.S. Environmental Protection Agency's (EPA) ENERGY STAR® Portfolio Manager Energy benchmarking system. The Marlboro High School received a national energy performance rating of 30, which indicates that this building is in the 30th percentile when compared to other schools that are eligible for a national energy performance rating.

Based on the current state of the building and its energy use, SWA recommends implementing various energy conservation measures from the savings detailed in Table 1. The measures are categorized by payback period in Table 2 below:

Table 2: Energy Conservation Measure Recommendations

ECMs	First Year Savings ($)	Simple Payback Period (years)	Initial Investment, $	CO2 Savings, lbs/yr
0-5 Year	13,104	3.1	41,119	135,992
5-10 Year	46,245	8.5	393,022	117,362
>10 year	1,903	21	39,875	22,125
Total	61,252	7.8	481,773	275,479
Renewables	178,827	8.1	1,450,650	325,841

SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 23 cars from the roads each year or avoiding the need of 671 trees to absorb the annual CO_2 generated.

Other recommendations to increase building efficiency pertaining to operations and maintenance and capital improvements are listed below. This is an abbreviated list with only a select few highly recommended improvements. For the full list please see the Proposed Further Recommendations sections.

Further Recommendations:

SWA recommends that the Marlboro High School further explore the following:

- Capital Improvements
  - Install NEMA premium motors when replacements are required
- Operations and Maintenance
  - Repair and patch roof leakage areas and remove sharp objects from roof surface
  - Maintain downspouts and cap flashing
  - Provide weather-stripping/air-sealing
  - Repair/seal wall cracks and penetrations

Financial Incentives and Other Program Opportunities

Based on the requirements of the LGEA program, the Freehold RHSD must commit to implementing some of these measures, and must submit paperwork to the Local Government Energy Audit program within one year of this report's approval to demonstrate that they have spent, net of other NJCEP incentives, at least 25% of the cost of the audit (per building). The Marlboro High School should spend a minimum of $5,466 (or 25% of $21,864) worth of ECMs, net of other NJCEP incentives, to fulfill the obligations.

Financial Incentives and Other Program Opportunities

The table below summarizes the recommended next steps that Freehold RHSD can take to achieve greater energy efficiency, reduce operating costs and exceed the 25% expenditure requirement.

Table 3: Next Steps for the Marlboro High School

Recommended ECMs	Incentive Program (Please refer to Appendix F for details)
Install one hundred and sixty-four (164) new CFL fixtures	N/A
Install (47) new bi-level T8 fluorescent fixtures in stairwells	Smart Start, Direct Install
Install twenty-eight (28) new occupancy sensors	Smart Start, Direct Install
Install twelve (12) new LED exit signs	Smart Start, Direct Install

There are various incentive programs that the Freehold RHSD could apply for that could help lower the cost of installing the ECMs. For the Marlboro High School, and contingent upon available funding, SWA recommends the following incentive programs:

Direct Install 2010 Program: Buildings can receive up to 60% of the installed cost of energy saving upgrades. The 200 kW peak demand threshold has been waived for local government entities who receive their Energy Efficiency and Conservation Block Grant in conjunction with Direct Install.

Smart Start: Majority of energy saving equipment and design measures have moderate incentives under this program.

Renewable Energy Incentive Program: Receive up to $0.75/Watt toward installation cost for PV panels upon available funding. For each 1,000 kWh generated by renewable energy a credit between $475 and $600.

Utility Sponsored Programs: See available programs with PSE&G.

Energy Efficiency and Conservation Block Grant Rebate Program: Provides up to $20,000 per local government toward energy saving measures.

Please refer to Appendix F for further details.

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 38-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 Marlboro High School at 95 North Main Street, Marlboro, NJ 07746. The process of the audit included facility visits on April 19, May 6, July 2 and July 6, 2010, benchmarking and energy bills analysis, assessment of existing conditions, energy modeling, 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 Freehold RHSD to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures for the Marlboro High School.

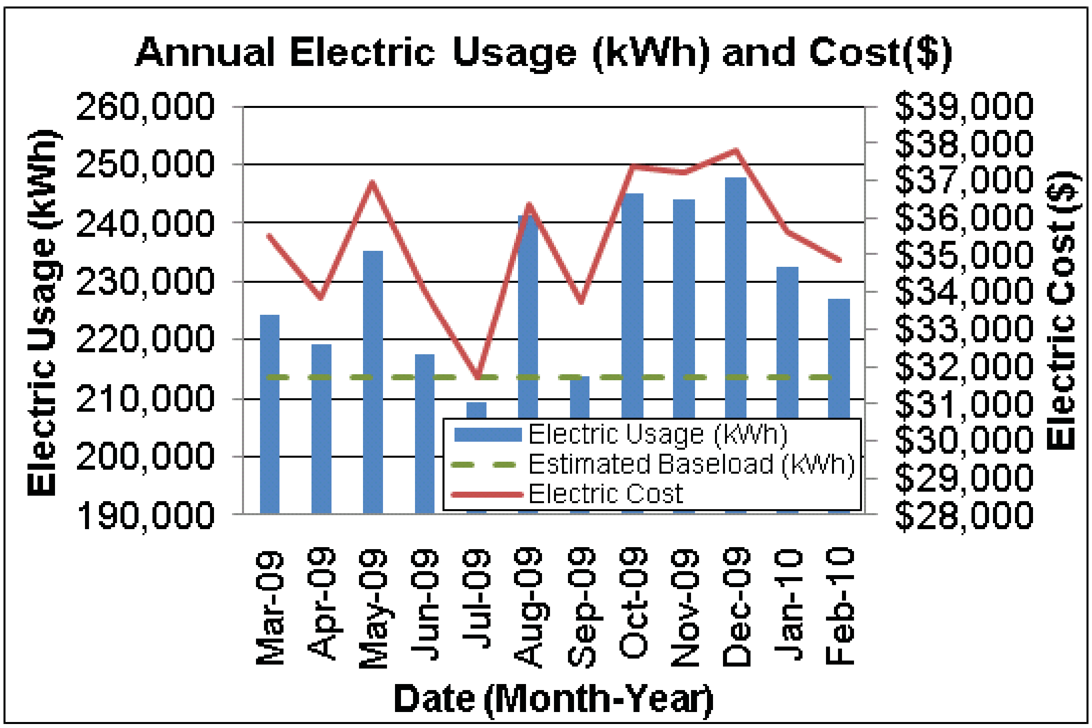
HISTORICAL ENERGY CONSUMPTION

Energy usage, load profile and cost analysis

SWA reviewed utility bills from March 2008 through February 2010 that were received from the utility companies supplying the Marlboro High School with electric and natural gas. A 12 month period of analysis from March 2009 through February 2010 was used for all calculations and for purposes of benchmarking the building.

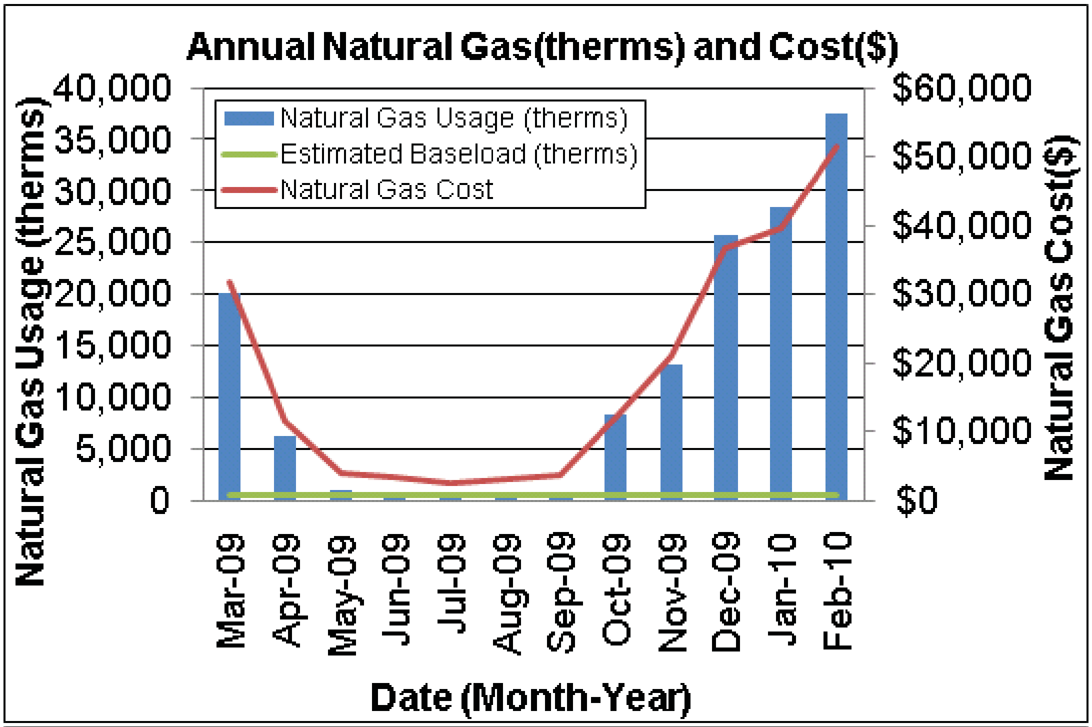
Electricity - The Marlboro High School is currently served by one electric meter. The Marlboro High School currently buys electricity from JCP&L at **an average aggregated rate of $0.154/kWh**. The Marlboro High School purchased **approximately 2,757,196 kWh, or $425,088 worth of electricity,** in the previous year. The average monthly demand was 604.4 kW and the annual peak demand was 709.4 kW.

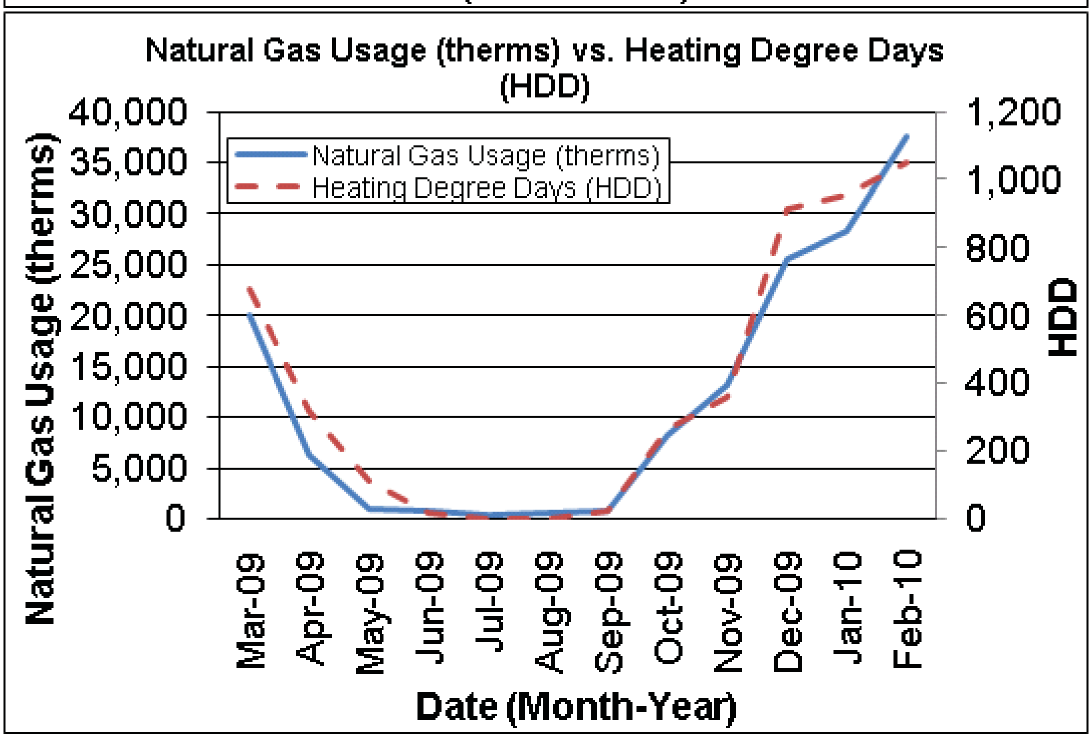
The chart below shows the monthly electric usage and costs. The dashed green line represents the approximate baseload or minimum electric usage required to operate the Marlboro High School.



Natural gas - The Marlboro High School is currently served by one meter for natural gas. The Marlboro High School currently buys natural gas from Pepco Energy Services (commodity gas) and NJ Natural Gas (transportation) at **an average aggregated rate of $1.549/therm**. The Marlboro High School purchased **approximately 142,751 therms, or $221,168 worth of natural gas,** in the previous year.

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 Marlboro High School.

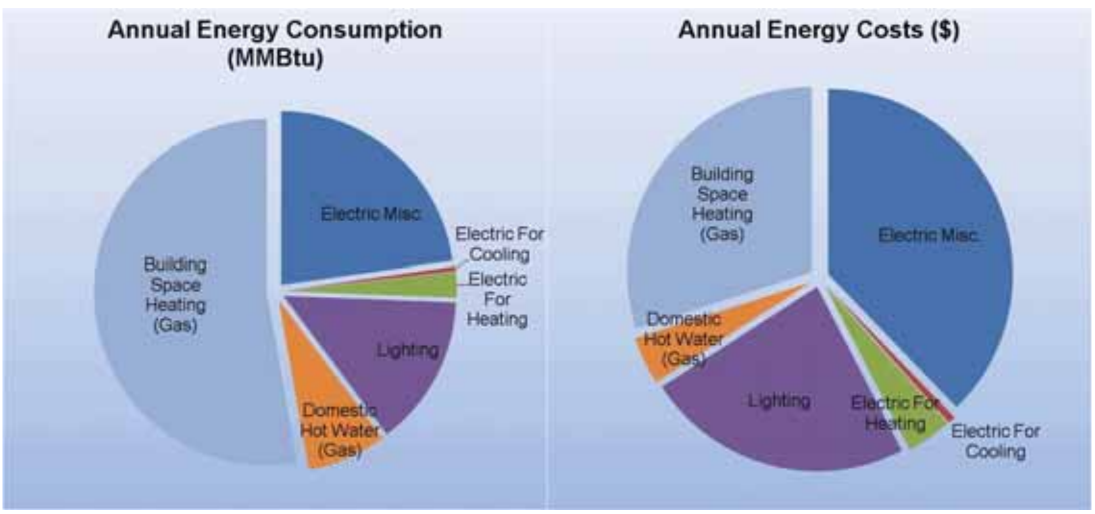




The chart above shows the monthly natural gas usage along with the heating degree days or HDD. Heating degree days is the difference of the average daily temperature and a base temperature, on a particular day. The heating degree days are zero for the days when the average temperature exceeds the base temperature. SWA's analysis used a base temperature of 65 degrees Fahrenheit.

The following graphs, pie charts, and table show energy use for Marlboro High School based on utility bills for the 12 month period. Note: electrical cost at $45/MMBtu of energy is 3 times as expensive as natural gas at $15/MMBtu

Annual Energy Consumption / Costs					
	MMBtu	**% MMBtu**	**$**	**% $**	**$/MMBtu**
Electric Miscellaneous	5,381	23%	$243,105	38%	45
Electric For Cooling	108	0%	$4,901	1%	45
Electric For Heating	569	2%	$25,708	4%	45
Lighting	3,350	14%	$151,375	23%	45
Domestic Hot Water (Gas)	1,784	8%	$27,646	4%	15
Building Space Heating (Gas)	12,491	53%	$193,522	30%	15
Totals	23,683	100%	$646,256	100%	---
Total Electric Usage	9,408	40%	$425,088	66%	45
Total Gas Usage	14,275	60%	$221,168	34%	15
Totals	23,683	100%	$646,256	100%	---



Energy benchmarking

SWA has entered energy information about the Marlboro High School in the U.S. Environmental Protection Agency's (EPA) *ENERGY STAR® Portfolio Manager* energy benchmarking system. This high school is categorized as a K-12 School space type. The Marlboro High School received a national energy performance rating of 30. The Site Energy Use Intensity is 90.0 kBtu/ft^2-yr compared to the national average of a school building consuming 75.0 kBtu/ft^2-yr. See ECM section for guidance on how to improve the building's rating.
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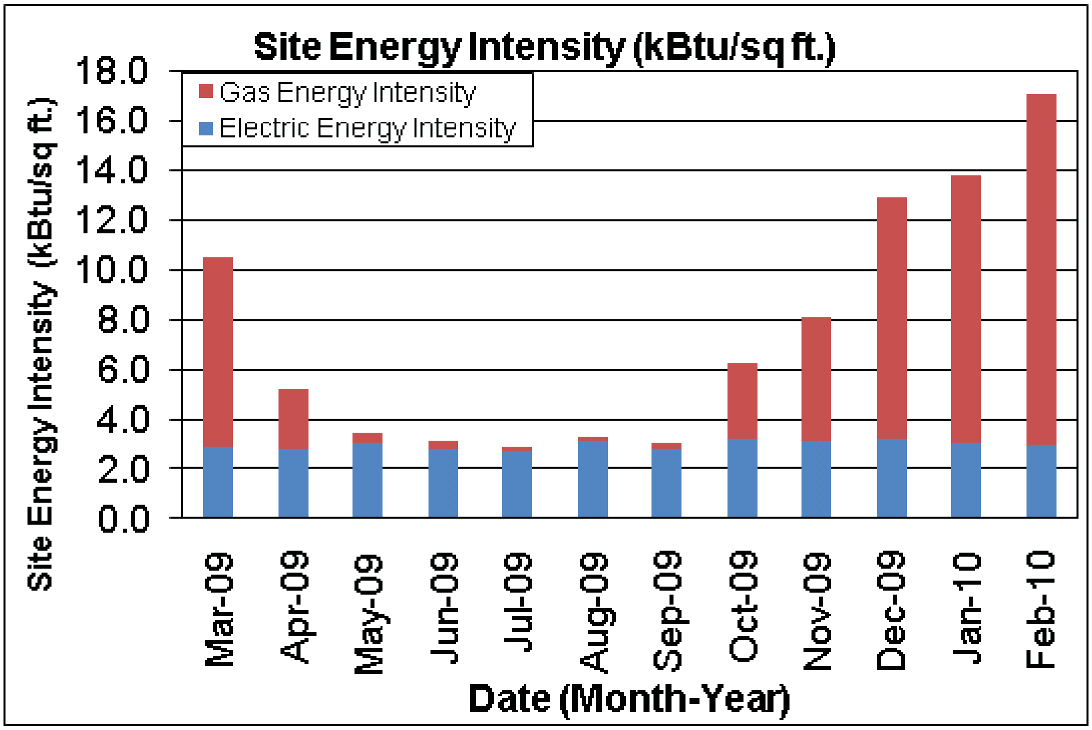


Per the LGEA program requirements, SWA has assisted the Freehold RHSD to create an *ENERGY STAR® Portfolio Manager* account and share the Marlboro High School facilities information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager account information with the Freehold RHSD (user name of "frhsd8579" with a password of *"*frhsd8579*")* and TRC Energy Services (user name of "TRC-LGEA").

Tariff analysis

As part of the utility bill analysis, SWA evaluated the current utility rates and tariffs. Tariffs are typically assigned to buildings based on size and building type.

Tariff analysis is performed to determine if the rate that a Freehold RHSD is contracted to pay with each utility provider is the best rate possible resulting in the lowest costs for electric and gas provision. Typically, the natural gas prices increase during the heating months when natural gas is used by the hot water boiler units. Some high gas price per therm fluctuations in the summer may be due to high energy costs that recently occurred and low use caps for the non-heating months. Typically, electricity prices also increase during the cooling months when electricity is used by the HVAC condensing units and air handlers.

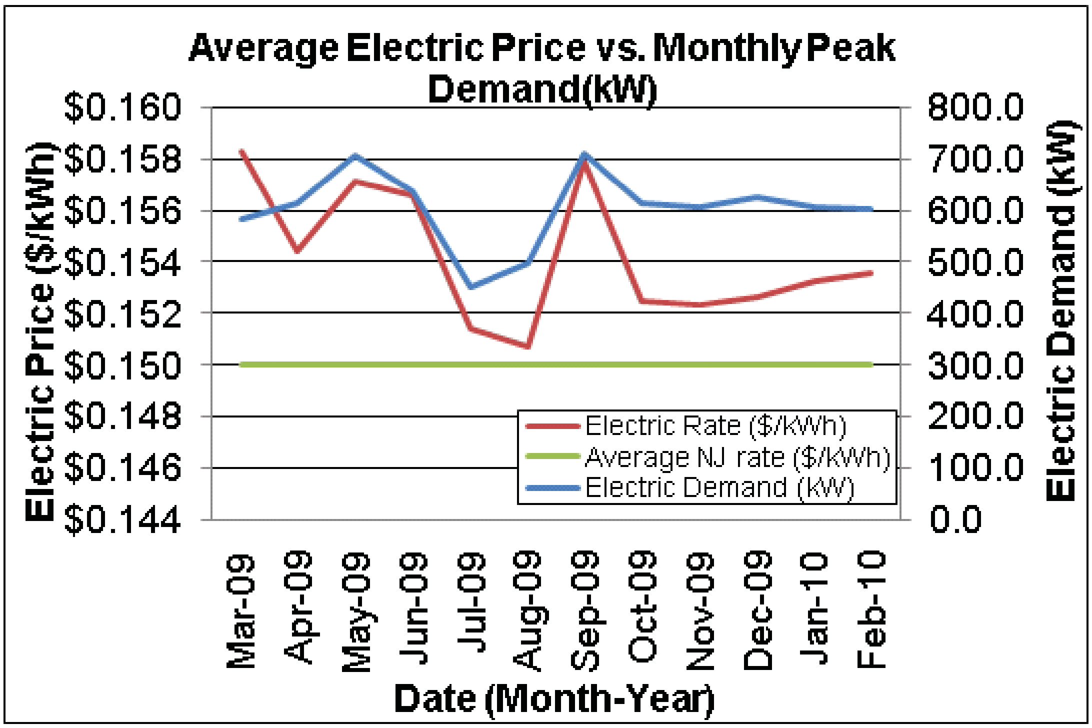
The supplier charges a market-rate price based on use, and the billing does not break down demand costs for all periods because usage and demand are included in the rate. Currently, the Freehold RHSD is paying a general service rate for natural gas. Demand is not broken out in the bill. Thus the building pays for fixed costs such as meter reading charges during the summer months. The building is direct metered and currently purchases electricity at a general service rate for usage with an additional charge for electrical demand factored into each monthly bill. The general service rate for electric charges is market-rate based on usage and demand.

Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year.

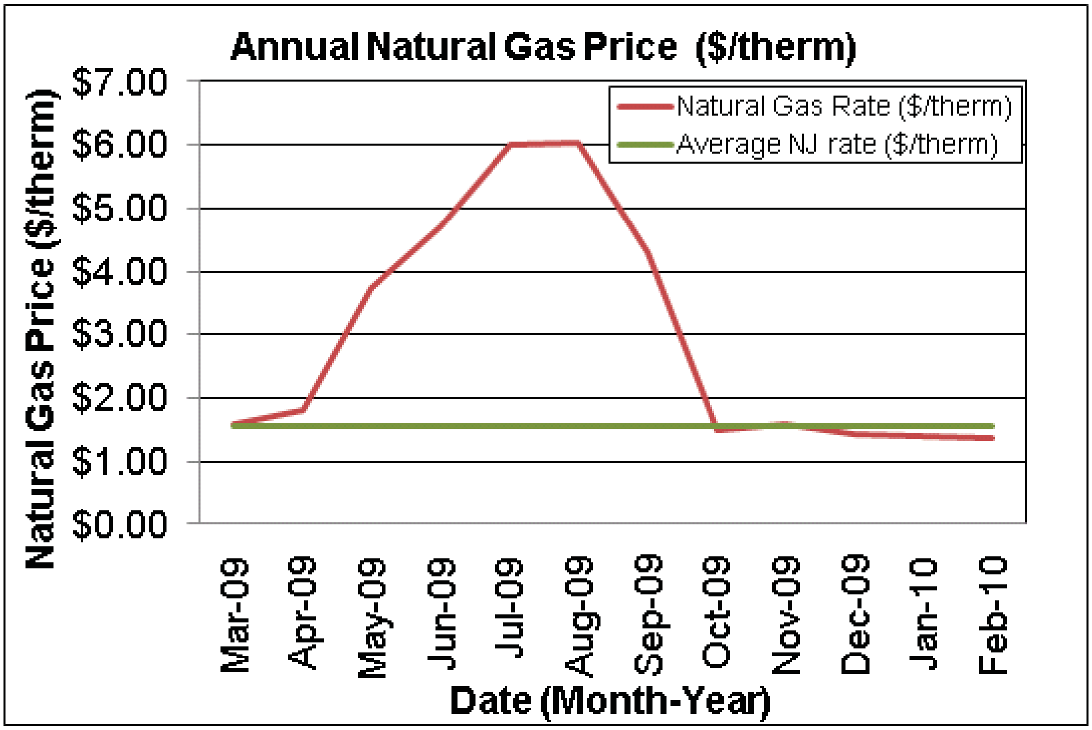
Energy Procurement strategies

Billing analysis is conducted using an average aggregated rate that is estimated based on the total cost divided by the total energy usage per utility per 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 Marlboro High School pays a rate of $0.154/kWh. The Marlboro High School annual electric utility costs are $11,509 higher, when compared to the average estimated NJ commercial utility rates. Electric bill analysis shows fluctuations up to 5% over the most recent 12 month period.



The average estimated NJ commercial utility rates for gas are $1.550/therm, while Marlboro High School pays a rate of $1.549/therm. Natural gas bill analysis shows fluctuations up to 77% over the most recent 12 month period.



Utility rate fluctuations may have been caused by adjustments between estimated and actual meter readings; others may be due to unusual high and recent escalating energy costs. Some high gas price per therm fluctuations in the summer may be due to high energy costs that recently occurred and low use caps for the non-heating months combined with fixed meter charges that are often billed in the summer.

SWA recommends that the Marlboro High School further explore opportunities of purchasing both natural gas and electricity from third-party suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the Marlboro High School. Appendix C contains a complete list of third-party energy suppliers for the Freehold RHSD 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 April 19, May 6, July 2 and July 6, the following data was collected and analyzed.

Building Characteristics

The two-story, with a partial basement, 264,000 square feet Marlboro High School building was originally constructed in 1968, with additions/alternations completed in 1986 and 2000. It houses administrative offices, three gymnasiums, a cafeteria, an auditorium and classrooms.


Front Façade


Partial Side Façade (typ.)


Rear Façade


Partial Side Façade (typ.)

Building Occupancy Profiles

Its occupancy is approximately 1,900 students and 176 faculty and staff from 7:30am until 3:30pm, extra-curricular activities continuing to 6:00pm and cleaning activities completed by midnight Monday through Friday. Saturday activities are 7:00am until 2:30pm and Sunday activities are sporadic and driven by sport events. There are not any summer school activities.

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.

Exterior Walls

The exterior wall envelope is mostly constructed of brick veneer and some limestone type accents, over concrete block with 2 inches of fiberglass batt cavity insulation. Other more recent additions are insulated with 1-1/2 inches of foam board insulation. The interior is mostly painted gypsum wallboard or painted concrete block.

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

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall acceptable, age-appropriate condition with no signs of uncontrolled moisture, air-leakage or other energy-compromising issues.

Roof

The building's roof is predominantly a flat and parapet type over steel decking with a built-up asphalt finish and reflective stone coating. It is original. Two and a half inches of foam board roof insulation were recorded. Also about two and a half inches of under roof deck applied spray cellulose ceiling insulation were added to some parts of the original building a few years ago. Other parts of the building are also covered by a recently updated dark colored EPDM single membrane finish.

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

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall acceptable, age-appropriate condition, with only a few signs of uncontrolled moisture, air-leakage or other energy-compromising issues. A few small leaks were also reported during periods of heavy downpours.

The following specific roof problem spots were identified:

Rocks/nails or other sharp objects on roof surface

Signs of standing water/pooling

Water damaged gypsum wallboard visible in the interior

Base

The building's base is composed of a slab on and below grade floor with a perimeter foundation and no detectable slab edge/perimeter insulation.

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

The building's base and its perimeter were inspected for signs of uncontrolled moisture or water presence and other energy-compromising issues. Overall the base was reported to be in acceptable condition with no signs of uncontrolled moisture, air-leakage and/or other energy-compromising issues except for reports of condensation on ground floor finishes during hot and humid outside conditions.

Windows

The building contains basically two different types of windows.

Casement type windows with non-insulated aluminum frames, clear double glazing and some interior shading devices. The windows are located throughout the building and were replaced 9-11 years ago.

Windows, shading devices, sills, 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 acceptable condition with only a few signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

Exterior doors

The building contains only one type of exterior door.

Aluminum/steel frame with safety glass type exterior doors. They are located throughout the building and are original.

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

The following specific door problem spot was identified:

Missing/worn weather-stripping was found throughout the building

Building air-tightness

Overall the field auditors found the building to be reasonably air-tight with only a few areas of suggested improvements, as described in more detail earlier in this chapter.

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

The building is heated by two boiler plants, with cooling and/or ventilation provided by a combination of rooftop units, heating and ventilating units and exhaust fans for the common and office areas, and unit ventilators for many of the classrooms. Some of the unit ventilators contain a split system DX cooling component and some are heating and ventilating only. The original 1968 building containing the A, B, and C wings, as well as the E Wing addition in 1986 are heated by the original boiler plant. The D Wing was added in 2001-02 and contains its own boiler plant. There are comfort issues throughout the building. Although some of these issues may be attributed to aging equipment, it should also be noted that a good portion of the school HVAC systems are still controlled by the original pneumatic Automatic Temperature Controls (ATC) systems. Partial renovations within the last ten years have come with the addition of standalone digital controls in some equipment, and a Johnson Metasys digital ATC system in other portions of the building. It is likely that the older pneumatic system does not function properly, and that the newer systems may need to be recalibrated.

Equipment

The Marlboro High School has undergone several renovations and three (3) additions since the original building was constructed in 1968. With each renovation or addition, there has been equipment added to condition the affected portion of the building. The following paragraphs contain a summary of the systems in the various portions of the building. A comprehensive Equipment List can be found in Appendix A.

The Auditorium contains two (2) heating and ventilating (H&V) units suspended from the ceiling above the stage. These units provide heating and ventilation for the Auditorium and Stage area. Heating is provided by hot water coils in the units that are fed by the building's original boiler plant. This equipment appears to be original to the building and replacement should be considered as part of a capital improvement project. Two (2) packaged DX cooling rooftop units (RTUs) were added in 2007 and provide cooling for the space. There is also a large rooftop exhaust fan above the Auditorium to provide relief of the fresh air introduced through the H&V units.

One of (2) H&V units serving the auditorium

The Main Office(s) are heated, ventilated and cooled by (2) multi-zone Trane rooftop units. The units utilize hot water heating and DX cooling. As with the majority of the rooftop units on the building, the hot water coils are located in the supply air ductwork just below the roof deck. The units were installed in 1988 and should be replaced. Replacement should provide an increase in cooling efficiency. The Guidance Offices are heated, ventilated and cooled by a Lennox rooftop unit that was installed in 2002. There is a hot water coil in the ductwork below, and DX cooling in the unit. The unit is in good condition and can be retained for another 6-7 years. There are also multiple exhaust fans located above the Main and Guidance offices that provide ventilation to the spaces as well as the associated toilet rooms and corridors.

One of (2) Trane RTUs serving the main offices

The Nurse's Suite is served by an original hot water, floor-mounted Nesbit unit ventilator. This unit should be replaced. Replacement will provide minimal energy savings and should be considered as part of the next capital improvement plan. Three offices adjacent to the

Nurse's suite are heated, ventilated, and cooled by floor-mounted hot water unit ventilators paired with a condensing unit located on the roof.

The Media Center and its ancillary offices are heated, cooled and ventilated by a Trane RTU and a pair of large McQuay air handling units (AHUs) and paired Lennox condensing units. The Trane RTU serves the office and utilizes hot water heating via a hot water coil in the supply ductwork below the roof deck and DX cooling. The unit was installed in 1984 and should be replaced. The McQuay built-up AHUs are located in equipment rooms in the adjacent Media center courtyards. They provide heating and ventilation via hot water coils and fresh-air intakes respectively. Each unit is paired with a Lennox condensing unit located on the roof above the building zone. The McQuay and Lennox units were all manufactured in 2002, are in good condition, and should be retained for another 7-8 years. Trane hydronic unit heaters provide heating to the equipment rooms (1 per room) housing the McQuay units. Several rooftop exhaust fans above the Media Center provide general ventilation and relief of the fresh air introduced through the AHUs.

Trane RTU serving media center offices

Rooms A130, A132, A134, and the adjacent Faculty Lounge are heated, ventilated, and cooled via hot water, floor-mounted AAF unit ventilators and paired Lennox condensing units. All equipment was installed in 2002 and is in good condition. The paired condensing units are located on grade in the adjacent courtyard. The computer room office located between rooms A132 and A134 is conditioned by a Sanyo ceiling-mounted, ductless split system with paired condensing unit also located in the adjacent courtyard. The equipment was installed in 2000 and 2004 respectively and is in good condition.

The remaining classrooms in A Wing are heated and ventilated by hot water, floor-mounted Nesbitt unit ventilators and rooftop exhaust fans. The unit ventilators are original to the building and should be replaced. Replacement will provide minimal energy savings and should be considered as part of the next capital improvement plan. Two of the second floor A Wing classrooms contain laboratory fume exhaust hoods served by rooftop utility set fans.

Example of the floor-mounted, hot water unit ventilators serving the A-wing classrooms

The E Wing was added to the school in 1986 and is heated and ventilated entirely by Trane hot water, floor-mounted and ceiling-mounted unit ventilators and rooftop exhaust fans. The equipment is beyond its expected useful life and should be replaced. Replacement will provide minimal energy savings and should be considered as part of the next capital improvement plan in the district. Four of the second floor E Wing classrooms contain laboratory fume exhaust hoods served by rooftop utility set fans.

Examples of floor-mounted (Left) and ceiling-mounted hot water unit ventilators in the E-wing

D Wing, part of the 2002 addition to the school, houses a portion of the school's science rooms. The first floor rooms and classrooms, as well as room D205, are heated, ventilated and cooled via hot water, floor mounted AAF unit ventilators and paired Lennox condensing units on the 2nd floor roof. The remaining 2nd floor classrooms and all corridors of D Wing are conditioned by RTUs. The units utilize hot water heating and DX cooling. Similar to previously mentioned RTUS on the building, the hot water coils are located in the supply air ductwork just below the roof deck. Six of the second floor D wing classrooms contain laboratory fume exhaust hoods served by rooftop utility set fans. There is a large rooftop make-up air unit serving the wing to compensate for the air lost through the laboratory hoods. All equipment mentioned above for the D Wing is in good condition and should be retained.

The original Cafeteria received an addition in 2002 enlarging the existing cafeteria and adding a Faculty Dining area. The Cafeteria expansion as well as a portion of the original Cafeteria is heated and ventilated by a large rooftop H&V unit located above the addition. The original Cafeteria is heated and ventilated by a large H&V unit located in a crawl space off of room A234. The new rooftop H&V unit serving the expansion is ducted down to diffusers in the new drop ceiling of the expansion area and sidewall diffusers in a soffit serving a portion of the original Cafeteria. The H&V unit serving the original Cafeteria supplies the heating and ventilation via sidewall registers located high on the wall along the hallway leading to the school's A and D wings. A hot water circulation pump is also located in the crawl space and supplies the H&V unit with the required hot water. The Faculty Dining Area is heated, cooled and ventilated via a packaged DX cooling RTU located on the roof above the space which was installed during the addition. The unit makes use of hot water heating and DX cooling. The RTU is in very good condition and should be retained for another 7-8 years. Multiple rooftop exhaust fans above the Cafeteria, Cafeteria addition, and Faculty Dining area provide general ventilation and relief of the fresh air introduced through the H&V units.

Several of the B Wing rooms were renovated approximately (8) years ago and are conditioned in a variety of ways. Room B101 is provided cooling by a condensing unit located on the roof above the space. B107 and B109 are heated and ventilated by a pair of AHUs located in the Wood Storage room between the two rooms. Hot water coils provide the heating for both units. Both units are original to the school and should be replaced. Replacement will provide minimal energy savings and should be considered as part of the next capital improvement plan. B107, which is a computer room, receives cooling via a paired condensing unit located on the roof above the space. The condensing unit was added in 2005 and is in good condition.

One of (2) AHUs located in the wood storage room serving classrooms B107 and B109

Rooms B106 and B108 and their ancillary rooms/offices are heated, ventilated, and cooled by a packaged DX cooling RTU and air handling unit with hot water coil. The RTU was installed in 2001, is in good condition, and should be retained for another 5-6 years. The AHU is located in the Custodial Break room, adjacent to the two spaces, is original to the school, and should be replaced as part of the next capital improvement plan. A circulation pump is located at the unit to provide the required hot water to the coil.

Original AHU located in custodial break room serving B106 and B108 and the ancillary offices

Rooms B111 and B113 were converted from auto-body bays into classrooms and are heated, ventilated, and cooled by a pair of Trane packaged DX cooling rooftop units. The units were installed in 2005 and 2003 respectively and are in good condition. Hot water coils in the supply ductwork provide the required heating for the spaces. Multiple rooftop exhaust fans serve the various B Wing rooms and corridors providing ventilation and relief of the fresh air introduced through the various AHUs mentioned in the sections above. Room B110 is heated and ventilated via a hot water, floor-mounted unit ventilator. This equipment is in fair condition and has exceeded its expected service life of 15 years. Replacement will provide minimal energy savings and should be considered as part of the next capital improvement plan.

In addition to the equipment mentioned above, the Wood Shop rooms (B106, B108, and B109) each contain a ducted dust collection system. The dust collection system serving B109 is located in outside the Wood Shop. This system contains a 10 HP fan that appears to be original to the building. SWA recommends that this system is replaced as part of a capital improvement plan, since the ductwork is in fair to poor condition, and the fan is standard efficiency. Based on the estimated low operating hours of the fan and the cost of replacing the duct system, this measure was not included as an ECM. In addition, SWA recommends that New Jersey codes and OSHA regulations be reviewed to confirm that the room meets the requirements to contain a wood dust collection system since the wood dust is considered combustible. The collection systems serving B106 and B108 are located in an adjacent storage closet. SWA recommends similar action for these two systems as mentioned above.

The Wrestling Gym and Weight Room are heated and ventilated via two (2) H&V units with hot water coils located in a mezzanine area between to the two spaces. The units are original to the school and should be replaced as part of a capital improvement plan in the district. The two gyms are exhausted by multiple rooftop exhaust fans which also provide relief of the fresh air introduced through the H&V units.

The Main Gymnasium is heated and ventilated via four (4) large H&V units. The units are located in the ceiling space of the gym. The fresh air intake is ducted directly from the exterior of the building to the unit. Heating is provided by hot water coils that are served by four (4) circulations pumps (1 per unit) that pump the hot water to the coils. The Gym is exhausted by multiple rooftop exhaust fans. The locker rooms and associated offices that are adjacent to the Main Gym are heated and ventilated by a large air handling unit with hot water coils. This unit is located in an adjacent storage room in the Girl Locker Room. All

H&V and AHUs mentioned directly above are original to the building and have exceeded their expected service lives. Replacement will provide minimal energy savings and should be consider as part of the next capital improvement plan in the district.

Typical H&V unit serving the main gym (Left) and AHU serving the associated locker rooms

The Small Gym is heated and ventilated via two (2) AHUs with hot water coils located in a mezzanine mechanical room above the adjoining locker rooms and are ducted into the ceiling level of the gym as exposed ductwork. The gym is exhausted by multiple rooftop exhaust fans. The locker rooms that are adjacent to the gym are heated and ventilated by an additional AHU with hot water coil also located in the mezzanine level. This unit is ducted through the mezzanine level and down to the various spaces it serves. All AHUs mentioned directly above were installed in the 1980s and have exceeded their expected service lives. This equipment should be replaced as part of a capital improvement plan in the district. The mezzanine itself is heated by a pair of Trane hydronic unit heaters.

One (of 2) AHUs serving the small gym

The New Gym, added in 2002, is heated and ventilated via two (2) large H&V units located on the roof. The units are ducted down into the ceiling space of the gym as exposed ductwork. Heating is provided by hot water coils that are served by two (2) circulation pumps (1 per unit) that pump the hot water to the coils. The Gym is exhausted by a pair of large rooftop exhaust fans that provide relief of the fresh air introduced through the H&V units as well as several rooftop exhaust fans serving the New Gym's equipment room.

The Trainer's Room, part of the New Gym addition in 2002, is cooled by a condensing unit located above the building zone. The unit was installed in 2002, is in good condition, and can be retained for another 10-12 years. A rooftop exhaust fan serves the Trainer's Room toilet and adjacent Girls and Boys toilet rooms.

Classrooms C128 and C130 are conditioned by AAF hot water heating/DX cooling floor-mounted unit ventilators. The associated condensing units are located on the roof. Both the unit ventilators and the rooftop condensers were installed during the 2002 New Gym addition and are in very good condition. The adjacent classroom, C126, still retains its original Nesbitt hot water unit ventilator and receives no cooling. There are several rooftop exhaust fans located above the (3) classrooms providing ventilation.

The Band Room is conditioned by a packaged DX cooling only RTU and ceiling-mounted, hot water unit ventilator. The RTU was installed in 2006 and is in very good condition. The ceiling-mounted unit ventilator is an original Nesbitt unit and should be replaced. The adjacent Choir Room is cooled by a pair of wall-mounted, ductless split systems with matched condensing units on the roof above the space. The split systems were installed in 2005 and are in good condition. A pair of Nesbitt ceiling-mounted, hot water ventilators heat and ventilate the Band/Choir ancillary offices and storage rooms. A hydronic unit heater is also located in the main storage room. The equipment serving the ancillary offices are all original to the school and have exceeded their expected service lives. Replacement will provide minimal energy savings and should be part of a capital improvement plan in the district.   There are several rooftop exhaust fans providing ventilation and relief for Band and Choir rooms.

Original Nesbitt ceiling-mounted unit ventilator serving the music storage room

In general, the rooftop units in this building contain a direct expansion (DX) system for cooling, made up of an evaporator, condenser and refrigerant loop. The heating section consists of a hydronic (hot water) coil located in the supply ductwork below the roof deck. In cooling mode, the refrigerant absorbs heat from the passing air in the evaporator coil and transfers the heat to the atmosphere in the condenser. Much of the equipment contains refrigerant R-22, which contains CFCs and is being phased out of production for environmental reasons. Newer equipment will contain refrigerant R-410A, which is more environmentally-friendly than R-22.

The rooftop units draw in outside air directly, providing a means of ventilation without an additional building penetration above what is required for the distribution ductwork.

The H&V unit coils, unit ventilators, hydronic unit heaters and finned-tube radiation located in the A, B, C, and E Wings of the building are provided with heating hot water by (3) HB Smith sectional cast iron boilers located in the original boiler room. These boilers were installed in 1968 and are in fair to poor condition. This equipment is at the end of its expected life of 30 years per the 2007 ASHRAE Applications Handbook. The thermal efficiency of this equipment can be expected to be approximately 65%.

One (of 3) HB Smith Boilers in the original boiler room

The HB Smith boilers produce heating hot water that is stored in three (3) storage tanks in the original boiler room and pumped by one of six (6) floor-mounted pumps to the A, B, C, and E Wings. The six (6) pumps are in three (3) pairs that operate in lead/lag fashion and serve different sections of the A, B, C, and E wings. One (1) of the pair of floor-mounted pumps was added during the 2002 additions and upgrades to the school. Some pump motors are recommended to be replaced with premium efficiency motors in the ECM section of this report.

The hydronic unit heaters, duct-mounted heating coils and finned-tube radiation located in the D Wing (2002 addition) are provided with heating hot water by two (2) Aerco Benchmark 2.0 condensing boilers located in a boiler room adjacent to Room D102. The boilers were installed in 2002 and are in very good condition. This equipment is about one third of its way through its expected service life of 30 years. The efficiency of this equipment can range from about 80-93%. In general, condensing boilers are most efficient when operating at temperatures that are lower than non-condensing or cast iron boilers.

(2) Aerco benchmark boilers in the 2002 D Wing boiler room

The Aerco boilers produce heating hot water that is pumped by a pair of floor-mounted pumps in the D Wing Boiler Room. These pumps are in very good condition. The pump motors are standard efficiency and are recommended to be replaced with premium efficiency motors in the ECM section of this report.

There are several exhaust fans located on the roof, which serve the bathrooms, kitchen hood and general exhaust. The fans vary in age and condition, but were all operating at the time of the field visit. In general, most of the building exhaust fans have an estimated 0-50% useful operating life left.

Distribution Systems

The heating hot water produced in both boiler rooms is distributed via pumps and copper piping to the H&V unit coils, unit ventilators, finned-tube radiators, unit heaters and cabinet unit heaters scattered throughout the building. The HB Smith boilers are piped in a primary pumping arrangement. Three pairs of floor-mounted pumps in the boiler room operate in a lead-lag fashion to distribute the water to various heating zones throughout the A, B, C, and E Wings of the building. The Aerco boilers are piped in a primary pumping arrangement, with (2) floor-mounted pumps delivering the water to the terminal equipment in the D Wing of the building. These pumps operate in lead-lag fashion, and usually one pump can satisfy the heating load in this area of the building.

Examples of pumps in the original boiler room (Left) and in the 2002 boiler room

A typical rooftop unit arrangement draws in fresh air and brings it into a mixing box, where it is combined with return air from the building. A small portion of the return air is purged and vented outside prior to entering the mixing box. The mixed air inside the air handler is sent through a filter before passing through the evaporator or direct expansion (DX) coil. The air handler fan then pushes the air through the duct-mounted hot water coil before the conditioned air is distributed into the building spaces. The hot water coil is only active in the heating season and the DX system is only active in the cooling season. In between these seasons neither system may operate and only the blower will be active to provide fresh air to the building.

Marlboro High School has constant air volume systems as described above. Typically, with this type of arrangement, the outside air damper is opened and the supply fan runs constantly during occupied hours, and the outside air damper is closed and the supply fan cycles when heating or cooling is required during unoccupied hours. The heating coils contain a control valve that opens to let heating water into the hot water coil upon a heating call from the thermostat. Upon a call for cooling, the DX compressor in the RTU is operated to provide cooling.

There is one (1) large commercial kitchen exhaust hood over the ovens and range in the kitchen. There is no dedicated source of makeup air for this hood. Therefore, it is likely that heated air provided to the Cafeteria is being exhausted out the kitchen hood. Significant energy savings could be realized by installing a dedicated, rooftop, gas-fired makeup air unit in order to minimize conditioned air being lost via the hood. This unit would be ducted into the kitchen adjacent to the hoods.

Controls

There are a few different Automatic Temperature Controls (ATC) systems within the building. The A, B, and C Wing including the Main Gym, Small Gym, adjacent locker rooms, wood shops, Kitchen, and Cafeteria were originally provided with a pneumatic temperature control system whose air compressors and control station is located in the 1968 boiler room. Renovations to some of these areas have updated the controls in the affected areas only. For example, the Band/Choir Room has both Johnson Controls and Honeywell thermostats located in the same room. A Johnsons Controls Panel is located in the Main Boiler Room along with a Honeywell Communications Panel used by an outside vendor to monitor the boilers and other control systems within the building.

Honeywell Communications Panel (Left) and Johnson Control Panel added during a 1980's addition

As is common with older pneumatic ATC systems, many of the thermostats do not provide adequate temperature control. The ATC equipment is beyond its expected service life and there is air leakage in the system, as evidenced by frequent cycling of the air compressor in the original boiler room.

Some examples of the various thermostats encountered in the building

The different controls listed above do not communicate with each other to provide one consistent control scheme throughout the school.

The D Wing boilers are provided with an Aerco boiler control panel. All controls in this portion of the school are computer controlled.

SWA recommends that one uniform ATC system is provided for the school. A logical approach for the district would be to combine and build on the existing Johnson ATC systems to provide one comprehensive ATC system. This would allow salvaging of the controls equipment in a significant portion of the school.

Domestic Hot Water

The domestic hot water (DHW) for the school is provided by an A.O. Smith Burkay type, gas-fired water heater and adjacent storage tank located in the Original Boiler Room. The heater and tank were installed in 2004, and are in very good condition. This system is provided with recirculation pumps to provide a constant supply of domestic hot water throughout the building. This reduces water consumption by eliminating the need to wait for hot water.

Domestic water heater and storage tank in original boiler room

There is also a 45 KW electric booster heater at the dishwasher in the kitchen. This equipment is brand new and in excellent condition.

Commercial Refrigeration

The school also has (2) approximately 8' x 8' walk-in coolers inside the kitchen. The coolers were manufactured by Bally and appear to be original to this portion of the building (1968). The equipment is in fair condition. There is a savings opportunity from changing the original, existing evaporator fan section from the Russell model to a more modern model.

The kitchen also has a walk-in freezer of similar size to the (2) coolers. This freezer is newer and appears to be about (10) years old and in very good condition. There were (3) evaporator fans observed, however no nameplate data was observed to indicate the size.

The kitchen contained three (3) stainless steel coolers/freezers, two (2) commercial refrigerators, two (2) open case coolers, a milk cooler, and several glass door merchandisers, some of which were currently in the Cafeteria space. Most equipment appears to be in relatively good condition.

The kitchen contains one (1) ice machine as well as the New Gym Trainer's Room. This equipment was installed in the last 8-10 years and is in good condition.

Electrical systems

Lighting

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

As of **July 1, 2010** magnetic ballasts most commonly used for the operation of T12 lamps will no longer be produced for commercial and industrial applications. Also, many T12 lamps will be phased out of production starting July 2012.

Interior Lighting - The Marlboro High School currently contains a combination of fixtures with electronically ballasted T8 lamps and magnetically ballasted T12 lamps. Also installed were fixtures with incandescent and CFL (Compact Fluorescent Lightbulb) self ballasted bulbs as well as mercury vapor and pulse start metal halide fixtures. Based on measurements of lighting levels for each space, there are no vastly over-illuminated areas.

Exit Lights - Exit signs were found to be a combination of LED and fluorescent type.

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be a mix of fixtures with electronically ballasted T8, metal halide, and high pressure sodium lamps as well as CFL fixtures. Exterior lighting is controlled by timers.

Appliances and process

SWA has 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, printers, etc. all create an electrical load on the building that is hard to separate out from the rest of the building’s energy usage based on utility analysis.

A total of twenty refrigerators were installed at Marlboro High School. Five of them are newer model efficient units and or ENERGY STAR® qualified units whose replacement is not recommended. Fifteen of the refrigerators are older model inefficient units that SWA recommends replacing with ENERGY STAR® qualified units. Of these fifteen, five are compact refrigerators while ten are full size units.

In the cafeteria and kitchen areas there are nine commercial refrigerators, two refrigerated chiller units, a walk-in refrigerator, two combination walk-in refrigerators and freezers, a commercial dishwasher and ice machine. Also installed in the school were four older model inefficient dishwashers, a washer and dryer, five older model vending machines, four newer model and or ENERGY STAR® qualified refrigerated vending machines and three older model refrigerated vending machines. The four dishwashers are manufactured by Kenmore, Whirlpool and Maytag. The clothes washer is manufactured by GE and is model # WBSR3140G5WW. The dryer is an electric powered unit manufactured by GE and is model # DSSR463EG6WW.

Elevators

Marlboro High School contains one (1) hydraulic elevator in A Wing. The submersible, hydraulic pump was rated at 15 Hp. This elevator is original to the building. Based on the age of the equipment, SWA recommends that this elevator is replaced as part of a capital improvement project. If the elevator is retained, it is recommended that further study is undertaken to confirm that the elevator meets current code, and that the required upgrades are performed to bring the elevator into compliance.

Generator

There is one (1) Onan 75 KW natural gas emergency generator located in the original boiler room. This generator was installed in 1968, is in fair condition overall and has been well maintained considering its age.

Other electrical systems

Currently there are energy-impacting electrical systems installed at Marlboro High School in the form of seventeen transformers. Seven of the transformers are manufactured by General Electric, four of them are 45 kVA units, two are 30 kVA units and the other is a 112.5 kVA unit. Eight of the transformers are manufactured by Cutler Hammer, two of them are 75 kVA units, one is a 45 kVA unit, four are 30 kVA units and the other is a 15 kVA unit. There is also a Jefferson Electric manufactured 75 kVA unit and Federal Pacific Electric manufactured 45 kVA unit.

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 state and federal 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. Technology such as photovoltaic panels or wind turbines, use natural resources to generate electricity on the site. Geothermal systems offset the thermal loads in a building by using water stored in the ground as either a heat sink or heat source. Solar thermal collectors heat a specified volume of water, reducing the amount of energy required to heat water using building equipment. Cogeneration or CHP allows you to generate electricity locally, while also taking advantage of heat wasted during the generation process.

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.

Based on utility analysis and a study of roof conditions, the Marlboro High School is a good candidate for a 48.30 kW or 148.12 kW Solar Panel installation. See ECM's# 13 & 15 for details.

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

Geothermal

The Marlboro High School is not a good candidate for geothermal installation since it would require replacement of the entire existing HVAC system, of which major components still have between 50% and 80% remaining useful life.

Combined Heat and Power

The Marlboro High 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 high electrical baseload to accommodate the electricity generated, as well as a means for using waste heat generated. Typical applications include buildings with an absorption chiller, where waste heat would be used efficiently.

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.

Recommendations: Energy Conservation Measures

ECM#	Description of Recommended 0-5 Year Payback ECMs
1	Install One Hundred and Sixty-Four (164) New CFL Fixtures
2	Retrofit Five (5) Existing Vending Machines with SnackMiser™ Devices
3	Retrofit Three (3) Refrigerated Vending Machines with VendingMiser™ Devices
4	Install (47) New bi-level T8 Fluorescent Fixtures in Stairwells
5	Install Premium Efficiency Motors on Four (4) 10 HP Heating Hot Water Circulators
6	Install Premium Efficiency Motors on Two (2) 5 HP Heating Hot Water Circulators
7	Install Variable Frequency Drives on Four (4) 10 HP Motors of Heating Hot Water Circulators
8	Install Premium Efficiency Motors on Two (2) 3 HP Heating Hot Water Circulators
9	Install Twenty-Eight (28) New Occupancy Sensors
10	Install Twelve (12) New LED Exit Signs
ECM#	Description of Recommended 5-10 Year Payback ECMs
11	Install Variable Frequency Drives on Two (2) 5 HP Motors of Heating Hot Water Circulators
12	Install Twenty-Four (24) New Pulse Start Metal Halide Fixtures
14	Replace Five (5) Compact Refrigerators with 2.7 Cu. Ft. ENERGY STAR® Models
16	Replace Three (3) Cast Iron Boilers with Six (6) 95% AFUE High Efficiency Condensing Boilers
17	Replace Ten (10) Large Refrigerators with ENERGY STAR® Units
18	Replace Four (4) Washing Machines with ENERGY STAR® Units
19	Retrofit Five (5) Existing Refrigerated Coolers and Commercial Refrigerators with CoolerMiser™ Devices
20	Install Variable Frequency Drives on Two (2) 3 HP Motors of Heating Hot Water Circulators
21	Install Five Hundred and Sixty-Four (564) New T8 Fluorescent Fixtures
22	Install Premium Efficiency Motors on Walk-In Box Evaporator Fans
ECM#	Description of Recommended 10 Year or Greater Payback ECMs
23	Replace Trane 4-ton Packaged DX Cooling Only Rooftop HVAC Unit Serving the Main Offices with a 14.8 SEER High Efficiency Unit
24	Replace 5-ton DX Cooling Condensing Unit with 14 SEER High Efficiency Unit
25	Replace Trane 7.5-Ton Packaged DX Cooling Only Rooftop HVAC Unit Serving the Main Offices with a 13 SEER High Efficiency Unit
ECM#	Description of Recommended Renewable Energy ECMs
13	Install 48.30 kW PV Rooftop System
15	Install 148.12 kW PV rooftop system without incentives

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

ECM#1: Install One Hundred and Sixty-Four (164) New CFL Fixtures

On the day of the site visit, SWA completed a lighting inventory of Marlboro High School (see Appendix B). The existing lighting inventory contained a total of 164 inefficient incandescent lamps. SWA recommends that each incandescent lamp is replaced with a more efficient, Compact Fluorescent Lamp (CFL). CFLs are capable of providing equivalent or better light output while using less power.

Installation cost:

Estimated installed cost: $1,476 (includes $820 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

Economics:

est. installed cost, $	est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
1,476	none at this time	1,476	12,919	2.7	0	0.2	767	2,756	5	13,782	0.5	834	167	186	11,075	23,131

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

Rebates/financial incentives:

- There is no incentive available for this measure at this time.

Please see Appendix F for more information on Incentive Programs.

ECM#2: Retrofit Five (5) Existing Vending Machines with SnackMiser™ Devices

A simple plug and play device the VendingMiser™ device is compatible with refrigerated vending machines. It utilizes Passive Infrared Sensors (PIR) to help the vending machine save power. This unit is to be installed on the existing refrigerated vending machines.

Installation cost:

Estimated installed cost: $495 (Includes $100 of labor)
Source of cost estimate: *Manufacturers info*

Economics:

est. installed cost, $	est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
495	0	495	1,664	0.3	0	0.0	0	256	15	3,844	1.9	677	45	52	2,520	2,979

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. Average weekly operating hours = 40.

Rebates/financial incentives:
NJ Clean Energy – None available for this ECM

Please see Appendix F for more information on Incentive Programs.

ECM#3: Retrofit Three (3) Refrigerated Vending Machines with VendingMiser™ Devices

A simple plug and play device the VendingMiser™ device is compatible with refrigerated vending machines. It utilizes Passive Infrared Sensors (PIR) to help the vending machine save power. This unit is to be installed on the existing refrigerated vending machines.

Installation cost:

Estimated installed cost: $597 (Includes $60 of labor)
Source of cost estimate: *Manufacturers info*

Economics:

est. installed cost, $	est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
597	0	597	1,664	0.3	0	0.0	0	256	15	3,844	2.3	544	36	43	2,418	2,979

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. Average weekly operating hours = 40.

Rebates/financial incentives:
NJ Clean Energy – None available for this ECM

Please see Appendix F for more information on Incentive Programs.

ECM#4: Install (47) New bi-level T8 Fluorescent Fixtures in Stairwells

On the day of the site visit, SWA completed a lighting inventory of Marlboro High School (see Appendix B). The school currently contains 27 T8 fluorescent lighting fixtures that are operated 16 hours per day in stairwells. New technology called bi-level lighting, combines fluorescent lighting fixtures with an occupancy sensor. These efficient light fixtures operate at a minimal light level in order to meet code and safety requirements and power up to a higher level when any motion is detected in the stairwells. Marlboro High School would be an appropriate application for these fixtures since there are large periods of time when the stairwells should be unoccupied.

Installation cost:

Estimated installed cost: $6,615 (includes $2,820 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

Economics:

est. installed cost, $	est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	Therms of Natural gas, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
7,790	1,175	6,615	12,320	2.6	0	0.2	0	1,897	15	28,459	3.5	330	22	28	15,711	22,059

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA also assumed an aggregated 5 hrs/yr to replace aging burnt out lamps vs. newly installed.

Rebates/financial incentives:

- *NJ Clean Energy – SmartStart – bi-level T8 fluorescent fixtures ($25 per fixture)- Maximum incentive amount: $1,175*

Please see Appendix F for more information on Incentive Programs

ECM#5: Install Premium Efficiency Motors on Four (4) 10 HP Heating Hot Water Circulators

The original boiler room houses a pair of 10 Hp floor-mounted circulator supply pumps, and the D Wing boiler room houses one pair of 10 Hp floor-mounted circulator supply pumps as part of the hot water heating system to serve the hot water coils in the air handling units and other hot water terminal units listed in this report. The four 10 Hp pumps in the original boiler room are in fair condition and are suggested for replacement as part of a capital improvement project. These pumps are nearing the end of their expected service lives of 20 years. The other pumps mentioned above are in very good condition. All sets of pumps operate in a lead-lag fashion. All pump motors are standard efficiency. Marlboro High School will realize energy savings by utilizing premium efficiency motors for either the existing or new pumps.

Installation cost:

Estimated installed cost: $2,344 (includes $635 labor)
Source of cost estimate: Similar projects and DOE Motor Master International selection & savings analysis

Economics (with incentives):

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 energy 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
2,704	360	2,344	4,354	0.9	0	0.1	0	671	20	13,410	3.5	472	24	28	7,632	5,965

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. The DOE Motor Master International selection and calculator was used with the assumption that one of each set of heating water pumps operates for the heating season. According to weather bin data for McGuire AFB, Trenton, NJ, each set of pumps considered should operate for approximately 4,000 hours per year.

Rebates/financial incentives:

NJ Clean Energy – Premium motors ($45-$700 per motor)
Maximum incentive amount: $576

Please see Appendix F for more information on Incentive Programs.

ECM#6: Install Premium Efficiency Motors on Two (2) 5 HP Heating Hot Water Circulators

The original Boiler Room houses a pair of 5 Hp floor-mounted circulator pumps as part of the hot water heating system to serve the hot water coils and other hot water terminal units in all parts of the building besides D wing. The pair of 5 Hp pumps in the original boiler room are in fair condition and are suggested for replacement as part of a capital improvement project. These pumps are nearing the end of their expected service lives of 20 years. All sets of pumps operate in a lead-lag fashion. All pump motors are standard efficiency. Marlboro High School will realize energy savings by utilizing premium efficiency motors for either the existing or new pumps.

Installation cost:

Estimated installed cost: $700 (includes $317 labor)
Source of cost estimate: Similar projects and DOE Motor Master International selection & savings analysis

Economics (with incentives):

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 energy 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
808	108	700	1,127	0.2	0	0.0	0	174	20	3,471	4.0	396	20	24	1,882	1,544

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. The DOE Motor Master International selection and calculator was used with the assumption that one of each set of heating water pumps operates for the heating season. According to weather bin data for McGuire AFB, Trenton, NJ, each set of pumps considered should operate for approximately 4,000 hours per year.

Rebates/financial incentives:

NJ Clean Energy – Premium motors ($45-$700 per motor)
Maximum incentive amount: $576

Please see Appendix F for more information on Incentive Programs.

ECM#7: Install Variable Frequency Drives on Four (4) 10 HP Motors of Heating Hot Water Circulators

The original boiler room houses a pair of 10 Hp floor-mounted circulator supply pumps, and the D Wing boiler room houses one pair of 10 Hp floor-mounted circulator supply pumps as part of the hot water heating system to serve the hot water coils in the air handling units and other hot water terminal units listed in this report. All pairs of pumps operate in a lead/lag fashion. The pump motors are on-off operation. Adding variable frequency drives (VFDs) to these pumps will vary the flow according to the required heating capacity to better meet the load of the building. Marlboro High School will realize energy savings by utilizing variable frequency drives for the pump motors, and incorporating this new motor control method into the BMS programming.

Installation cost:

Estimated installed cost: $21,200 (includes $6,000 labor)
Source of cost estimate: RS Means Cost Data and Honeywell VFD Quick Savings Estimator

Economics (with no incentives):

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 energy 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
21,200	0	21,200	32,226	6.7	0	0.4	0	4,963	20	99,256	4.3	368	18	23	52,634	44,150

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. The Honeywell VFD Quick Savings Estimator was used with the assumption that one of each set of heating water pumps operates for the heating season. According to weather bin data for McGuire AFB, Trenton, NJ, each set of pumps considered should operate for approximately 4,000 hours per year.

Rebates/financial incentives:
NJ Clean Energy – There are no incentives at this time for hot water pump applications, only for chilled water pumps and centrifugal fans.

Please see Appendix F for more information on Incentive Programs.

ECM#8: Install Premium Efficiency Motors on Two (2) 3 HP Heating Hot Water Circulators

The original Boiler Room houses a pair of 3 Hp floor-mounted circulator pumps as part of the hot water heating system to serve the hot water coils and other hot water terminal units in all parts of the building besides D wing. They serve the heating equipment in the D Wing and are in very good condition. All sets of pumps operate in a lead-lag fashion. All pump motors are standard efficiency. Marlboro High School will realize energy savings by utilizing premium efficiency motors for either the existing or new pumps.

Installation cost:

Estimated installed cost: $606 (includes $335 labor)
Source of cost estimate: Similar projects and DOE Motor Master International selection & savings analysis

Economics (with incentives):

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 energy 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
714	108	606	890	0.2	0	0.0	0	137	20	2,741	4.4	352	18	22	1,433	1,219

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. The DOE Motor Master International selection and calculator was used with the assumption that one of each set of heating water pumps operates for the heating season. According to weather bin data for McGuire AFB, Trenton, NJ, each set of pumps considered should operate for approximately 4,000 hours per year.

Rebates/financial incentives:

NJ Clean Energy – Premium motors ($45-$700 per motor)
Maximum incentive amount: $576

Please see Appendix F for more information on Incentive Programs.

ECM#9: Install Twenty-Eight (28) New Occupancy Sensors

On the days of the site visits, SWA completed a lighting inventory of Marlboro High School (see Appendix B). The building contains twenty two areas that could benefit from the installation of twenty-eight occupancy sensors. These areas consisted of various offices, meeting rooms, lounges, and bathrooms that 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 micro-phonic lighting sensors include sound detection as a means to controlling lighting operation.

Installation cost:

Estimated installed cost: $5,600 (includes $2,240 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

Economics:

est. installed cost, $	est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	Therms of Natural gas, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
6,160	560	5,600	7,570	1.6	0	0.1	0	1,166	15	17,487	4.8	212	14	19	8,118	13,554

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

Rebates/financial incentives:

- *NJ Clean Energy – SmartStart – Wall-mounted Occupancy Sensors ($20 per control)- aximum incentive amount: $560*

Please see Appendix F for more information on Incentive Programs.

ECM#10: Install Twelve (12) New LED Exit Signs

On the days of the site visits, SWA completed a lighting inventory of the Marlboro High School (see Appendix B). The school currently contains 12 fluorescent exit signs. SWA recommends replacing these exit signs with newer, more efficient LED models. Exit signs present a good opportunity for savings since they are operated 24 hours per day.

Installation cost:

Estimated installed cost: $1,566 (includes $180 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

Economics:

est. installed cost, $	est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	Therms of Natural gas, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
1,806	240	1,566	1,218	0.3	0	0.0	128	316	15	4,736	5.0	202	13	19	2,149	2,180

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

Rebates/financial incentives:

- *NJ Clean Energy – SmartStart – LED Exit Signs ($20 per fixture)- Maximum incentive amount: $240*

Please see Appendix F for more information on Incentive Programs

ECM#11: Install Variable Frequency Drives on Two (2) 5 HP Motors of Heating Hot Water Circulators

The original boiler room houses a pair of 5 Hp, supply pumps as part of the hot water heating system to serve the hot water coils in the air handling units and other hot water terminal units listed in this report. All pairs of pumps operate in a lead/lag fashion. The pump motors are on-off operation. Adding variable frequency drives (VFDs) to these pumps will vary the flow according to the required heating capacity to better meet the load of the building. Marlboro High School will realize energy savings by utilizing variable frequency drives for the pump motors, and incorporating this new motor control method into the BMS programming.

Installation cost:

Estimated installed cost: $7,900 (includes $3,000 labor)
Source of cost estimate: RS Means Cost Data and Honeywell VFD Quick Savings Estimator

Economics (with no incentives):

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 energy 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
7,900	0	7,900	8,056	1.7	0	0.1	0	1,241	20	24,812	6.4	214	11	15	10,557	11,037

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. The Honeywell VFD Quick Savings Estimator was used with the assumption that one of each set of heating water pumps operates for the heating season. According to weather bin data for McGuire AFB, Trenton, NJ, each set of pumps considered should operate for approximately 4,000 hours per year.

Rebates/financial incentives:

NJ Clean Energy – There are no incentives at this time for hot water pump applications, only for chilled water pumps and centrifugal fans.

Please see Appendix F for more information on Incentive Programs.

ECM#12: Install Twenty-Four (24) New Pulse Start Metal Halide Fixtures

On the day of the site visit, SWA completed a lighting inventory of the Marlboro High School (see Appendix B). The existing lighting inventory contained twenty-four fixtures with inefficient metal halide lamps. SWA recommends replacing them with more efficient, Pulse Start Metal Halide fixtures with electronic ballasts. Pulse Start Metal Halide fixtures with electronic ballasts provide equivalent or better light output while reducing energy consumption by 30% when compared to metal halide or high pressure sodium fixtures. .

Installation cost:

Estimated installed cost: $18,600 (includes $11,400 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

Economics:

est. installed cost, $	est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
19,200	600	18,600	15,418	3.2	0	0.2	60	2,434	15	36,515	7.6	96	6	10	10,045	27,605

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA also assumed an aggregated 1 hr/yr to replace aging burnt out lamps vs. newly installed.

Rebates/financial incentives:

- NJ Clean Energy - Smart Start - Pulse Start Metal Halide Fixtures ($25 per fixture) - *Maximum incentive amount: $600*

Please see Appendix F for more information on Incentive *Programs.*

ECM's#13 & 15: Install 148.12 kW PV rooftop system without incentives Or Install 48.30 kW PV rooftop system with incentives

Currently, the building does not use any renewable energy systems. Renewable energy systems such as photovoltaic (PV) panels can be mounted on the building roof facing south which can offset a portion of the purchased electricity for the building. Power stations generally have two separate electrical charges: usage and demand. Usage is the amount of electricity in kilowatt-hours that a building uses from month to month. Demand is the amount of electrical power that a building uses at any given instance in a month period. During the summer periods, electric demand at a power station is high, due to the amount of air conditioners, lights, and other equipment being used within the region. Demand charges increase to offset the utility's cost to provide enough electricity at that given time. Photovoltaic systems offset the amount of electricity used by a building and help to reduce the building's electric demand, resulting in a higher cost savings. Installing a PV system will offset electric demand and reduce annual electric consumption, while utilizing available state incentives. PV systems are modular and readily allow for future expansions.

The size of the system was determined considering the available roof surface area, without compromising service space for roof equipment and safety, as well as the facilities' annual base load and mode of operation. A PV system could be installed on a portion of the roof with panels facing south. A commercial multi-crystalline 230 watt panel has 17.5 square feet of surface area (providing 13.1 watts per square foot). A 48.30 kW system needs approximately 210 panels which would take up 3,684 square feet. The larger 148.12 kW system would require approximately 644 panels which would take up 11,296 square feet.

A PV system would reduce the building's electric load and allow more capacity for surrounding buildings as well as serve as an example of energy efficiency for the community. The building is not eligible for a residential 30% federal tax credit. Marlboro High School may want to consider applying for a grant and / or engage a PV generator / leaser who would install the PV system and then sell the power at a reduced rate. Typically, a major utility provides the ability to buy SREC's at $600/MWh or best market offer.

Two different system sizes were proposed due to installation incentives only being offered for systems less than 50kW in size. The first option takes advantage of these incentives by staying below the 50kW system threshold, and the second option takes advantage of the total usable space on the school's roof to install a PV system. SWA recommends installing the larger system; however, if sufficient funding is not available, Marlboro High School should at least install the 48.30kW system. As mentioned above, these systems are modular and can be expanded in the future.

Please note that this analysis did not consider the structural capability of the existing building to support the above recommended system. SWA recommends that Marlboro High School contract with a structural engineer to determine if additional building structure is required to support the recommended system and what costs would be associated with incorporating the additional supports prior to system installation. Should additional costs be identified, Marlboro High School should include these costs in the financial analysis of the project.

Installation cost:
Estimated installed cost – 148.12 kW system: $1,110,900 (includes $444,360 of labor)
Estimated installed cost – 48.30 kW system: $339,750 (includes $144,900 of labor)
Source of cost estimate: Similar projects.

ECM#13: Install 48.30 kW PV rooftop system with incentives

Economics (with incentives):

Install a 48.30 kW PV System with Incentives																
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 energy 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
362,250	22,500	339,750	59,098	48	0	0.8	0	44,501	25	227,527	7.6	123.3	4.9	10.6	241,332	80,964

cash flow yr 0	cash flow yr 1	cash flow yr 2	cash flow yr 3	cash flow yr 4	cash flow yr 5	cash flow yr 6	cash flow yr 7	cash flow yr 8	cash flow yr 9	cash flow yr 10	cash flow yr 11	cash flow yr 12
-339,750	44,501	44,501	44,501	44,501	44,501	44,501	44,501	44,501	44,501	44,501	44,501	44,501

cash flow yr 13	cash flow yr 14	cash flow yr 15	cash flow yr 16	cash flow yr 17	cash flow yr 18	cash flow yr 19	cash flow yr 20	cash flow yr 21	cash flow yr 22	cash flow yr 23	cash flow yr 24	cash flow yr 25
44,501	44,501	44,501	9,101	9,101	9,101	9,101	9,101	9,101	9,101	9,101	9,101	9,101

ECM#15: Install 148.12 kW PV rooftop system without incentives

Economics (without incentives):

Install a 148.12 kW PV System without Incentives																	
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 energy 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
1,110,900	0	1,110,900	178,742	148	0	2.3	0	134,326	25	688,157	8.3	106.2	4.2	9.3	643,390	244,877

cash flow yr 0	cash flow yr 1	cash flow yr 2	cash flow yr 3	cash flow yr 4	cash flow yr 5	cash flow yr 6	cash flow yr 7	cash flow yr 8	cash flow yr 9	cash flow yr 10
-1,110,900	134,326	134,326	134,326	134,326	134,326	134,326	134,326	134,326	134,326	134,326

cash flow yr 11	cash flow yr 12	cash flow yr 13	cash flow yr 14	cash flow yr 15	cash flow yr 16	cash flow yr 17	cash flow yr 18	cash flow yr 19	cash flow yr 20	cash flow yr 21	cash flow yr 22	cash flow yr 23
134,326	134,326	134,326	134,326	134,326	27,526	27,526	27,526	27,526	27,526	27,526	27,526	27,526

cash flow yr 24	cash flow yr 25
27,526	27,526

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

Rebates/financial incentives:

NJ Clean Energy - Renewable Energy Incentive Program, Incentive based on $0.75 / watt Solar PV application for the first 30 kW of systems 50 kW or less. Incentive amount for this application is $22,500 for the 48.30 kW proposed option. There are no associated incentives for the larger 148.12 kW system due to the NJ Clean Energy - Renewable Energy Incentive Program's cap on the size of the PV system.

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

NJ Clean Energy - Solar Renewable Energy Certificate Program. Each time a solar electric system generates 1,000kWh (1MWh) of electricity, a SREC is issued which can then be sold or traded separately from the power. The buildings must also become net-metered in order to earn SRECs as well as sell power back to the electric grid. A total annual SREC credit of $35,400 has been incorporated in the above costs for the 48.30 kW system and an annual SREC credit of $106,800 for the 148.12 kW system; however, it requires proof of performance, application approval and negotiations with the utility.

Options for funding ECM:

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

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

Please see Appendix F for more information on Incentive Programs.

ECM#14: Replace Five (5) Compact Refrigerators with 2.7 Cu. Ft. ENERGY STAR® Models

On the day of the site visit, SWA observed that there were seven older 2.7 cu. ft. model refrigerators that are not ENERGY STAR® rated (using approximately 254 kWh/year). Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. SWA recommends the replacement of the older model compact refrigerators with a 2.7 cf. ft. ENERGY STAR® model or equivalent. Besides saving energy, the replacement will also keep their surroundings cooler. When compared to the average electrical consumption of older equipment, Energy Star equipment results in large savings. Look for the Energy Star label when replacing appliances and equipment, including: window air conditioners, refrigerators, printers, computers, copy machines, etc. More information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov.

Installation cost:

Estimated installed cost: $495 (Includes $75 in labor cost)
Source of cost estimate: Manufacturer and Store established costs

Economics:

est. installed cost, $	est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
495	0	495	400	0.1	0	0.0	0	62	12	739	8.0	49	4	9	230	716

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

Rebates/financial incentives:

- There is no incentive available for this measure at this time.

Please see Appendix F for more information on Incentive Programs.

ECM#16: Replace Three (3) Cast Iron Boilers with Six (6) 95% AFUE High Efficiency Condensing Boilers

The existing cast iron HB Smith boilers in the Original Boiler room were installed in 1968 and are in fair condition. The boilers are relatively inefficient as compared to modern boilers. No outdoor temperature reset controls were observed. The boilers should be considered for replacement to achieve energy savings as well as operating and maintenance savings. The initial efficiency of the existing boilers is approximately 80%, but it can be assumed that in the time since installation, it has degraded to an efficiency of about 65%. An upgrade to a pair of higher efficiency condensing boilers of minimum 84% combustion efficiency each should be considered by Marlboro High School as a means of energy conservation.

The new high efficiency condensing boilers should have a guaranteed minimum thermal efficiency of 85% at the worst case boiler operating conditions, such as mid-fire or high-fire conditions with a return water temperature in the range of 140-160 degrees Fahrenheit, and efficiencies of up to 95% achievable with lower return water temperatures. The boiler should be Low NOx certified with a 5:1 turndown burner, PVC direct venting and direct exhaust, hydronic safety controls and interface systems. The boiler shall have compact design for easy retrofit installation, with sectional aluminum block, ASME relief valve, stainless steel burner as a minimum. The air blower should be variable speed combustion with easily removable access panels. Model shall be similar to Patterson-Kelley C-2000 condensing boiler

Installation cost:

Estimated installed cost: $261,000 (includes $63,000 of labor)
Source of cost estimate: Manufacturer's data and similar projects

Economics:

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 energy 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
273,000	12,000	261,000	0	0.0	20,575	7.8	0	31,788	25	794,709	8.2	204	8	11	292,536	240,728

Assumptions: SWA calculated the savings for this measure using nameplate data taken on the day of the field visit and using the billing analysis and that the boiler will be replaced with (6) 2,000 MBH input capacity boilers.

Rebates/financial incentives:
NJ Clean Energy - Gas-fired boilers > 1500 MBH - ≤4000 MBH ($1.00 per MBH)
Maximum incentive amount is $12,000.

Please see Appendix F for more information on Incentive Programs.

ECM#17: Replace Ten (10) Large Refrigerators with ENERGY STAR® Units

On the day of the site visit, SWA observed that there were ten older 17 cu. ft. model inefficient refrigerators in the apartment units which were not Energy Star rated (using approximately 773 kWh/yr each). Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. SWA recommends the replacement of the existing older refrigerators with a 17 cu. ft. top freezer refrigerator ENERGY STAR®, or equivalent. Besides saving energy, the replacement will also keep their surroundings cooler. When compared to the average electrical consumption of older equipment, Energy Star equipment results in large savings. Look for the Energy Star label when replacing appliances and equipment, including: window air conditioners, refrigerators, printers, computers, copy machines, etc. More information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov.

Installation cost:

Estimated installed cost: $4,500 (includes $1,000 of labor)
Source of cost estimate: Manufacturer

Economics:

est. installed cost, $	est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	Therms of Natural gas, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
4,500	0	4,500	3,000	0.6	0	0.0	34	496	12	5,952	9.1	32	3	7	1,336	5,372

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

Rebates/financial incentives:

- *None*

Please see Appendix F for more information on Incentive Programs

ECM#18: Replace Four (4) Washing Machines with ENERGY STAR® Units

On the day of the site visit, SWA observed that there were four older model washing machines installed. SWA recommends replacing these units with four new ENERGY STAR® labeled washing machines.

Installation cost:

Estimated installed cost: $3,200 (includes $200 of labor)
Source of cost estimate: Manufacturer

Economics:

est. installed cost, $	est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	Therms of Natural gas, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
3,200	0	3,200	2,000	0.4	0	0.0	34	342	12	4,104	9.4	28	2	7	824	3,581

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

Rebates/financial incentives:

- *None*

Please see Appendix F for more information on Incentive Programs

ECM#19: Retrofit Five (5) Existing Refrigerated Coolers and Commercial Refrigerators with CoolerMiser™ Devices

A simple plug and play device the CoolerMiser™ device is compatible with refrigerated coolers and commercial refrigerators. It utilizes Passive Infrared Sensors (PIR) to help the vending machine save power. This unit is to be installed on the existing refrigerated vending machines.

Installation cost:

Estimated installed cost: $1,990 (Includes $100 of labor)
Source of cost estimate: *Manufacturers info*

Economics:

est. installed cost, $	est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
1,990	0	1,990	1,331	0.3	0	0.0	0	205	15	3,075	9.7	55	4	6	422	2,383

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. Average weekly operating hours = 40.

Rebates/financial incentives:
NJ Clean Energy – None available for this ECM

Please see Appendix F for more information on Incentive Programs

ECM#20: Install Variable Frequency Drives on Two (2) 3 HP Motors of Heating Hot Water Circulators

The original boiler room houses a pair of 3 HP as part of the hot water heating system to serve the hot water coils in the air handling units and other hot water terminal units listed in this report. All pairs of pumps operate in a lead/lag fashion. The pump motors are on-off operation. Adding variable frequency drives (VFDs) to these pumps will vary the flow according to the required heating capacity to better meet the load of the building. Marlboro High School will realize energy savings by utilizing variable frequency drives for the pump motors, and incorporating this new motor control method into the BMS programming.

Installation cost:

Estimated installed cost: $7,300 (includes $3,000 labor)
Source of cost estimate: RS Means Cost Data and Honeywell VFD Quick Savings Estimator

Economics (with no incentives):

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 energy 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
7,300	0	7,300	4,834	1.0	0	0.1	0	744	20	14,889	9.8	104	5	8	3,775	6,623

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. The Honeywell VFD Quick Savings Estimator was used with the assumption that one of each set of heating water pumps operates for the heating season. According to weather bin data for McGuire AFB, Trenton, NJ, each set of pumps considered should operate for approximately 4,000 hours per year.

Rebates/financial incentives:
NJ Clean Energy – There are no incentives at this time for hot water pump applications, only for chilled water pumps and centrifugal fans.

Please see Appendix F for more information on Incentive Programs.

ECM#21: Install Five Hundred and Sixty-Four (564) New T8 Fluorescent Fixtures

On the day of the site visit, SWA completed a lighting inventory of the Marlboro High School (see Appendix B). The existing lighting inventory contained five hundred and sixty-four 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 a T12 fixture with magnetic ballast.

Installation cost:

Estimated installed cost: $84,537 (includes $22,560 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

Economics:

est. installed cost, $	est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
92,997	8,460	84,537	28,225	5.9	0	0.4	4,235	8,581	15	128,720	9.9	52	3	6	16,441	50,536

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA also assumed an aggregated 4 hrs/yr to replace aging burnt out lamps vs. newly installed.

Rebates/financial incentives:

- NJ Clean Energy - Smart Start - T8 fixtures with electronic ballasts ($15 per fixture) - Maximum Amount: $8,460

Please see Appendix F for more information on Incentive Programs.

ECM#22: Install Premium Efficiency Motors on Walk-In Box Evaporator Fans

There are two (2) walk-in cooler boxes and one (1) walk-in freezer box in the Kitchen of Marlboro High School. The freezer is relatively new and can be ignored for the purposes of this ECM. Typically, the evaporator and condenser fans of walk-in coolers will run 24 hours per day, 7 days per week for a cooler and 18 hours per day, 7 days per week for a freezer. The motors on these fans are standard efficiency, shaded pole motors. It is assumed the motors are fractional horsepower. Marlboro High School will realize energy savings by utilizing premium efficiency motors for these fans.

Installation cost:

Estimated installed cost: $3,500 (includes $1,300 of labor)
Source of cost estimate: Similar projects and manufacturer's data

Economics (with incentives):

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 energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
3,500	0	3,500	2,283	0.5	0	0.0	0	352	20	7,032	10.0	101	5	329	682,207	3,128

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. Calculations were completed with the assumption that all of the cooler fans operate for 8,760 hours per year and all of the freezer fans operate for 6,570 hours per year.

Rebates/financial incentives:
NJ Clean Energy – There are no incentives available since these are single phase, fractional horsepower motors

Please see Appendix F for more information on Incentive Programs.

ECM#23: Replace Trane 4-ton Packaged DX Cooling Only Rooftop HVAC Unit Serving the Main Offices with a 14.8 SEER High Efficiency Unit

The Main Offices are cooled by a 4-ton packaged DX cooling only rooftop unit located on the roof above the associated building zone. The equipment was installed in 1988 and is beyond the end of its expected service lives of 15 years. SWA recommends replacement of the packaged rooftop unit to gain an increase in operating efficiency. This measure cannot be justified by energy savings alone, but should be considered as an end-of-life-cycle energy savings opportunity.

The current 4-ton equipment is operating with a cooling Seasonal Energy Efficiency Ratio (SEER) of approximately 8.0. The new equipment should have a 14.8 SEER rating. The equipment shall be Energy Star certified and ASHRAE 90.1 compliant. The equipment shall utilize R-410A refrigerant.

Installation cost:

Estimated installed cost $9,632 (includes $3,000 of labor)
Source of cost estimate: Manufacturer’s data and similar projects

Economics (with incentives):

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 energy 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
10,000	368	9,632	3,308	0.7	0	1.1	0	509	15	7,890	18.9	-18	-1	-3	-3,550	4,532

Assumptions: SWA calculated the savings for this measure using nameplate data taken on the days of the field visits and using the billing analysis, and by estimating the total of 1,200 cooling hours for one year using weather bin data for McGuire AFB, Trenton, NJ.

Rebates/financial incentives:

NJ Clean Energy - Electric Unitary HVAC <5.4 tons and Min. 14.0 SEER ($92/ton)
Maximum incentive amount is $368.

NJ Clean Energy - Electric Unitary HVAC ≥5.4 tons to <11.25 tons and Min. 11.5 EER ($73/ton)
Maximum incentive amount is $547.50.

Please see Appendix F for more information on Incentive Programs.

ECM#24: Replace 5-ton DX Cooling Condensing Unit with 14 SEER High Efficiency Unit

Several of the Main Offices are cooled by a 5-ton split system DX cooling condensing unit located on the roof above the associated building zone. This piece of equipment was installed in 1968 and is beyond its expected service life of 20 years. SWA recommends replacement of the condensing unit to gain increase in operating efficiency. This measure cannot be justified by energy savings alone, but should be considered as an end-of-life-cycle energy savings opportunity.

The current equipment is operating with a cooling Seasonal Energy Efficiency Ratio (SEER) of approximately 8.0. The new equipment should have a minimum 12.0 SEER rating, but preferably 14.0 SEER. The higher SEER will involve increased cost for the equipment over units with lower EER. The equipment shall be Energy Star certified and ASHRAE 90.1 compliant. The equipment shall utilize R-410A refrigerant.

Installation cost:

Estimated installed cost: $12,040 (includes $3,750 of labor)
Source of cost estimate: Manufacturer's data and similar projects

Economics (with incentives):

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 energy 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
Replace 5-ton split system condensing unit with 12-SEER unit																
10,000	0	10,000	3,000	0.6	0	1.0	0	462	20	9,540	21.6	-5	0	-4	-4,485	4,110
Incremental cost to replace 5-ton condensing unit with 14-SEER unit vs. 12-SEER unit																
2,500	460	2,040	857	0.2	0	0.3	0	132	20	2,725	15.5	34	2	0	-464	1,174
Replace 5-ton split system condensing unit with 14-SEER unit																
12,500	**460**	**12,040**	**3,857**	**0.8**	**0**	**1.2**	**0**	**594**	**20**	**12,265**	**20.3**	**2**	**0**	**-4**	**-4,949**	**5,284**

Assumptions: SWA calculated the savings for this measure using nameplate data taken on the days of the field visits and using the billing analysis, and by estimating the total of 1,200 cooling hours for one year using weather bin data for McGuire AFB, Trenton, NJ.

Rebates/financial incentives:
NJ Clean Energy - Electric Unitary HVAC <5.4 tons and Min. 14.0 EER ($92/ton)
Maximum incentive amount is $460.

Please see Appendix F for more information on Incentive Programs.

ECM#25: Replace Trane 7.5-Ton Packaged DX Cooling Only Rooftop HVAC Unit Serving the Main Offices with a 13 SEER High Efficiency Unit

The Main Offices are cooled by a 7.5-ton packaged DX cooling only rooftop unit located on the roof above the associated building zone. This piece of equipment was installed in 1988 and is beyond the end of its expected service lives of 15 years. SWA recommends replacement of the packaged rooftop unit to gain an increase in operating efficiency. This measure cannot be justified by energy savings alone, but should be considered as an end-of-life-cycle energy savings opportunity.

The current 7.5-ton equipment is operating with a cooling Energy Efficiency Ratio (EER) of approximately 8.0. The new equipment should have a minimum 11.0 EER rating, but preferably 13.0 EER. The higher SEER/EER for each of the units will involve increased cost for the equipment over units with lower SEER/EER. The equipment shall be Energy Star certified and ASHRAE 90.1 compliant. The equipment shall utilize R-410A refrigerant.

Installation cost:

Estimated installed cost (7.5-ton Unit): $18,203 (includes $5,625 of labor)
Source of cost estimate: Manufacturer’s data and similar projects

Economics (with incentives):

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 energy 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
Incremental cost to replace Trane 7.5-ton cooling only rooftop unit with 14.8 SEER unit vs. 12 SEER unit																
2,000	368	1,632	908	0.2	0	0.3	0	140	15	2,166	11.7	33	2	3	37	1,244
Replace Trane 7.5-ton cooling only rooftop unit with 11 EER unit																
15,000	0	15,000	3,682	0.8	0	1.2	0	567	15	8,782	26.5	-41	-3	-6	-8,231	5,044
Incremental cost to replace Trane 7.5-ton cooling only rooftop unit with 13 EER unit vs. 11 EER unit																
3,750	547.50	3,203	1,510	0.3	0	0.5	0	233	15	3,601	13.8	12	1	1	-426	2,069
Replace Trane 7.5-ton cooling only rooftop unit with 13 EER unit																
18,750	**547.50**	**18,203**	**5,192**	**1.1**	**0**	**1.7**	**0**	**800**	**15**	**12,383**	**22.8**	**-32**	**-2**	**-5**	**-8,657**	**7,113**

Assumptions: SWA calculated the savings for this measure using nameplate data taken on the days of the field visits and using the billing analysis, and by estimating the total of 1,200 cooling hours for one year using weather bin data for McGuire AFB, Trenton, NJ.

Rebates/financial incentives:

NJ Clean Energy - Electric Unitary HVAC <5.4 tons and Min. 14.0 SEER ($92/ton)
Maximum incentive amount is $368.

NJ Clean Energy - Electric Unitary HVAC ≥5.4 tons to <11.25 tons and Min. 11.5 EER ($73/ton)
Maximum incentive amount is $547.50.

Please see Appendix F 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, or if the installed costs can be shared with other improvements, such as major building renovations. SWA recommends the following capital improvements for the Marlboro High School:

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

- Replace existing clothes dryers with the most energy efficient units available, even though ENERGY STAR® does not qualify dryers.

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

- Replace common area heating equipment - such as finned tube radiation and cabinet unit heaters in the toilet rooms, vestibules and corridors. This equipment is in fair condition, but age and wear have reduced the heat transfer capacity. This equipment should be replaced with more modern equipment suited for the intended use. These changes cannot be justified based on energy savings alone. However, replacement is strongly recommended along with upgrades to other portions of the heating system. This is a replacement in kind recommendation which offers negligible energy savings.

- Replace and re-commission the Automatic Temperature Controls (ATC) system - There are a few different systems within Marlboro High School that do not communicate with each other, as detailed in Section 2.1 Mechanical Systems, Controls above. In general, the building has fair temperature control, mostly due to the efforts of the maintenance staff. It should be noted that it is difficult to get replacement parts for the original pneumatic and Honeywell ATC systems. SWA recommends that one uniform ATC system is provided for the school. Since the school has a few separate areas with a Johnson Controls system, SWA recommends that the School removes the ATC systems in the remainder of the school and upgrades and enhances the existing Johnson systems to provide one, comprehensive ATC system. In addition, any equipment not currently interfaced with a current ATC system shall be incorporated into the new ATC system. The Johnson system is open BACnet protocol. The cost to provide one Johnson ATC system utilizing as much of the existing system as possible is $1,340,000.

- Replace unit ventilators - The (51) Nesbitt unit ventilators installed in 1968 and (26) E Wing units were installed in 1986. These units are beyond their expected service life. Considering the increased maintenance repair costs and that replacement parts are difficult to find, SWA recommends replacement of this equipment. There is better control offered by the newer, electronically controlled units, although energy savings are negligible.
    - The unit ventilators are operating beyond their useful operating lives. SWA evaluated replacement of all (77) units with new. The updated fan coils should be double inlet, forward curved of centrifugal variety; have a maximum speed of 1,000 rpm with permanent split capacitor motors. The fan housing should be constructed of heavy

gauge metal to help reduce air noise during operation. Wheel motors are to be premium efficiency, single speed, and permanent split capacitor with overload protection. Each fan should be equipped with a three speed switch for air balancing. An ultra-low leak, blade type outside air damper will ensure low leakage of the outside air when the equipment is not operating. The unit shall have a solid-state defrost control system and two separate filters. The provided air-to-air heat exchanger should be designed to support two air streams in a counter-flow direction. The heat exchanger matrix shall permit less than one percent of cross contamination between the air streams. The heat exchanger shall have an effectiveness of approximately 80% with equal airflow. The proposed unit will not be that much more energy efficient than the existing unit. The estimated budget installed cost of 77 new fan coil ventilators is $734,000. The recommended enhancements over the replacement in kind will offer negligible energy savings.

  - Marlboro High School may wish to consider adding DX cooling as part of the equipment replacement. In this case, it should be recognized that cooling will result in an increase in energy usage versus providing heating and ventilation only. The estimated budget installed cost for DX coil and air cooled condensing units for the unit ventilators is an additional $282,000. ***Note that the addition of air conditioning may require an upgrade to the existing electric service. The cost of the electric service upgrade is broken out separately below but should be included if the cooling option above is incorporated.***

- Replace (5) H&V units serving the Main Gym and associated Locker Rooms - The hot water heating only ventilation system for the Main Gym is beyond its expected service life. SWA recommends that this equipment is replaced as part of a capital improvement project, and that it is designed to provide code minimum ventilation rates. The estimated budget installed cost for (5) hot water H&V units for the Main Gym and its associated Locker Rooms is $243,750. Marlboro High School may wish to consider providing DX cooling as part of this system to make the room more functional in warm weather, but should recognize that this will increase energy usage versus providing a heating and ventilation system only. If cooling is desired, it is strongly recommended that a system is provided that utilizes a heat recovery wheel for pretreatment of the outside air and CO_2 sensors for demand control ventilation. This is a replacement in kind recommendation which offers negligible energy savings. The estimated budget installed cost for (5) rooftop H&V units with DX cooling and heat recovery wheel is $350,000. ***Note that the addition of air conditioning may require an upgrade to the existing electric service. The cost of the electric service upgrade is broken out separately below but should be included if the cooling option above is incorporated.***

- Replace (3) H&V units serving the Small Gym and associated Locker Rooms - The hot water heating only ventilation system for the Small Gym and its Locker Rooms is beyond its expected service life. SWA recommends that this equipment is replaced as part of a capital improvement project, and that it is designed to provide code minimum ventilation rates. The estimated budget installed cost for (3) hot water H&V units for the Small Gym and its associated Locker Rooms is $150,000. Marlboro High School may wish to consider providing DX cooling as part of this system to make the room more functional in warm weather, but should recognize that this will increase energy usage versus providing a heating and ventilation system only. If cooling is desired, it is strongly recommended that a system is provided that utilizes a heat recovery wheel for pretreatment of the outside air and CO_2 sensors for demand control ventilation. This is a replacement in kind recommendation which offers negligible energy savings. The estimated budget installed cost for (3) rooftop H&V units with DX cooling and heat recovery wheel is

$210,000. ***Note that the addition of air conditioning may require an upgrade to the existing electric service. The cost of the electric service upgrade is broken out separately below but should be included if the cooling option above is incorporated.***

- Replace (2) H&V units serving the Weightlifting and Wrestling Gyms - The hot water heating only ventilation system for the Weightlifting and Wrestling Gyms is beyond its expected service life. SWA recommends that this equipment is replaced as part of a capital improvement project, and that it is designed to provide code minimum ventilation rates. The estimated budget installed cost for (2) hot water H&V units for the Weightlifting and Wrestling Gyms is $95,000. Marlboro High School may wish to consider providing DX cooling as part of this system to make the room more functional in warm weather, but should recognize that this will increase energy usage versus providing a heating and ventilation system only. If cooling is desired, it is strongly recommended that a system is provided that utilizes a heat recovery wheel for pretreatment of the outside air and CO2 sensors for demand control ventilation. This is a replacement in kind recommendation which offers negligible energy savings. The estimated budget installed cost for (2) rooftop H&V units with DX cooling and heat recovery wheel is $140,000. ***Note that the addition of air conditioning may require an upgrade to the existing electric service. The cost of the electric service upgrade is broken out separately below but should be included if the cooling option above is incorporated.***

- Replace (1) H&V unit serving the Original Cafeteria - The hot water heating only ventilation system for the Original Cafeteria is beyond its expected service life. SWA recommends that this equipment is replaced as part of a capital improvement project, and that it is designed to provide code minimum ventilation rates. The estimated budget installed cost for (1) hot water H&V unit for the Original Cafeteria is $50,000. Marlboro High School may wish to consider providing DX cooling as part of this system to make the room more functional in warm weather, but should recognize that this will increase energy usage versus providing a heating and ventilation system only. If cooling is desired, it is strongly recommended that a system is provided that utilizes a heat recovery wheel for pretreatment of the outside air and CO2 sensors for demand control ventilation. This is a replacement in kind recommendation which offers negligible energy savings. The estimated budget installed cost for (1) rooftop H&V units with DX cooling and heat recovery wheel is $70,000. ***Note that the addition of air conditioning may require an upgrade to the existing electric service. The cost of the electric service upgrade is broken out separately below but should be included if the cooling option above is incorporated.***

- Replace (2) H&V units serving the Auditorium - The hot water heating only ventilation system for the Auditorium is beyond its expected service life. SWA recommends that this equipment is replaced as part of a capital improvement project, and that it is designed to provide code minimum ventilation rates. The estimated budget installed cost for (2) hot water H&V units for the Auditorium is $95,000. Marlboro High School may wish to consider providing DX cooling as part of this system to make the room more functional in warm weather, but should recognize that this will increase energy usage versus providing a heating and ventilation system only. If cooling is desired, it is strongly recommended that a system is provided that utilizes a heat recovery wheel for pretreatment of the outside air and CO2 sensors for demand control ventilation. This is a replacement in kind recommendation which offers negligible energy savings. The estimated budget installed cost for (2) rooftop H&V units with DX cooling and heat recovery wheel is $140,000. ***Note that the addition of air conditioning may require an upgrade to the existing electric service. The cost of the electric service upgrade is broken out separately below but should be included if the cooling option above is incorporated.***

- Replace (3) H&V units serving B106, B107, B108, and B109 - The hot water heating only ventilation system for rooms B106, B107, B108, and B109 is beyond its expected service life. SWA recommends that this equipment is replaced as part of a capital improvement project, and that it is designed to provide code minimum ventilation rates. The estimated budget installed cost for (3) hot water H&V units for B106, B107, B108, and B109 is $150,000. Marlboro High School may wish to consider providing DX cooling as part of this system to make the room more functional in warm weather, but should recognize that this will increase energy usage versus providing a heating and ventilation system only. If cooling is desired, it is strongly recommended that a system is provided that utilizes a heat recovery wheel for pretreatment of the outside air and CO2 sensors for demand control ventilation. This is a replacement in kind recommendation which offers negligible energy savings. The estimated budget installed cost for (3) rooftop H&V units with DX cooling and heat recovery wheel is $210,000. ***Note that the addition of air conditioning may require an upgrade to the existing electric service. The cost of the electric service upgrade is broken out separately below but should be included if the cooling option above is incorporated.***

- Provide dedicated makeup air unit for Cafeteria – Per the current system operation, conditioned air from the Cafeteria is transferred to the kitchen and out of the building via the kitchen hood. SWA recommends adding a dedicated makeup air unit to be ducted into the kitchen to greatly reduce the need for conditioned transfer air from the Cafeteria to serve the kitchen hood.

- Replace existing elevator in C Wing. This elevator is 40+ years old and is at the end of its expected service life. Replacement will yield negligible energy savings. The estimated replacement cost is $60,000.

- Replace window air conditioners – Several of the existing window air conditioners still have some useful life remaining (on the average 0-5 years left) but replacement should be considered with more modern, energy efficient systems. The window air conditioners should be replaced with split systems to allow for closing up of the existing window or wall penetrations. These upgrades cannot be justified by energy savings alone but will result in a decrease in energy usage versus the existing equipment. In addition, some of the existing systems utilize R-22 refrigerant, which is not an ozone-friendly refrigerant. Newer systems should be specified with R-410A refrigerant.

- Consider replacement of the (2) 1968 walk-in coolers with newer models. The wall and roof panels of the box itself are likely not insulated to the levels of current walk-in coolers. This is a replacement in kind recommendation which cannot be recommended based on energy savings alone.

- Replace 10 HP fan motor on dust collection system with premium efficiency motor rated for this use. This measure cannot be justified by energy savings alone due to the estimated low annual operating hours, but will result in reduced electricity usage by this equipment.

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.

- Repair and patch roof leakage area.

- Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly.

- Maintain downspouts and cap flashing - Repair/install missing downspouts and cap flashing as needed to prevent water/moisture infiltration and insulation damage. SWA recommends round downspout elbows to minimize clogging.

- Provide weather-stripping/air-sealing - SWA observed that exterior door weather-stripping was beginning to deteriorate in places. Doors and vestibules should be observed annually for deficient weather-stripping and replaced as needed. The perimeter of all window frames should also be regularly inspected, and any missing or deteriorated caulking should be re-caulked to provide an unbroken seal around the window frames. Any other accessible gaps or penetrations in the thermal envelope penetrations should also be sealed with caulk or spray foam.

- Repair/seal wall cracks and penetrations - SWA recommends as part of the maintenance program installing weep holes, installing proper flashing and correct masonry efflorescence, and sealing wall cracks and penetrations wherever necessary in order to keep insulation dry and effective.

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

- SWA recommends that the building considers purchasing the most energy-efficient equipment, including ENERGY STAR® labeled appliances, when equipment is installed or replaced. More information can be found in the "Products" section of the ENERGY STAR® website at: http://www.energystar.gov.

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

- Create an energy educational program - that teaches how to minimize energy use. 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/.

- Boilers and building piping insulation - Insulate un-insulated heating piping throughout the building to efficiently deliver heat where required and provide personnel protection.

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

- For Aerco condensing boilers, inspect the igniter and flame sensor and calibrate combustion every six months per manufacturer's recommendations.

- Change filters in rooftop units and air handling units monthly to ensure efficient operation of the fan, ensure adequate air delivery to the space.

- Tighten belts on exhaust fans and air handling unit supply fans every three to six months – tightening belts on belt-driven fans can maximize overall efficiency of the equipment.

- Inspect RTU and air handling unit coils for dirt buildup or coil freezeup every three to six months. These conditions should be rectified if found and they will cause inefficient operation and possibly damage to the equipment.

- Inspect condensate pan and drain line on all RTUs and air handling units. Remove sludge or foreign materials that might obstruct proper drainage.

- Inspect and replace gasketing around door into (2) walk-in refrigeration boxes. Ineffective gasketing allows infiltration of warm air into the walk-in box, which increases the run-time of the compressors.

The recommended ECMs and the list above are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for the Freehold RHSD. Based on the requirements of the LGEA program, the Freehold RHSD must commit to implementing some of these measures, and must submit paperwork to the Local Government Energy Audit program within one year of this report's approval to demonstrate that they have spent, net of other NJCEP incentives, at least 25% of the cost of the audit (per building). The Marlboro High School should spend a minimum of $5,466 (or 25% of $21,864) worth of ECMs, net of other NJCEP incentives, to fulfill the obligations.

APPENDIX A: EQUIPMENT LIST

Inventory

Building System	Description	Model #	Fuel	Location	Space Served	Date Installed	Estimated Remaining Useful Life %
Ventilation	(2) Exhaust Fans: Greenheck (EF#3a, #3b)	M# GB-121-4X-QD S#02J14800 S#02J14804	Electric	Roof above New Gym	New Gym	2002	60%
Heating	(2) Make-up Air Units: McQuay (AHU#2a, #2b)	M# RDS708BY S#FB0U031 00037603 S#FB0u031 00037403 460V 3ø 14 MCA 20 MOCP	Electric	Roof above New Gym	New Gym	2002	45%
Ventilation	(2) Exhaust Fans: Penn Ventilation	M# LB-24	Electric	Roof above Small Gym	Small Gym	1968	0%
Ventilation	(4) Exhaust Fans: Domex	(illegible nameplate) Est. 1 HP	Electric	Roof above Girls & Boys Locker rooms	Girls & Boys Locker rooms	1968	0%
Ventilation	(3) Exhaust Fans: Domex	(no nameplate) Est. 1/4 HP	Electric	Roof above Girls & Boys Locker rooms	Girls & Boys Locker rooms	1968	0%
Ventilation	Exhaust Fan: Penn Barry	M# DX30B S#C07AB8 2448 230V 3ø 2 HP	Electric	Main Gym	Main Gym	2007	85%
Ventilation	(3) Exhaust Fans: Penn Ventilation	M# DX30B 230V 3ø 2 HP ea.	Electric	Main Gym	Main Gym	1968	0%
Cooling	(2) Air-cooled Condensing Units: Lennox Est. 11 EER	M# HS29-042-9G S#5802L 02770 S#5802L 02771 460V 3ø 8.6 MCA 15 MOCP 5 lbs. 6 oz. R-22 ea.	Electric	Roof above C-wing	C128 C130	2002	60%
Ventilation	Exhaust Fan: Greenheck	M# GB-101-4X-QD-4X-QD-4R S#02D29781	Electric	Roof above C-wing	C128 C130	2002	60%
Ventilation	(2) Exhaust Fans	(no nameplate)	Electric	Roof above C-wing	C126	1968	0%
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Building System	Description	Model #	Fuel	Location	Space Served	Date Installed	Estimated Remaining Useful Life %
Cooling	Rooftop unit: Trane Est. 11 EER	M# TSC060A4 E0A S#632102058L 460V 3ø 16 MCA 25 MOCP 4.9 lbs R-22	Electric	Roof above Band/Choir room	Band Room	2006	75%
Ventilation	(2) Exhaust Fans	(no nameplate)	Electric	Roof above Band/Choir room	Band Room	1968	0%
Cooling	Condensing Unit: EnviroAir Est. 11 EER	M# CCW-24DB 220V 1ø 15 MCA 26 MOCP 1,850 g R-22	Electric	Roof above Band/Choir room	Choir Room	2005	75%
Ventilation	Exhaust Fan	(no nameplate)	Electric	Roof above Band/Choir room	Choir Room	1968	0%
Cooling	Condensing Unit: EnviroAir Est. 11.5 EER	M# CCW-18DC 208V 1ø 11 MCA 15 MOCP 1,000 g R-22	Electric	Roof above Band/Choir room	Choir Room	2005	75%
Ventilation	Exhaust Fan	(no nameplate)	Electric	Roof above band/Choir room	Band Room	1968	0%
Ventilation	Exhaust Fan: Dayton	M# 3C424 115V 1ø 1/4 HP	Electric	Roof above band/Choir room	Band Room	2005	75%
Ventilation	(4) Exhaust Fans	(no nameplate)	Electric	Roof above Main Gym Locker rooms	Main Gym Locker Rooms	1968	0%
Ventilation	Exhaust Fan: Penn Ventilation	M# BT45	Electric	Roof above Main Gym Locker rooms	Main Gym Locker Rooms	2000	50%
Ventilation	(3) Exhaust Fans	(no nameplate)	Electric	Roof above Main Gym Locker rooms	Main Gym Locker Rooms	1968	0%
Ventilation	Exhaust Fan	(no nameplate)	Electric	Core rooms & Offices adjacent to Auditorium	Core rooms & Offices adjacent to Auditorium	1968	0%
Ventilation	Exhaust Fan: Penn Barry	M# DX16R S#G07AC 75935 115V 1ø 1/2 HP	Electric	Core rooms & Offices adjacent to Auditorium	Core rooms & Offices adjacent to Auditorium	2007	85%
Ventilation	Exhaust Fan	(no nameplate)	Electric	Core rooms & Offices adjacent to Auditorium	Core rooms & Offices adjacent to Auditorium	1968	0%
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Building System	Description	Model #	Fuel	Location	Space Served	Date Installed	Estimated Remaining Useful Life %
Cooling	Rooftop Unit: Trane Est. 8 SEER	M# SAHB-B404-A S#C84K-05219 460V 3ø 20 MOCP 6.5 lbs. R-22	Electric	Roof above Main Offices	Main Offices	1988	0%
Ventilation	(2) Exhaust Fans	(no nameplate)	Electric	Roof above Main Offices	Main Offices	1968	0%
Cooling	Rooftop Unit: Trane Est. 8 EER	M# SAHE-B754-AA S#C84L-10746 460V 3ø 21 MCA 30 MOCP 10.5 lbs. R-22	Electric	Roof above Main Offices	Main Offices	1988	0%
Ventilation	Exhaust Fan	(no nameplate)	Electric	Roof above Main Offices	Main Offices	1968	0%
Ventilation	Exhaust Fan	(no nameplate)	Electric	Roof above Main Offices	Main Offices	1968	0%
Ventilation	Exhaust Fan	(no nameplate) Est. 2 HP	Electric	Roof above Auditorium	Auditorium	Circa 1970	0%
Cooling	(2) Rooftop Units: Trane Est. 11 EER	M# TCD180 B400HB S#735101506D S#735101844D 460V 3ø 39 MCA 50 MOCP 27 lbs. R-22	Electric	Roof above Auditorium	Auditorium	2007	80%
Ventilation	Exhaust Fan	(no nameplate)	Electric	Roof above Main Offices	Main Offices	1968	0%
Cooling	Condensing Unit: Carrier Est. 8 SEER	M# 38BA006 400 S#7349230 208V 3ø	Electric	Roof above Main Offices	Main Offices	1968	0%
Ventilation	Exhaust Fan	(no nameplate)	Electric	Roof above Main Offices	Main Offices	1968	0%
Ventilation	Exhaust Fan: Greenheck	M# GB-080-G S#02F11036	Electric	Roof above Guidance Offices	Guidance Offices	2002	60%
Cooling	Rooftop Unit: Lennox Est. 10 EER	M# LCA090 HN1G S#5602L 09654 460V 3ø 24 MCA 25 MOCP 20 lbs. R-22	Electric	Roof above Guidance Offices	Guidance Offices	2002	45%
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Building System	**Description**	**Model #**	**Fuel**	**Location**	**Space Served**	**Date Installed**	**Estimated Remaining Useful Life %**
Ventilation	Exhaust Fan	(no nameplate)	Electric	Roof above Guidance Offices	Guidance Offices	1968	0%
Ventilation	Exhaust Fan	(no nameplate) disconnected	-	Roof above Guidance Offices	N/A	1968	0%
Ventilation	Exhaust Fan: Greenheck	M# GB-080-G S#02F11847	Electric	Roof above Guidance Offices	Guidance Offices	2002	60%
Ventilation	Exhaust Fan	(no nameplate)	Electric	Roof above Guidance Offices	Guidance Offices	1968	0%
Cooling	Rooftop Unit: Trane Est. 8 SEER	M# SAHB-B404-A S#084K 5218 460V 3ø 20 MOCP 6.5 lbs. R-22	Electric	Roof above Media Center	Media Center Offices	1984	0%
Ventilation	Exhaust Fan: Greenheck	M# GB-080-6 S#02F11848	Electric	Roof above Media Center	Media Center	2002	60%
Cooling	(2) Air-cooled Condensing Units: Lennox Est. 10 EER	M#HS29-120-29 S#5602F 09579 S#5602F 01594 460V 3ø 25 MCA 40 MOCP	Electric	Roof above Media Center	Media Center	2002	60%
Ventilation	Exhaust Fan: Penn Ventilation	M# LB-24	Electric	Roof above Media Center	Media Center	1968	0%
Ventilation	(3) Exhaust Fans	(no nameplate)	Electric	Roof above Media Center	Media Center	1968	0%
Cooling	Air-cooled Condensing Unit: Lennox Est. 11 EER	M# HS29-018-2P S#5802L 51842 208V 1ø 11.9 MCA 20 MOCP 3 lbs. 7 oz. R-22	Electric	Roof above Trainers Room	Trainer's Room	2002	60%
Ventilation	Exhaust Fan: Greenheck	M# GB-070-6 S#02J11779	Electric	Roof above Trainers Room	Toilet Rooms near Trainer's Room	2002	60%
Cooling	Air-cooled Condensing Unit: Trane Est. 9 EER	M# TTD730B 100A1 S#E05240986 230V 1ø 24 MCA 40 MOCP 4 lbs. 5 oz. R-22 (Disconnected)	Electric	Roof above Gym Equipment Room	N/A	1990	0%
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Building System	**Description**	**Model #**	**Fuel**	**Location**	**Space Served**	**Date Installed**	**Estimated Remaining Useful Life %**
Ventilation	(3) Exhaust Fans: Penn Ventilation	(no nameplate)	Electric	Roof above Gym Equipment Room	Gym Equipment Room	1968	0%
Ventilation	Exhaust Fan: Penn Ventilation	(no nameplate) motor removed / disconnected	Electric	Roof above B-wing	N/A	Pre-1978	0%
Cooling	Air-cooled Condensing Unit: American Standard Est. 11 EER	"Allegiance 10" M# 2A7C006 0A3000AA S#5283LCR3F 230V 3ø 40 MCA 45 MOCP 7 lbs. 7 oz. R-22	Electric	Roof above B-wing	B107	2005	75%
Ventilation	Exhaust Fan: Penn Ventilation	(no nameplate)	Electric	Roof above B-wing	B-wing	1968	0%
Ventilation	Exhaust Fan	(no nameplate) not working / disconnected	Electric	Roof above B-wing	N/A	1968	0%
Cooling	(2) Rooftop Units: Trane Est. 11 EER	M# TSC060 A4E0A S#527100007L S#332100730L 460V ø 16 MCA 25 MOCP 4.9 lbs. R-22	Electric	Roof above B-wing	B111 B113	2005 2003	65% 55%
Ventilation	Exhaust Fan	(no nameplate) disconnected	Electric	Roof above B-wing	N/A	1968	0%
Ventilation	Exhaust Fan	(no nameplate) disconnected	Electric	Roof above B-wing	N/A	1968	0%
Ventilation	(2) Exhaust Fans: Penn Ventilation	(no nameplate)	Electric	Roof above Boiler room restroom	Boiler room restroom	1968	0%
Ventilation	Exhaust Fan	(no nameplate)	Electric	Roof above Boiler room	Boiler room	New Motor: 1998	40%
Cooling	Rooftop Unit: Trane Est. 10 EER	M# TCD090 C300BC S#Z30100130D 208V 3ø 43.1 MCA 60 MOCP 10.6 lbs R-22	Electric	Roof above B106 & B108	B106 B108	2001	40%
Ventilation	Exhaust Fan	(no nameplate)	Electric	Roof above B106 & B108	B106 B108	1968	0%
Ventilation	(2) Exhaust Fans: Penn Ventilation	(no nameplate)	Electric	Roof above B-wing	B-wing	1968	0%
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Building System	Description	Model #	Fuel	Location	Space Served	Date Installed	Estimated Remaining Useful Life %
Ventilation	Exhaust Fan: Penn Ventilation	M# DX16VSR	Electric	Roof above B-wing	B-wing	2004	70%
Ventilation	Exhaust Fan: Penn Barry	M# DX16R S#G07AC75936 115V 1ø 1/2 HP	Electric	Roof above B-wing	B-wing	2007	85%
Cooling	Air-cooled Condensing Unit: Trane Est. 11 EER	M# 2TTA0048 A3000AA S#2405P9Y3F 230V 3ø 20 CA 30 MOCP 6lbs. 13 oz. R-22	Electric	Roof above B-wing	Career Center (B101)	2002	60%
Ventilation	(6) Exhaust Fans: Penn Ventilation	(no nameplate)	Electric	Roof above B-wing	B-wing	1968	0%
Refrigeration	Walk-in Box Condenser Unit: Copeland Est. 9 EER	M# LAC1-0310-TAC S#LT 84F13422 208V	Electric	Roof above Kitchen	Kitchen	Pre-1990	0%
Ventilation	Exhaust Fan	(no nameplate)	Electric	Roof above Kitchen	Kitchen	1968	0%
Refrigeration	Walk-in Box Condenser Unit: Trane Est. 8 EER	M# RAUC-356-C S#C81A-24481 208V 3ø 21 MCA 30 MOCP	Electric	Roof above Kitchen	Kitchen	1984	0%
Ventilation	Exhaust Fan: Penn Ventilation	(no nameplate)	Electric	Roof above Kitchen	Kitchen	1968	0%
Ventilation	Exhaust Fan: Penn Ventilation	M# CB-18	Electric	Roof above Cafeteria	Cafeteria	1968	0%
Ventilation	Exhaust Fan	(no nameplate)	Electric	Roof above Cafeteria	Cafeteria	1968	0%
Ventilation	Exhaust Fan: Greenheck (EF#9)	M# GB-080-6 S#02J11790	Electric	Roof above Lobby adjacent to Cafeteria	Lobby adjacent to Cafeteria	2002	60%
Heating	Air Handling / Make-up Air unit: McQuay (AHU#1)	M# RDS800 CYY S#FB0U031000 36600 460V 3ø	Electric	Roof above Cafeteria Expansion	Cafeteria	2002	45%
Ventilation	Exhaust Fan: Greenheck (EF#2)	M# GB-161-5 S#02J12008	Electric	Roof above Cafeteria Expansion	Cafeteria Expansion	2002	60%

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Building System	**Description**	**Model #**	**Fuel**	**Location**	**Space Served**	**Date Installed**	**Estimated Remaining Useful Life %**
Cooling	Rooftop Unit: Lennox (RTU#1) Est 10 EER	M# LCA102 HN3G S#5602L 09605 460V 3ø 24 MCA 30 MOCP 21 lbs. R-22	Electric	Roof above Faculty Dining	Faculty Dining	2002	45%
Ventilation	Exhaust Fan: Greenheck (EF#1)	M# GB-141-4X-QD S#02J09630	Electric	Roof above Faculty Dining	Faculty Dining	2002	60%
Ventilation	(2) Exhaust Fans: Penn Ventilation	(no nameplate)	Electric	Roof above Wrestling & Weightlifting rooms	Wrestling & Weightlifting rooms	Pre-1980	0%
Ventilation	(32) Exhaust Fans	(no nameplate)	Electric	Roof above A-wing	A-wing	Pre-1980	0%
Ventilation	(25+) Exhaust Fans	(no nameplate)	Electric	Roof above E-wing	E-wing	1986	0%
Cooling	(6) Air-cooled Condensing Units: Lennox Est. 11 EER	M#HS29-042-9G 460V 3ø 8.6 MCA 15 MOCP 5 lbs. 6 oz. R22	Electric	Roof above D-wing	1st Floor D-wing Classrooms	2002	60%
Cooling	(5) Air-cooled Condensing Units: Lennox Est. 11 EER	M#HS29-036-9G 460V 3ø 6.9 MCA 10 MOCP 4 lbs. 13 oz. R22	Electric	Roof above D-wing	1st Floor D-wing Classrooms & D205	2002	60%
Cooling	(2) Air-cooled Condensing Units: Lennox Est. 11 EER	M#HS29-018-2P 208V 1ø 11.9 MCA 20 MOCP 3 lbs. 7 oz. R22	Electric	Roof above D-wing	1st Floor D-wing Classrooms	2002	60%
Cooling	(6) Rooftop Units: Lennox Est. 10 EER	M#LCA090HN1G 460V 3ø 24 MCA 25 MOCP 20 lbs. R410A	Electric	Roof above D-wing	2nd Floor D-wing Classrooms & core areas	2002	45%
Ventilation	(6) Exhaust Fans: Greenheck	M#GB-121-4	Electric	Roof above D-wing	D-wing	2002	60%
Ventilation	(6) Exhaust Fans: Greenheck	M#CUBE-101-7	Electric	Roof above D-wing	D-wing	2002	60%
Ventilation	(3) Exhaust Fans: Greenheck	M#GRS-12-QD	Electric	Roof above D-wing	D-wing	2002	60%
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Building System	Description	Model #	Fuel	Location	Space Served	Date Installed	Estimated Remaining Useful Life %
Ventilation	(4) Exhaust Fans: Greenheck	(1) M#CUBE-180HP-10 (1) M#CUBE-161HP-4 (1) M#GB-260-30 (1) M#GB-141-5	Electric	Roof above D-wing	D-wing	2002	60%
Heating / Ventilation	Make-up Air Unit: McQuay	M#RDS800CYY S#FB0U0331 00036800 460V 3ø	Electric	Roof above D-wing	D-wing	2002	45%
Heating	(2) Circulation Pumps: Bell & Gossett Est. 80% eff.	(nameplate inaccessible) Est. 1/2 HP	Electric	New Gym Ceiling	New Gym AHUs (1 / AHU)	2002	60%
Heating	(2) Air Handling Units: Trane	'Climate Changer' M#CCD810AL08	Electric	Mezzanine above Small Gym Locker Rooms	Small Gym	1981	0%
Heating	Air Handling Unit: Trane	'Climate Changer' M#CCD806AL08	Electric	Mezzanine above Small Gym Locker Rooms	Small Gym Associated Locker Rooms	1981	0%
Heating	(2) Hydronic Unit Heaters: Trane	(nameplate illegible)	Electric	Mezzanine above Small Gym Locker Rooms	Mezzanine above Small Gym Locker Rooms	1968	0%
Heating / Cooling	(2) unit Ventilators: AAF	(no nameplate)	Electric	C130 C128	C130 C128	2002	60%
Heating	(3) Unit Ventilators: Nesbitt	(no nameplate)	Electric	C126 B110 Nurse's Suite	C126 B110 Nurse's Suite	1968	0%
Heating	(4) H&V Units	(no nameplate)	Electric	Main Gym	Main Gym	1968	0%
Heating	(4) Circulating Pumps: Bell & Gossett Est. 80% eff.	(nameplate inaccessible) Est. 1/2 HP ea. (1 / H&V unit)	Electric	Main Gym	Main Gym H&V units (1 / H&V)	1995	25%
Heating / Cooling	Air Handling Unit (w/ cooling coil)	(no nameplate)	Electric	Wood Room between B107 & B109	B107 Computer Room	1968	0%

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Building System	**Description**	**Model #**	**Fuel**	**Location**	**Space Served**	**Date Installed**	**Estimated Remaining Useful Life %**
Heating	Air Handling Unit	(no nameplate)	Electric	Wood Room between B107 & B109	B109	1968	0%
Heating	Air Handling Unit	(no nameplate)	Electric	Ceiling of Custodial Break Room	Custodial Break Room, Custodial Supervisor Room, Rooms off of B106 & B108	1968	0%
Heating	Circulation Pump: Bell & Gossett Est. 85% eff.	(no nameplate)	Electric	Ceiling of Custodial Break Room	AHU serving Custodial Break Room, Custodial Supervisor Room, Rooms off of B106 & B108	2005	75%
Cooling	(2) Wall Mounted Split Systems A/C Units: Enviro-Aire Est. 11 EER	M#ACW-189C	Electric	C101 Choir Room	C101 Choir Room	2005	75%
Heating / Cooling	(3) Unit Ventilators	(no nameplate)	Electric	3 offices adjacent to courtyard of Main Offices	3 offices adjacent to courtyard of Main Offices	2002	60%
Heating	Air Handling Unit	(no nameplate)	Electric	Storage room in Girls Main Gym Locker Room	Main Gym Locker Room Offices	1968	0%
Heating	(2) H&V Units	(nameplate inaccessible)	Electric	Stage of Auditorium	Auditorium	1968	0%
Heating	(2) H&V Units: Nesbitt	(no nameplate)	Electric	Wrestling Gym & Weight Room	Wrestling Gym & Weight Room	1968	0%
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Building System	**Description**	**Model #**	**Fuel**	**Location**	**Space Served**	**Date Installed**	**Estimated Remaining Useful Life %**
Heating / Cooling	(18) Unit Ventilators: AAF	(no nameplate)	Electric	D-wing 1st Floor Classrooms & D205 A130 A132 A134 Faculty Lounge	D-wing 1st Floor Classrooms & D205 A130 A132 A134 Faculty Lounge	2002	60%
Heating	(48) Unit Ventilators: Nesbitt	(no nameplate)	Electric	A-wing Classrooms	A-wing Classrooms	1968	0%
Heating	(21) Unit Ventilators: Trane	(no nameplate)	Electric	E-wing Classrooms	E-wing Classrooms	1986	0%
Heating	(5) Ceiling Unit Ventilators: Trane	(no nameplate)	Electric	E-wing Classrooms	E-wing Classrooms	1986	0%
Heating	(16+) Hydronic Cabinet Unit Heaters Nesbitt	(no nameplate)	Electric	Building Corridors, Stairwells, etc.	Building Corridors, Stairwells, etc.	1968 1986 2002 (per location)	0% 0% 60% (per location)
Heating	(14+) Hydronic Ceiling Cabinet Unit Heaters Nesbitt	(no nameplate)	Electric	Building Corridors, Stairwells, etc.	Building Corridors, Stairwells, etc.	1968 1986 2002 (per location)	0% 0% 60% (per location)
Heating	Baseboard Radiators	(no nameplate)	Electric	Building Corridors, Stairwells, etc.	Building Corridors, Stairwells, etc.	1968 1986 (per location)	0% 0% (per location)
Cooling	(15+) Window Air Conditioners	various makes & models	Electric	Various rooms & classrooms of Original Building	Various rooms & classrooms of Original Building	Varies	25-75%
Cooling	Ceiling Mounted Split System A/C: Sanyo Est. 11 EER	(no nameplate)	Electric	A134 Computer Office	A134 Computer Office	2000	50%
Heating	H & V Unit	(no nameplate)	Electric	Crawl Space off of room A234	Cafeteria	1968	0%
Heating	Hot Water Circulation Pump: Bell & Gossett Est. 80% eff.	(inaccessible)	Electric	Crawl Space off of room A234	Cafeteria H&V unit	2000	50%
Trans-portation	Submersible Hydraulic Pump Est. 75% eff.	200V 3ø 15 HP	Electric	Elevator machine Room	Elevator	1969	0%
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Building System	Description	Model #	Fuel	Location	Space Served	Date Installed	Estimated Remaining Useful Life %
Cooling	Air-cooled Condensing Unit: Lennox Est. 11 EER	M#HS29-042-9G S#5802L02769 460V 3ø 8.6 MCA 15 MOCP 5 lbs. 6 oz. R22	Electric	Media Center Courtyard #1	A130	2002	60%
Cooling	(5) Air-cooled Condensing Units: Lennox Est. 11 EER	M#HS29-036-9G 460V 3ø 6.9 MCA 10 MOCP 4 lbs. 13 oz. R22	Electric	Media Center Courtyard #1	(2) A132, (2) A134, (1) Faculty Room	2002 2002 2003	60% 60% 65%
Cooling	Air-cooled Condensing Unit: Sanyo Est. 11 EER	M#C1211 S#000642 115V 1ø 15 MCA 20 MOCP 12 MBH cooling	Electric	Media Center Courtyard #1	Computer Room Office	2004	70%
Heating / Cooling	Air Handling Unit: McQuay (AHU-3A)	(2 sections) M#CAH008FDAC S#FB0U0207 00549	Electric	Media Center Courtyard #1 Equip. Room	Media Center	2002	45%
Heating / Cooling	Air Handling Unit: McQuay (AHU-3B)	(2 sections) M#CAH012FDAC S#FB0U0206 01221	Electric	Media Center Courtyard #2 Equip. Room	Media Center	2002	45%
Heating	(2) Hyrdonic Unit Heaters: Trane	M#UHSA-018S-8A-AAA S#S81B-02369	Electric	Media Center Courtyard Equip Rooms (1 / room)	Media Center Courtyard Equip Rooms	2002	60%
Heating	(2) Hot Water Circulation Pumps: Bell & Gossett Est. 85% eff.	208V 3ø 3 HP (ea.)	Electric	Original Boiler Room	Original Building	2002	60%
Heating	(2) Hot Water Circulation Pumps Est. 80% eff.	208V 3ø 10 HP (ea.)	Electric	Original Boiler Room	Original Building	Est. 1995	25%
Heating	(2) Hot Water Circulation Pumps Est. 80% eff.	208V 3ø 5 HP (ea.)	Electric	Original Boiler Room	Original Building	Est. 1995	25%
Heating	(3) Cast Iron Sectional Boilers: HB Smith Est. 65% eff.	M#4500 Mills 16 sections 6540 MBH input (ea.) Burner: 208V 3ø 3 HP (1 / boiler)	Natural Gas	Original Boiler Room	Original Building	1968	0%

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Building System	**Description**	**Model #**	**Fuel**	**Location**	**Space Served**	**Date Installed**	**Estimated Remaining Useful Life %**
Controls	Air Compressor: Quincy Est. 90% eff.	M#FF325 S#5025863 200V 3ø 5 HP	Electric	Original Boiler Room	Original Building	Est. 2000	50%
Controls	Air Compressor: Quincy Est. 75% eff.	208V 3ø 5 HP	Electric	Original Boiler Room	Original Building	Pre-1980	0%
Emergency Power	Natural Gas Generator: Onan	M#85KR-4R/13K S#0468022456 75 kW	Natural Gas	Original Boiler Room	Original Building	1968	0%
Domestic Hot Water	Hot Water Heater A.O. Smith Est. 85% eff.	'Burkay Copper Coil Boiler' M# HW 670932 S#G-0403866 660 MBH input w/ Storage Tank	Natural Gas	Original Boiler Room	Original Building	2004	70%
Domestic Hot Water	Circulation Pump: Bell & Gossett Est. 90% eff.	3/4 HP	Electric	Original Boiler Room	Original Building	2009	95%
Heating	(2) Condensing Boilers: Aerco Benchmark 2.0 Est. 90% eff.	2000 MBH input (ea.)	Natural Gas	D-wing Boiler Room	D-wing	2002	70%
Heating	(2) Circulation Pumps: Bell & Gossett Est. 90% eff.	10 HP 89.5% NEMA eff.	Electric	D-wing Boiler Room	D-wing	2002	60%
Heating	Hydronic Unit Heater: Sterling	M#H8-136A S#M02334345 001D01 115V 1ø 1/20 HP 35.9 MBH output	Electric	D-wing Boiler Room	D-wing Boiler Room	2002	60%
Refrigeration	Ice Machine: Hoshizaki	M#KML400MWF S#L00228A 208V 1ø 20A	Electric	Trainer's Room	Trainer's Room	2001	55%
Refrigeration	(2) Walk-in Coolers (8x8): Bally	Evaporator Fan: M#BA-56 S#41679	Electric	Kitchen	Kitchen	1968	0%
Refrigeration	Milk Cooler: Powers	M# 780 S# B072603 115V; 4 A	Electric	Kitchen	Kitchen	2007	80%
Refrigeration	Walk-in Freezer (8x8): Penn	(no nameplate)	Electric	Kitchen	Kitchen	2002	50%
Refrigeration	3-Door Stainless Steel Freezer: Continental	M# 3F S#13687725 208V 3ø R404a	Electric	Kitchen	Kitchen	1987	0%
Refrigeration	(2) Commercial Refrigerators: Victory	(no nameplate)	Electric	Kitchen	Kitchen	1983	0%
Cooking	(2) Pizza Rack Ovens: General Electric	M#CF30 S#RCK6263 S#RCK6261	Electric	Kitchen	Kitchen	1983	0%
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Building System	**Description**	**Model #**	**Fuel**	**Location**	**Space Served**	**Date Installed**	**Estimated Remaining Useful Life %**
Cooking	4-Burner Range: Garland	(no nameplate)	Natural Gas	Kitchen	Kitchen	1968	0%
Cooking	Steam Kettle: Legion Equip. Co.	M#LGB-40 S#830321	Natural Gas	Kitchen	Kitchen	1983	0%
Cooking	Top-Bottom Oven: Vulcan	M#GC04S S#481175807	Natural Gas	Kitchen	Kitchen	2000	50%
Refrigeration	(2) Open Case Coolers: Federal Industries	M#RSSM478SC S#87294-2 R22	Electric	Kitchen	Kitchen	1987	0%
Misc.	Commercial Dishwasher: Hobart w/ Booster Heater: A.O. Smith	M#CL64E S#85-1072326 208V 3ø 90.6A (Energy Star labeled) Booster Heater: M#SU45 S#SG041046073 208V 3ø 45 kW	Electric	Kitchen	Kitchen	2010	100%
Refrigeration	Ice Machine: Hoshizaki	M#M255-BAH S#S01018F R404a	Electric	Kitchen	Kitchen	2001	55%
Cooking	(2) Heated Display Cabinets: Hatco	M#GRSDS-52D S#9737720009 22.7 A M#GR2SDS-36D S#9134800249	Electric	Kitchen	Kitchen	2005	50%
Refrigeration	Glass Door Merchandiser: Universal NOLIN	M#MC750-1 S#3709S22640 R134A	Electric	Kitchen	Kitchen	2009	95%
Refrigeration	Stainless Steel Cooler: Traulsen	M#RIH-1-32-2 S#126026	Electric	Kitchen	Kitchen	1970s	0%
Refrigeration	Glass Door Merchandiser: Beverage-Air	M#MT17 R134A	Electric	Kitchen	Kitchen	2005	75%
Refrigeration	Glass Door Merchandiser: Beverage-Air	M#MT27 R134A	Electric	Kitchen	Kitchen	2008	90%
Refrigeration	Refrigerated Display Case: Servolift	M#RMDC-48H S#02/03-225188-1	Electric	Kitchen	Kitchen	2003	65%
Refrigeration	2-Door Cooler: Traulsen	M#G20010 S#T38134102 115V 1ø 8.5A R134A	Electric	Kitchen	Kitchen	2002	60%
Cooking	Heated Holding Cabinet: Metro	115V 1ø 1400W	Electric	Kitchen	Kitchen	2002	20%
Refrigeration	Glass Door Merchandiser: True	M#GDM26 S#3669687 115V 1ø 1/3 HP R134A	Electric	Cafeteria	Cafeteria	2008	90%
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Building System	**Description**	**Model #**	**Fuel**	**Location**	**Space Served**	**Date Installed**	**Estimated Remaining Useful Life %**
Refrigeration	Glass Door Merchandiser: Universal NOLIN	M#MC750-1 S#1609S12517 120V 1ø 6.9A R134A	Electric	Cafeteria	Cafeteria	2009	95%
Refrigeration	Glass Door Merchandiser: Beverage-Air	M#MT27 115V 1ø 9.9A R134A	Electric	Cafeteria	Cafeteria	2005	75%
Misc.	(2) Commercial Mixers: Hobart	M#H-600 208V 3ø 1 HP	Electric	Kitchen	Kitchen	1970	0%
Lighting	See details - Appendix B	-	Electric	See details - Appendix B	Marlboro HS	2000	33%

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: 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	Lobby	Recessed Parabolic	E	4'T8	12	2	32	Sw	24	365	5	828	7,253	N/A	Recessed Parabolic	4'T8	E	Sw	12	2	32	24	365	5	828	7253	0	0	0
2	1	Janitor's Closet	Recessed	E	4'T8 U-Shaped	1	2	32	Sw	2	261	5	69	36	N/A	Recessed	4'T8 U-Shaped	E	Sw	1	2	32	2	261	5	69	36	0	0	0
3	1	Bathroom Men	Recessed	E	4'T8	2	4	32	Sw	8	261	5	266	555	N/A	Recessed	4'T8	E	Sw	2	4	32	8	261	5	266	555	0	0	0
4	1	Bathroom Women	Recessed	E	4'T8	2	4	32	Sw	8	261	5	266	555	N/A	Recessed	4'T8	E	Sw	2	4	32	8	261	5	266	555	0	0	0
5	1	Hallway	Recessed	E	4'T8	4	4	32	Sw	24	365	5	532	4,660	N/A	Recessed	4'T8	E	Sw	4	4	32	24	365	5	532	4660	0	0	0
6	1	Hallway	Recessed	E	4'T8	14	4	32	Sw	24	365	5	1,862	16,311	N/A	Recessed	4'T8	E	Sw	14	4	32	24	365	5	1862	16311	0	0	0
7	1	Hallway	Exit Sign	E	Fl	1	1	15	N	24	365	2	17	145	LEDex	Exit Sign	LED	E	N	1	1	5	24	365	1	6	48	96	0	96
8	1	Classroom (A101)	Recessed	E	4'T8	11	4	32	Sw	8	190	5	1,463	2,224	N/A	Recessed	4'T8	E	Sw	11	4	32	8	190	5	1463	2224	0	0	0
9	1	Classroom (A102)	Recessed	M	4'T12	9	4	40	Sw	8	190	12	1,548	2,353	T8	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	534	0	534
10	1	Classroom (A104)	Recessed	M	4'T12	9	4	40	Sw	8	190	12	1,548	2,353	T8	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	534	0	534
11	1	Classroom (A103)	Recessed	E	4'T8	11	3	32	Sw	8	190	5	1,111	1,689	N/A	Recessed	4'T8	E	Sw	11	3	32	8	190	5	1111	1689	0	0	0
12	1	Classroom (A105)	Recessed	E	4'T8	12	3	32	Sw	8	190	5	1,212	1,842	N/A	Recessed	4'T8	E	Sw	12	3	32	8	190	5	1212	1842	0	0	0
13	1	Classroom (A106)	Recessed	M	4'T12	9	4	40	Sw	8	190	12	1,548	2,353	T8	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	534	0	534
14	1	Classroom (A108)	Recessed	M	4'T12	9	4	40	Sw	8	190	12	1,548	2,353	T8	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	534	0	534
15	1	Classroom (A107)	Recessed	E	4'T8	12	4	32	Sw	8	190	5	1,596	2,426	N/A	Recessed	4'T8	E	Sw	12	4	32	8	190	5	1596	2426	0	0	0
16	1	Classroom (A109)	Recessed	E	4'T8	12	4	32	Sw	8	190	5	1,596	2,426	N/A	Recessed	4'T8	E	Sw	12	4	32	8	190	5	1596	2426	0	0	0
17	1	Hallway	Recessed	E	4'T8	4	4	32	Sw	24	365	5	532	4,660	N/A	Recessed	4'T8	E	Sw	4	4	32	24	365	5	532	4660	0	0	0
18	1	Hallway	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
19	1	Vestibule	Recessed	M	4'T12	1	4	40	Sw	8	365	12	172	502	T8	Recessed	4'T8	E	Sw	1	4	32	8	365	5	133	388	114	0	114
20	1	Classroom (A113)	Recessed	E	4'T8	12	4	32	Sw	8	190	5	1,596	2,426	N/A	Recessed	4'T8	E	Sw	12	4	32	8	190	5	1596	2426	0	0	0
21	1	Classroom (A111)	Recessed	E	4'T8	12	4	32	Sw	8	190	5	1,596	2,426	N/A	Recessed	4'T8	E	Sw	12	4	32	8	190	5	1596	2426	0	0	0
22	1	Bathroom Men	Recessed	E	4'T8	2	4	32	Sw	8	261	5	266	555	N/A	Recessed	4'T8	E	Sw	2	4	32	8	261	5	266	555	0	0	0
23	1	Bathroom Women	Recessed	E	4'T8	2	4	32	Sw	8	261	5	266	555	N/A	Recessed	4'T8	E	Sw	2	4	32	8	261	5	266	555	0	0	0
24	1	Janitor's Closet	Ceiling Suspended	S	Inc	1	1	150	Sw	2	261	0	150	78	CFL	Ceiling Suspended	CFL	S	Sw	1	1	50	2	261	0	50	26	52	0	52
25	1	Electrical Room	Ceiling Suspended	S	Inc	1	1	150	Sw	2	261	0	150	78	CFL	Ceiling Suspended	CFL	S	Sw	1	1	50	2	261	0	50	26	52	0	52
26	1	Elevator Machine Room	Ceiling Suspended	S	Inc	1	1	150	Sw	2	261	0	150	78	CFL	Ceiling Suspended	CFL	S	Sw	1	1	50	2	261	0	50	26	52	0	52
27	1	Elevator	Recessed	M	4'T12	1	2	40	Sw	9	261	12	92	216	T8	Recessed	4'T8	E	Sw	1	2	32	9	261	5	69	162	54	0	54
28	1	Office	Recessed	E	4'T8	2	4	32	Sw	9	261	5	266	625	N/A	Recessed	4'T8	E	Sw	2	4	32	9	261	5	266	625	0	0	0
29	1	Classroom (A115)	Recessed	M	4'T12	9	4	40	Sw	8	190	12	1,548	2,353	T8	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	534	0	534
30	1	Classroom (A117)	Recessed	M	4'T12	9	4	40	Sw	8	190	12	1,548	2,353	T8	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	534	0	534
31	1	Classroom (A119)	Recessed	E	4'T8	5	3	32	Sw	8	190	5	505	768	N/A	Recessed	4'T8	E	Sw	5	3	32	8	190	5	505	768	0	0	0
32	1	Hallway	Recessed	E	4'T8	17	4	32	Sw	24	365	5	2,261	19,806	N/A	Recessed	4'T8	E	Sw	17	4	32	24	365	5	2261	19806	0	0	0
33	1	Hallway	Exit Sign	E	Fl	1	1	15	N	24	365	2	17	145	LEDex	Exit Sign	LED	E	N	1	1	5	24	365	1	6	48	96	0	96
34	1	Library	Recessed	E	4'T8	11	4	32	Sw	8	190	5	1,463	2,224	N/A	Recessed	4'T8	E	Sw	11	4	32	8	190	5	1463	2224	0	0	0
35	1	Media Room	Recessed	E	4'T8	36	4	32	Sw	8	190	5	4,788	7,278	N/A	Recessed	4'T8	E	Sw	36	4	32	8	190	5	4788	7278	0	0	0
36	1	Media Room	Parabolic Ceiling Suspended	E	4'T8	3	20	32	Sw	8	190	5	1,935	2,941	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	3	20	32	8	190	5	1935	2941	0	0	0
37	1	Media Room Video Storage	Recessed	E	4'T8	6	4	32	Sw	2	190	5	798	303	N/A	Recessed	4'T8	E	Sw	6	4	32	2	190	5	798	303	0	0	0
38	1	Media Room Classroom	Recessed	E	4'T8	6	4	32	Sw	8	190	5	798	1,213	C	Recessed	4'T8	E	OS	6	4	32	6	190	5	798	910	0	303	303
39	1	Media Room Storage	Recessed	M	4'T12	1	4	40	Sw	2	190	12	172	65	T8	Recessed	4'T8	E	Sw	1	4	32	2	190	5	133	51	15	0	15
40	1	Media Room Storage	Recessed	M	4'T12	2	4	40	Sw	2	190	12	344	131	T8	Recessed	4'T8	E	Sw	2	4	32	2	190	5	266	101	30	0	30
41	1	Media Room Storage	Recessed	E	4'T8	3	4	32	Sw	2	190	5	399	152	N/A	Recessed	4'T8	E	Sw	3	4	32	2	190	5	399	152	0	0	0
42	1	Library	Parabolic Ceiling Suspended	E	4'T8	6	10	32	Sw	8	190	5	1,950	2,964	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	6	10	32	8	190	5	1950	2964	0	0	0
43	1	Library	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
44	1	Classroom (A121)	Recessed	M	4'T12	9	4	40	Sw	8	190	12	1,548	2,353	T8	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	534	0	534
45	1	Classroom (A123)	Recessed	M	4'T12	9	4	40	Sw	8	190	12	1,548	2,353	T8	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	534	0	534
46	1	Classroom (A125)	Recessed	M	4'T12	9	4	40	Sw	8	190	12	1,548	2,353	T8	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	534	0	534
47	1	Classroom (A130)	Recessed	E	4'T8	12	4	32	Sw	8	190	5	1,596	2,426	N/A	Recessed	4'T8	E	Sw	12	4	32	8	190	5	1596	2426	0	0	0
48	1	Hallway	Recessed	E	4'T8	15	4	32	Sw	24	365	5	1,995	17,476	N/A	Recessed	4'T8	E	Sw	15	4	32	24	365	5	1995	17476	0	0	0
49	1	Computer Lab (A132)	Recessed	E	4'T8	16	3	32	Sw	8	190	5	1,616	2,456	N/A	Recessed	4'T8	E	Sw	16	3	32	8	190	5	1616	2456	0	0	0
50	1	Computer Lab (A134)	Recessed	E	4'T8	16	3	32	Sw	8	190	5	1,616	2,456	N/A	Recessed	4'T8	E	Sw	16	3	32	8	190	5	1616	2456	0	0	0
51	1	Computer Lab (A134)	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
52	1	Computer Lab (A132)	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
53	1	Office (A132)	Recessed	E	4'T8	2	3	32	Sw	8	190	5	202	307	N/A	Recessed	4'T8	E	Sw	2	3	32	8	190	5	202	307	0	0	0
54	1	Electrical Room (A132)	Ceiling Suspended	E	4'T8	4	2	32	Sw	2	261	5	276	144	N/A	Ceiling Suspended	4'T8	E	Sw	4	2	32	2	261	5	276	144	0	0	0
55	1	Office (A134)	Recessed	E	4'T8	2	3	32	N	9	261	5	202	474	N/A	Recessed	4'T8	E	N	2	3	32	9	261	5	202	474	0	0	0
56	1	Server Room Occupied	Recessed	E	4'T8	4	4	32	Sw	2	261	5	532	278	N/A	Recessed	4'T8	E	Sw	4	4	32	2	261	5	532	278	0	0	0
57	1	Classroom (A135)	Recessed	E	4'T8	16	4	32	Sw	8	190	5	2,128	3,235	N/A	Recessed	4'T8	E	Sw	16	4	32	8	190	5	2128	3235	0	0	0
58	1	Storage Room (A135)	Parabolic Ceiling Suspended	M	4'T12	3	2	40	Sw	2	261	12	276	144	T8	Parabolic Ceiling Suspended	4'T8	E	Sw	3	2	32	2	261	5	207	108	36	0	36
59	1	Office (A135)	Recessed	E	4'T8	2	2	32	Sw	9	261	5	138	324	N/A	Recessed	4'T8	E	Sw	2	2	32	9	261	5	138	324	0	0	0
60	1	Classroom (A133)	Recessed	E	4'T8	4	4	32	Sw	8	190	5	532	809	N/A	Recessed	4'T8	E	Sw	4	4	32	8	190	5	532	809	0	0	0
61	1	Classroom (A131)	Recessed	M	4'T12	9	4	40	Sw	8	190	12	1,548	2,353	T8	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	534	0	534
62	1	Science Room / Laboratory (A127)	Recessed	M	4'T12	18	4	40	Sw	8	190	12	3,096	4,706	T8	Recessed	4'T8	E	Sw	18	4	32	8	190	5	2394	3639	1067	0	1067
63	1	Prep Room (A127)	Ceiling Mounted	M	4'T12	3	3	40	Sw	4	190	12	396	301	T8	Ceiling Mounted	4'T8	E	Sw	3	3	32	4	190	5	303	230	71	0	71
64	1	Hallway	Recessed	E	4'T8	8	4	32	Sw	24	365	5	1,064	9,321	N/A	Recessed	4'T8	E	Sw	8	4	32	24	365	5	1064	9321	0	0	0
65	1	Classroom (E126)	Recessed	M	4'T12	9	4	40	Sw	8	190	12	1,548	2,353	T8	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	534	0	534
66	1	Classroom Closet (E125)	Recessed	S	Inc	1	1	150	Sw	2	190	0	150	57	CFL	Recessed	CFL	S	Sw	1	1	50	2	190	0	50	19	38	0	38
67	1	Classroom (E125)	Recessed	M	4'T12	5	1	40	Sw	8	190	12	260	395	T8	Recessed	4'T8	E	Sw	5	1	32	8	190	5	185	281	114	0	114
68	1	Classroom (E123)	Recessed	M	4'T12	9	4	40	Sw	8	190	12	1,548	2,353	T8	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	534	0	534
69	1	Classroom Closet (E123)	Recessed	S	Inc	1	1	150	Sw	2	190	0	150	57	CFL	Recessed	CFL	S	Sw	1	1	50	2	190	0	50	19	38	0	38
70	1	Classroom (E123)	Recessed	M	4'T12	5	1	40	Sw	8	190	12	260	395	T8	Recessed	4'T8	E	Sw	5	1	32	8	190	5	185	281	114	0	114
71	1	Classroom (E121)	Recessed	M	4'T12	9	4	40	Sw	8	190	12	1,548	2,353	T8	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	534	0	534
72	1	Classroom Closet (E121)	Recessed	S	Inc	1	1	150	Sw	2	190	0	150	57	CFL	Recessed	CFL	S	Sw	1	1	50	2	190	0	50	19	38	0	38
73	1	Classroom (E121)	Recessed	M	4'T12	5	1	40	Sw	8	190	12	260	395	T8	Recessed	4'T8	E	Sw	5	1	32	8	190	5	185	281	114	0	114
74	1	Vestibule	Recessed	M	4'T12 U-Shaped	1	2	40	Sw	8	365	12	92	269	T8	Recessed	4'T8 U-Shaped	E	Sw	1	2	32	8	365	5	69	201	67	0	67
75	1	Hallway	Recessed	E	4'T8	9	4	32	Sw	24	365	5	1,197	10,486	N/A	Recessed	4'T8	E	Sw	9	4	32	24	365	5	1197	10486	0	0	0
76	1	Classroom (E119)	Recessed	M	4'T12	9	4	40	Sw	8	190	12	1,548	2,353	T8	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	534	0	534
77	1	Classroom Closet (E119)	Recessed	S	Inc	1	1	100	Sw	2	190	0	100	38	CFL	Recessed	CFL	S	Sw	1	1	35	2	190	0	35	13	25	0	25
78	1	Classroom (E119)	Recessed	M	4'T12	5	1	40	Sw	8	190	12	260	395	T8	Recessed	4'T8	E	Sw	5	1	32	8	190	5	185	281	114	0	114
79	1	Classroom (E117)	Recessed	M	4'T12	9	4	40	Sw	8	190	12	1,548	2,353	T8	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	534	0	534
80	1	Classroom Closet (E117)	Recessed	S	Inc	1	1	150	Sw	2	190	0	150	57	CFL	Recessed	CFL	S	Sw	1	1	50	2	190	0	50	19	38	0	38
81	1	Classroom (E117)	Recessed	M	4'T12	5	1	40	Sw	8	190	12	260	395	T8	Recessed	4'T8	E	Sw	5	1	32	8	190	5	185	281	114	0	114
82	1	Classroom (E115)	Recessed	M	4'T8	9	4	32	Sw	8	190	5	1,197	1,819	N/A	Recessed	4'T8	M	Sw	9	4	32	8	190	5	1197	1819	0	0	0
83	1	Classroom Closet (E115)	Recessed	S	Inc	2	1	150	Sw	2	190	0	300	114	CFL	Recessed	CFL	S	Sw	2	1	50	2	190	0	100	38	76	0	76
84	1	Classroom (E115)	Recessed	M	4'T12	5	1	40	Sw	8	190	12	260	395	T8	Recessed	4'T8	E	Sw	5	1	32	8	190	5	185	281	114	0	114
85	1	Classroom (E113)	Recessed	M	4'T8	9	4	32	Sw	8	190	5	1,197	1,819	N/A	Recessed	4'T8	M	Sw	9	4	32	8	190	5	1197	1819	0	0	0
86	1	Classroom (E111)	Recessed	M	4'T8	9	4	32	Sw	8	190	5	1,197	1,819	N/A	Recessed	4'T8	M	Sw	9	4	32	8	190	5	1197	1819	0	0	0
87	1	Classroom Closet (E113)	Recessed	S	Inc	2	1	100	Sw	2	190	0	200	76	CFL	Recessed	CFL	S	Sw	2	1	35	2	190	0	70	27	49	0	49
88	1	Classroom Closet (E111)	Recessed	S	Inc	2	1	100	Sw	2	190	0	200	76	CFL	Recessed	CFL	S	Sw	2	1	35	2	190	0	70	27	49	0	49
89	1	Classroom (E113)	Recessed	M	4'T12	5	1	40	Sw	8	190	12	260	395	T8	Recessed	4'T8	E	Sw	5	1	32	8	190	5	185	281	114	0	114
90	1	Classroom (E111)	Recessed	M	4'T12	5	1	40	Sw	8	190	12	260	395	T8	Recessed	4'T8	E	Sw	5	1	32	8	190	5	185	281	114	0	114

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)
91	1	Vestibule	Ceiling Mounted	E	4'T8	6	2	32	Sw	8	365	5	414	1,209	N/A	Ceiling Mounted	4'T8	E	Sw	6	2	32	8	365	5	414	1209	0	0	0
92	1	Vestibule	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
93	1	Hallway	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
94	1	Hallway	Recessed	E	4'T8 U-Shaped	4	2	32	Sw	24	365	5	276	2,418	N/A	Recessed	4'T8 U-Shaped	E	Sw	4	2	32	24	365	5	276	2418	0	0	0
95	1	Janitor's Closet	Ceiling Mounted	M	4'T12	1	2	40	Sw	2	261	12	92	48	T8	Ceiling Mounted	4'T8	E	Sw	1	2	32	2	261	5	69	36	12	0	12
96	1	Bathroom Women	Recessed	M	4'T12 U-Shaped	4	2	40	Sw	8	261	12	368	768	T8	Recessed	4'T8 U-Shaped	E	Sw	4	2	32	8	261	5	276	576	192	0	192
97	1	Bathroom Men	Recessed	M	4'T12 U-Shaped	4	2	40	Sw	8	261	12	368	768	T8	Recessed	4'T8 U-Shaped	E	Sw	4	2	32	8	261	5	276	576	192	0	192
98	1	Janitor's Closet	Ceiling Mounted	M	4'T12	1	2	40	Sw	2	261	12	92	48	T8	Ceiling Mounted	4'T8	E	Sw	1	2	32	2	261	5	69	36	12	0	12
99	1	Office	Ceiling Mounted	M	4'T12	4	2	40	Sw	9	261	12	368	864	T8	Ceiling Mounted	4'T8	E	OS	4	2	32	7	261	5	276	486	216	162	378
100	1	Hallway	Recessed	E	4'T8	10	4	32	Sw	24	365	5	1,330	11,651	N/A	Recessed	4'T8	E	Sw	10	4	32	24	365	5	1330	11651	0	0	0
101	1	Classroom (E100)	Recessed	E	4'T8	9	4	32	Sw	8	190	5	1,197	1,819	N/A	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	0	0	0
102	1	Classroom Closet (E100)	Recessed	S	Inc	2	1	100	Sw	2	190	0	200	76	CFL	Recessed	CFL	S	Sw	2	1	35	2	190	0	70	27	49	0	49
103	1	Classroom (E100)	Recessed	M	4'T12	5	1	40	Sw	8	190	12	260	395	T8	Recessed	4'T8	E	Sw	5	1	32	8	190	5	185	281	114	0	114
104	1	Classroom (E102)	Recessed	E	4'T8	9	4	32	Sw	8	190	5	1,197	1,819	N/A	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	0	0	0
105	1	Classroom Closet (E102)	Recessed	S	Inc	2	1	100	Sw	2	190	0	200	76	CFL	Recessed	CFL	S	Sw	2	1	35	2	190	0	70	27	49	0	49
106	1	Classroom (E102)	Recessed	M	4'T12	5	1	40	Sw	8	190	12	260	395	T8	Recessed	4'T8	E	Sw	5	1	32	8	190	5	185	281	114	0	114
107	1	Classroom (E104)	Recessed	E	4'T8	9	4	32	Sw	8	190	5	1,197	1,819	N/A	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	0	0	0
108	1	Classroom Closet (E104)	Recessed	S	Inc	2	1	100	Sw	2	190	0	200	76	CFL	Recessed	CFL	S	Sw	2	1	35	2	190	0	70	27	49	0	49
109	1	Classroom (E104)	Recessed	M	4'T12	5	1	40	Sw	8	190	12	260	395	T8	Recessed	4'T8	E	Sw	5	1	32	8	190	5	185	281	114	0	114
110	1	Storage Room (E106)	Ceiling Mounted	M	4'T12	4	2	40	Sw	2	261	12	368	192	T8	Ceiling Mounted	4'T8	E	Sw	4	2	32	2	261	5	276	144	48	0	48
111	1	Classroom (E106)	Recessed	M	4'T12	8	4	40	Sw	8	190	12	1,376	2,092	T8	Recessed	4'T8	E	Sw	8	4	32	8	190	5	1064	1617	474	0	474
112	1	Office (E110)	Recessed	M	4'T12	3	4	40	Sw	8	190	12	516	784	T8	Recessed	4'T8	E	Sw	3	4	32	8	190	5	399	606	178	0	178
113	1	Storage Room	Recessed	E	4'T8	2	4	32	Sw	2	261	5	266	139	N/A	Recessed	4'T8	E	Sw	2	4	32	2	261	5	266	139	0	0	0
114	1	Bathroom Men	Recessed	E	4'T8	2	4	32	Sw	8	261	5	266	555	N/A	Recessed	4'T8	E	Sw	2	4	32	8	261	5	266	555	0	0	0
115	1	Bathroom Women	Recessed	E	4'T8	2	4	32	Sw	8	261	5	266	555	N/A	Recessed	4'T8	E	Sw	2	4	32	8	261	5	266	555	0	0	0
116	1	Janitor's Closet	Ceiling Suspended	S	Inc	1	1	100	Sw	2	261	0	100	52	CFL	Ceiling Suspended	CFL	S	Sw	1	1	35	2	261	0	35	18	34	0	34
117	1	Janitor's Closet	Ceiling Suspended	S	Inc	1	1	100	Sw	2	261	0	100	52	CFL	Ceiling Suspended	CFL	S	Sw	1	1	35	2	261	0	35	18	34	0	34
118	1	Hallway	Recessed	E	4'T8	10	2	32	Sw	24	365	5	690	6,044	N/A	Recessed	4'T8	E	Sw	10	2	32	24	365	5	690	6044	0	0	0
119	1	Hallway	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
120	1	Hallway	Recessed	E	4'T8	7	2	32	Sw	24	365	5	483	4,231	N/A	Recessed	4'T8	E	Sw	7	2	32	24	365	5	483	4231	0	0	0
121	1	Hallway	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
122	1	Classroom (D114)	Parabolic Ceiling Suspended	E	4'T8	3	12	32	Sw	8	190	5	1,167	1,774	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	3	12	32	8	190	5	1167	1774	0	0	0
123	1	Classroom (D114)	Parabolic Ceiling Suspended	E	4'T8	1	10	32	Sw	8	190	5	325	494	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	1	10	32	8	190	5	325	494	0	0	0
124	1	Computer Lab (D112)	Parabolic Ceiling Suspended	E	4'T8	3	12	32	Sw	8	190	5	1,167	1,774	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	3	12	32	8	190	5	1167	1774	0	0	0
125	1	Computer Lab (D112)	Parabolic Ceiling Suspended	E	4'T8	1	10	32	Sw	8	190	5	325	494	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	1	10	32	8	190	5	325	494	0	0	0
126	1	Hallway	Recessed	E	4'T8	14	2	32	Sw	24	365	5	966	8,462	N/A	Recessed	4'T8	E	Sw	14	2	32	24	365	5	966	8462	0	0	0
127	1	Classroom (D105)	Parabolic Ceiling Suspended	E	4'T8	2	6	32	Sw	8	190	5	394	599	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	2	6	32	8	190	5	394	599	0	0	0
128	1	Classroom (D105)	Parabolic Ceiling Suspended	E	4'T8	4	10	32	Sw	8	190	5	1,300	1,976	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	4	10	32	8	190	5	1300	1976	0	0	0
129	1	Classroom (D105)	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	Classroom (D110)	Parabolic Ceiling Suspended	E	4'T8	3	12	32	Sw	8	190	5	1,167	1,774	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	3	12	32	8	190	5	1167	1774	0	0	0
131	1	Classroom (D108)	Parabolic Ceiling Suspended	E	4'T8	3	12	32	Sw	8	190	5	1,167	1,774	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	3	12	32	8	190	5	1167	1774	0	0	0
132	1	Classroom (D108)	Parabolic Ceiling Suspended	E	4'T8	1	10	32	Sw	8	190	5	325	494	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	1	10	32	8	190	5	325	494	0	0	0
133	1	Classroom (D110)	Parabolic Ceiling Suspended	E	4'T8	1	10	32	Sw	8	190	5	325	494	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	1	10	32	8	190	5	325	494	0	0	0
134	1	Classroom (D103)	Parabolic Ceiling Suspended	E	4'T8	3	10	32	Sw	8	190	5	975	1,482	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	3	10	32	8	190	5	975	1482	0	0	0
135	1	Classroom (D103)	Parabolic Ceiling Suspended	E	4'T8	2	8	32	Sw	8	190	5	522	793	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	2	8	32	8	190	5	522	793	0	0	0
136	1	Classroom (D103)	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
137	1	Classroom Kiln Room (D103)	Recessed	E	4'T8	2	2	32	Sw	2	190	5	138	52	N/A	Recessed	4'T8	E	Sw	2	2	32	2	190	5	138	52	0	0	0
138	1	Classroom (D106)	Parabolic Ceiling Suspended	E	4'T8	3	12	32	Sw	8	190	5	1,167	1,774	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	3	12	32	8	190	5	1167	1774	0	0	0
139	1	Classroom (D106)	Parabolic Ceiling Suspended	E	4'T8	1	10	32	Sw	8	190	5	325	494	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	1	10	32	8	190	5	325	494	0	0	0
140	1	Hallway	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
141	1	Vestibule	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
142	1	Vestibule	Recessed	E	4'T8	3	2	32	Sw	8	365	5	207	604	N/A	Recessed	4'T8	E	Sw	3	2	32	8	365	5	207	604	0	0	0
143	1	Classroom (D101)	Parabolic Ceiling Suspended	E	4'T8	5	10	32	Sw	8	190	5	1,625	2,470	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	5	10	32	8	190	5	1625	2470	0	0	0
144	1	Classroom (D101)	Parabolic Ceiling Suspended	E	4'T8	2	8	32	Sw	8	190	5	522	793	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	2	8	32	8	190	5	522	793	0	0	0
145	1	Classroom (D101)	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
146	1	Classroom (D101)	Track	S	Inc	2	5	90	Sw	8	190	0	900	1,368	CFL	Track	CFL	S	Sw	2	5	30	8	190	0	300	456	912	0	912
147	1	Classroom (D104)	Parabolic Ceiling Suspended	E	4'T8	1	12	32	Sw	8	190	5	389	591	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	1	12	32	8	190	5	389	591	0	0	0
148	1	Classroom (D102)	Parabolic Ceiling Suspended	E	4'T8	1	12	32	Sw	8	190	5	389	591	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	1	12	32	8	190	5	389	591	0	0	0
149	1	Classroom (D104)	Parabolic Ceiling Suspended	E	4'T8	1	10	32	Sw	8	190	5	325	494	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	1	10	32	8	190	5	325	494	0	0	0
150	1	Classroom (D102)	Parabolic Ceiling Suspended	E	4'T8	1	10	32	Sw	8	190	5	325	494	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	1	10	32	8	190	5	325	494	0	0	0
151	1	Classroom (D102)	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
152	1	Classroom (D104)	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
153	1	Mechanical Room	Ceiling Suspended	E	4'T8	9	2	32	Sw	2	261	5	621	324	N/A	Ceiling Suspended	4'T8	E	Sw	9	2	32	2	261	5	621	324	0	0	0
154	1	Mechanical Room	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
155	1	Bathroom Women	Recessed	E	4'T8	5	2	32	Sw	8	261	5	345	720	C	Recessed	4'T8	E	OS	5	2	32	6	261	5	345	540	0	180	180
156	1	Bathroom Men	Recessed	E	4'T8	5	2	32	Sw	8	261	5	345	720	C	Recessed	4'T8	E	OS	5	2	32	6	261	5	345	540	0	180	180
157	1	Janitor's Closet	Ceiling Mounted	E	4'T8	2	2	32	Sw	2	261	5	138	72	N/A	Ceiling Mounted	4'T8	E	Sw	2	2	32	2	261	5	138	72	0	0	0
158	1	Storage Room	Ceiling Mounted	E	4'T8	3	2	32	Sw	2	261	5	207	108	N/A	Ceiling Mounted	4'T8	E	Sw	3	2	32	2	261	5	207	108	0	0	0
159	1	Corridor	Recessed	E	4'T8	1	2	32	Sw	9	261	5	69	162	N/A	Recessed	4'T8	E	Sw	1	2	32	9	261	5	69	162	0	0	0
160	1	Hallway	Recessed	E	2'T8	27	2	17	Sw	24	365	2	972	8,515	N/A	Recessed	2'T8	E	Sw	27	2	17	24	365	2	972	8515	0	0	0
161	1	Hallway	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
162	1	Hallway	Recessed	E	4'T8	3	2	32	Sw	24	365	5	207	1,813	N/A	Recessed	4'T8	E	Sw	3	2	32	24	365	5	207	1813	0	0	0
163	1	Hallway	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
164	1	School store room	Recessed	E	4'T8	2	4	32	Sw	2	190	5	266	101	N/A	Recessed	4'T8	E	Sw	2	4	32	2	190	5	266	101	0	0	0
165	1	Storage Room	Ceiling Mounted	E	4'T8	2	2	32	Sw	2	190	5	138	52	N/A	Ceiling Mounted	4'T8	E	Sw	2	2	32	2	190	5	138	52	0	0	0
166	1	Hallway	Recessed	E	4'T8	11	4	32	Sw	24	365	5	1,463	12,816	N/A	Recessed	4'T8	E	Sw	11	4	32	24	365	5	1463	12816	0	0	0
167	1	Hallway	Recessed	M	4'T12 U-Shaped	1	2	40	Sw	24	365	12	92	806	T8	Recessed	4'T8 U-Shaped	E	Sw	1	2	32	24	365	5	69	604	201	0	201
168	1	Cafeteria	Recessed	M	4'T12	40	4	40	Sw	9	190	12	6,880	11,765	T8	Recessed	4'T8	E	Sw	40	4	32	9	190	5	5320	9097	2668	0	2668
169	1	Cafeteria	Recessed	S	Inc	35	1	150	Sw	9	190	0	5,250	8,978	CFL	Recessed	CFL	S	Sw	35	1	50	9	190	0	1750	2993	5985	0	5985
170	1	Cafeteria	Recessed	E	4'T8	43	3	32	Sw	9	190	5	4,343	7,427	N/A	Recessed	4'T8	E	Sw	43	3	32	9	190	5	4343	7427	0	0	0
171	1	Cafeteria	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
172	1	Teachers Lounge	Recessed	E	4'T8	12	3	32	Sw	9	190	5	1,212	2,073	C	Recessed	4'T8	E	OS	12	3	32	7	190	5	1212	1554	0	518	518
173	1	Teachers Lounge	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
174	1	Kitchen	Recessed	E	4'T8	8	3	32	Sw	8	190	5	808	1,228	N/A	Recessed	4'T8	E	Sw	8	3	32	8	190	5	808	1228	0	0	0
175	1	Kitchen	Recessed	E	4'T8	8	3	32	Sw	8	190	5	808	1,228	N/A	Recessed	4'T8	E	Sw	8	3	32	8	190	5	808	1228	0	0	0
176	1	Kitchen	Ceiling Suspended	M	4'T12	36	2	40	Sw	8	190	12	3,312	5,034	T8	Ceiling Suspended	4'T8	E	Sw	36	2	32	8	190	5	2484	3776	1259	0	1259
177	1	Kitchen	Ceiling Mounted	M	4'T12	1	2	40	Sw	8	190	12	92	140	T8	Ceiling Mounted	4'T8	E	Sw	1	2	32	8	190	5	69	105	35	0	35
178	1	Kitchen	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
179	1	Kitchen Storage	Ceiling Suspended	M	4'T12	2	1	40	Sw	2	190	12	104	40	T8	Ceiling Suspended	4'T8	E	Sw	2	1	32	2	190	5	74	28	11	0	11
180	1	Walk-in Refrigerator	Wall Mounted	S	Inc	1	1	150	Sw	2	190	0	150	57	CFL	Wall Mounted	CFL	S	Sw	1	1	50	2	190	0	50	19	38	0	38

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)
181	1	Kitchen	Ceiling Suspended	S	Inc	4	1	150	Sw	8	190	0	600	912	CFL	Ceiling Suspended	CFL	S	Sw	4	1	50	8	190	0	200	304	608	0	608
182	1	Walk-in Refrigerator	Wall Mounted	S	Inc	1	1	150	Sw	2	190	0	150	57	CFL	Wall Mounted	CFL	S	Sw	1	1	50	2	190	0	50	19	38	0	38
183	1	Walk-in Refrigerator	Wall Mounted	S	Inc	1	1	150	Sw	2	190	0	150	57	CFL	Wall Mounted	CFL	S	Sw	1	1	50	2	190	0	50	19	38	0	38
184	1	Kitchen - Storage	Ceiling Suspended	S	Inc	4	1	150	Sw	2	190	0	600	228	CFL	Ceiling Suspended	CFL	S	Sw	4	1	50	2	190	0	200	76	152	0	152
185	1	Kitchen	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
186	1	Kitchen - Office	Recessed	E	4'T8 U-Shaped	2	2	32	Sw	8	190	5	138	210	N/A	Recessed	4'T8 U-Shaped	E	Sw	2	2	32	8	190	5	138	210	0	0	0
187	1	Kitchen - Locker Room	Recessed	S	CFL	2	1	23	Sw	8	190	0	46	70	N/A	Recessed	CFL	S	Sw	2	1	23	8	190	0	46	70	0	0	0
188	1	Kitchen - Bathroom	Wall Mounted	S	CFL	1	1	13	Sw	4	190	0	13	10	N/A	Wall Mounted	CFL	S	Sw	1	1	13	4	190	0	13	10	0	0	0
189	1	Kitchen - Bathroom	Wall Mounted	S	Inc	1	1	150	Sw	4	190	0	150	114	CFL	Wall Mounted	CFL	S	Sw	1	1	50	4	190	0	50	38	76	0	76
190	1	Kitchen - Storage	Wall Mounted	S	Inc	1	1	150	Sw	2	190	0	150	57	CFL	Wall Mounted	CFL	S	Sw	1	1	50	2	190	0	50	19	38	0	38
191	1	Kitchen	Ceiling Mounted	E	4'T8	2	4	32	Sw	8	190	5	266	404	N/A	Ceiling Mounted	4'T8	E	Sw	2	4	32	8	190	5	266	404	0	0	0
192	1	Electrical Room	Ceiling Suspended	S	Inc	1	1	150	Sw	2	190	0	150	57	CFL	Ceiling Suspended	CFL	S	Sw	1	1	50	2	190	0	50	19	38	0	38
193	1	Faculty Lounge	Recessed	E	4'T8	12	4	32	Sw	8	190	5	1,596	2,426	C	Recessed	4'T8	E	OS	12	4	32	6	190	5	1596	1819	0	606	606
194	1	Faculty Lounge Storage	Recessed	S	CFL	1	1	23	Sw	2	190	0	23	9	N/A	Recessed	CFL	S	Sw	1	1	23	2	190	0	23	9	0	0	0
195	1	Faculty Lounge Storage	Recessed	S	CFL	1	1	23	Sw	2	190	0	23	9	N/A	Recessed	CFL	S	Sw	1	1	23	2	190	0	23	9	0	0	0
196	1	Faculty Lounge Storage	Ceiling Suspended	S	Inc	2	1	150	Sw	2	190	0	300	114	CFL	Ceiling Suspended	CFL	S	Sw	2	1	50	2	190	0	100	38	76	0	76
197	1	Office (A136)	Recessed	E	4'T8	4	3	32	Sw	8	190	5	404	614	N/A	Recessed	4'T8	E	Sw	4	3	32	8	190	5	404	614	0	0	0
198	1	Office	Recessed	M	4'T12	1	4	40	Sw	8	190	12	172	261	T8	Recessed	4'T8	E	Sw	1	4	32	8	190	5	133	202	59	0	59
199	1	Vestibule	Recessed	M	4'T12 U-Shaped	1	2	40	Sw	8	365	12	92	269	T8	Recessed	4'T8 U-Shaped	E	Sw	1	2	32	8	365	5	69	201	67	0	67
200	1	Bathroom Men	Recessed	E	4'T8	1	4	32	Sw	4	190	5	133	101	N/A	Recessed	4'T8	E	Sw	1	4	32	4	190	5	133	101	0	0	0
201	1	Bathroom Women	Recessed	M	4'T12	2	4	40	Sw	4	190	12	344	261	T8	Recessed	4'T8	E	Sw	2	4	32	4	190	5	266	202	59	0	59
202	1	Office Area - Guidance	Recessed	E	4'T8	8	2	32	Sw	8	190	5	621	944	C	Recessed	4'T8	E	OS	8	2	32	6	190	5	621	708	0	236	236
203	1	Office Area	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
204	1	Office	Recessed	E	4'T8	3	3	32	Sw	8	190	5	303	461	N/A	Recessed	4'T8	E	Sw	3	3	32	8	190	5	303	461	0	0	0
205	1	Office	Recessed	E	4'T8	3	3	32	Sw	8	190	5	303	461	N/A	Recessed	4'T8	E	Sw	3	3	32	8	190	5	303	461	0	0	0
206	1	Office	Recessed	E	4'T8	3	3	32	Sw	8	190	5	303	461	N/A	Recessed	4'T8	E	Sw	3	3	32	8	190	5	303	461	0	0	0
207	1	Corridor	Recessed	E	4'T8	5	3	32	Sw	8	190	5	505	768	N/A	Recessed	4'T8	E	Sw	5	3	32	8	190	5	505	768	0	0	0
208	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
209	1	Office	Recessed	E	4'T8	2	4	32	Sw	9	261	5	266	625	N/A	Recessed	4'T8	E	Sw	2	4	32	9	261	5	266	625	0	0	0
210	1	Office	Recessed	E	4'T8	2	4	32	Sw	9	261	5	266	625	N/A	Recessed	4'T8	E	Sw	2	4	32	9	261	5	266	625	0	0	0
211	1	Office	Recessed	E	4'T8	2	4	32	Sw	9	261	5	266	625	N/A	Recessed	4'T8	E	Sw	2	4	32	9	261	5	266	625	0	0	0
212	1	Office	Recessed	E	4'T8	3	4	32	Sw	9	261	5	399	937	C	Recessed	4'T8	E	OS	3	4	32	7	261	5	399	703	0	234	234
213	1	Meeting Room	Recessed	M	4'T12	4	4	40	Sw	4	261	12	688	718	T8	Recessed	4'T8	E	Sw	4	4	32	4	261	5	532	555	163	0	163
214	1	Bathroom Men	Recessed	M	4'T12 U-Shaped	1	2	40	Sw	4	261	12	92	96	T8	Recessed	4'T8 U-Shaped	E	Sw	1	2	32	4	261	5	69	72	24	0	24
215	1	Bathroom Women	Recessed	M	4'T12 U-Shaped	1	2	40	Sw	4	261	12	92	96	T8	Recessed	4'T8 U-Shaped	E	Sw	1	2	32	4	261	5	69	72	24	0	24
216	1	Electrical Room	Ceiling Suspended	S	Inc	1	1	150	N	2	261	0	150	78	CFL	Ceiling Suspended	CFL	S	N	1	1	50	2	261	0	50	26	52	0	52
217	1	Electrical Room	Ceiling Suspended	S	Inc	1	1	150	N	2	261	0	150	78	CFL	Ceiling Suspended	CFL	S	N	1	1	50	2	261	0	50	26	52	0	52
218	1	Office	Recessed Parabolic	E	4'T8	14	3	32	Sw	9	261	5	1,414	3,321	C	Recessed Parabolic	4'T8	E	OS	14	3	32	7	261	5	1414	2491	0	830	830
219	1	Office	Recessed Parabolic	E	4'T8 U-Shaped	2	2	32	Sw	9	261	5	138	324	N/A	Recessed Parabolic	4'T8 U-Shaped	E	Sw	2	2	32	9	261	5	138	324	0	0	0
220	1	Office	Recessed Parabolic	E	4'T8	2	3	32	Sw	9	261	5	202	474	N/A	Recessed Parabolic	4'T8	E	Sw	2	3	32	9	261	5	202	474	0	0	0
221	1	Office	Recessed Parabolic	E	4'T8	2	3	32	Sw	9	261	5	202	474	N/A	Recessed Parabolic	4'T8	E	Sw	2	3	32	9	261	5	202	474	0	0	0
222	1	Office	Recessed Parabolic	E	4'T8	2	3	32	Sw	9	261	5	202	474	N/A	Recessed Parabolic	4'T8	E	Sw	2	3	32	9	261	5	202	474	0	0	0
223	1	Office	Recessed Parabolic	E	4'T8	2	3	32	Sw	9	261	5	202	474	N/A	Recessed Parabolic	4'T8	E	Sw	2	3	32	9	261	5	202	474	0	0	0
224	1	Lunch Room	Recessed Parabolic	E	4'T8	2	3	32	Sw	4	261	5	202	211	N/A	Recessed Parabolic	4'T8	E	Sw	2	3	32	4	261	5	202	211	0	0	0
225	1	Meeting Room	Recessed	E	4'T8	2	4	32	Sw	4	261	5	266	278	N/A	Recessed	4'T8	E	Sw	2	4	32	4	261	5	266	278	0	0	0
226	1	Mechanical Room	Ceiling Mounted	E	4'T8	1	4	32	Sw	2	261	5	133	69	N/A	Ceiling Mounted	4'T8	E	Sw	1	4	32	2	261	5	133	69	0	0	0
227	1	Office - Guidance Supervisor	Recessed	E	4'T8	4	3	32	Sw	9	261	5	404	949	C	Recessed	4'T8	E	OS	4	3	32	7	261	5	404	712	0	237	237
228	1	Office	Recessed	E	4'T8	20	4	32	Sw	9	261	5	2,660	6,249	C	Recessed	4'T8	E	OS	20	4	32	7	261	5	2660	4686	0	1562	1562
229	1	Office	Recessed Parabolic	E	4'T8	4	3	32	Sw	9	261	5	404	949	C	Recessed Parabolic	4'T8	E	N	4	3	32	9	261	5	404	949	0	0	0
230	1	Lunch Room	Recessed	M	4'T12	4	4	40	Sw	4	261	12	688	718	T8	Recessed	4'T8	E	Sw	4	4	32	4	261	5	532	555	163	0	163
231	1	Corridor	Recessed Parabolic	E	4'T8	4	3	32	Sw	9	261	5	404	949	C	Recessed Parabolic	4'T8	E	OS	4	3	32	7	261	5	404	712	0	237	237
232	1	Storage Room	Ceiling Suspended	S	Inc	2	1	150	Sw	2	261	0	300	157	CFL	Ceiling Suspended	CFL	S	Sw	2	1	50	2	261	0	100	52	104	0	104
233	1	Office	Recessed Parabolic	E	4'T8	4	3	32	Sw	9	261	5	404	949	C	Recessed Parabolic	4'T8	E	OS	4	3	32	7	261	5	404	712	0	237	237
234	1	Bathroom	Recessed	S	CFL	1	1	23	Sw	4	261	0	23	24	N/A	Recessed	CFL	S	Sw	1	1	23	4	261	0	23	24	0	0	0
235	1	Bathroom Men	Recessed	S	CFL	1	1	23	Sw	4	261	0	23	24	N/A	Recessed	CFL	S	Sw	1	1	23	4	261	0	23	24	0	0	0
236	1	Storage Room	Recessed	S	Inc	1	1	60	Sw	2	261	0	60	31	CFL	Recessed	CFL	S	Sw	1	1	20	2	261	0	20	10	21	0	21
237	1	Storage Closet	Recessed Parabolic	E	4'T8	3	3	32	Sw	2	261	5	303	158	N/A	Recessed Parabolic	4'T8	E	Sw	3	3	32	2	261	5	303	158	0	0	0
238	1	Office	Recessed Parabolic	E	4'T8	5	3	32	Sw	9	261	5	505	1,186	C	Recessed Parabolic	4'T8	E	OS	5	3	32	7	261	5	505	990	0	297	297
239	1	Meeting Room	Recessed Parabolic	E	4'T8	2	3	32	Sw	4	261	5	202	211	N/A	Recessed Parabolic	4'T8	E	Sw	2	3	32	4	261	5	202	211	0	0	0
240	1	Corridor	Recessed Parabolic	E	4'T8	1	3	32	Sw	9	261	5	101	237	N/A	Recessed Parabolic	4'T8	E	Sw	1	3	32	9	261	5	101	237	0	0	0
241	1	Office	Recessed	E	4'T8 U-Shaped	6	2	32	Sw	9	261	5	414	972	C	Recessed	4'T8 U-Shaped	E	OS	6	2	32	7	261	5	414	729	0	243	243
242	1	Office	Recessed	S	CFL	1	2	13	Sw	9	261	0	26	61	N/A	Recessed	CFL	S	Sw	1	2	13	9	261	0	26	61	0	0	0
243	1	Office	Recessed	M	4'T12	6	4	40	Sw	9	261	12	1,032	2,424	T8	Recessed	4'T8	E	OS	6	4	32	7	261	5	798	1406	550	469	1018
244	1	Faculty Work Room	Recessed	E	4'T8	6	4	32	Sw	9	190	5	798	1,365	N/A	Recessed	4'T8	E	Sw	6	4	32	9	190	5	798	1365	0	0	0
245	1	Auditorium Ticket Booth	Recessed	E	4'T8 U-Shaped	2	2	32	Sw	2	20	5	138	6	N/A	Recessed	4'T8 U-Shaped	E	Sw	2	2	32	2	20	5	138	6	0	0	0
246	1	Auditorium Control Room	Recessed	S	Inc	11	1	45	Sw	8	20	0	495	79	CFL	Recessed	CFL	S	Sw	11	1	15	8	20	0	165	26	53	0	53
247	1	Auditorium Control Room	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
248	1	Auditorium	Recessed	E	4'T8	58	4	32	Sw	8	80	5	7,714	4,937	N/A	Recessed	4'T8	E	Sw	58	4	32	8	80	5	7714	4937	0	0	0
249	1	Auditorium	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
250	1	Auditorium	Sconce	S	CFL	7	2	13	Sw	8	80	0	182	116	N/A	Sconce	CFL	S	Sw	7	2	13	8	80	0	182	116	0	0	0
251	1	Stage	Ceiling Suspended	S	Inc	4	1	150	Sw	8	80	0	600	384	CFL	Ceiling Suspended	CFL	S	Sw	4	1	50	8	80	0	200	128	256	0	256
252	1	Backstage Area	Ceiling Suspended	S	Inc	8	1	150	Sw	8	80	0	1,200	768	CFL	Ceiling Suspended	CFL	S	Sw	8	1	50	8	80	0	400	256	512	0	512
253	1	Backstage Area	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
254	1	Lobby	Recessed	E	4'T8	4	4	32	Sw	24	365	5	532	4,660	N/A	Recessed	4'T8	E	Sw	4	4	32	24	365	5	532	4660	0	0	0
255	1	Hallway	Recessed	E	4'T8	9	4	32	Sw	24	365	5	1,197	10,486	N/A	Recessed	4'T8	E	Sw	9	4	32	24	365	5	1197	10486	0	0	0
256	1	Nurse's Station	Recessed	M	4'T12	4	2	40	Sw	9	190	12	368	629	T8	Recessed	4'T8	E	Sw	4	2	32	9	190	5	276	472	157	0	157
257	1	Nurse's Station	Recessed	M	4'T12	6	2	40	Sw	9	190	12	552	944	T8	Recessed	4'T8	E	OS	6	2	32	7	190	5	414	531	236	177	413
258	1	Bathroom	Recessed	M	4'T12	2	4	40	Sw	4	190	12	344	261	T8	Recessed	4'T8	E	Sw	2	4	32	4	190	5	266	202	59	0	59
259	1	Nurse's Station	Recessed	M	4'T12	1	4	40	Sw	9	190	12	172	294	T8	Recessed	4'T8	E	Sw	1	4	32	9	190	5	133	227	67	0	67
260	1	Storage Room	Ceiling Mounted	S	CFL	1	2	13	Sw	2	190	0	26	10	N/A	Ceiling Mounted	CFL	S	Sw	1	2	13	2	190	0	26	10	0	0	0
261	1	Nurse's Station	Recessed	M	4'T12	1	4	40	Sw	2	190	12	172	65	T8	Recessed	4'T8	E	Sw	1	4	32	2	190	5	133	51	15	0	15
262	1	Football Coach Office	Recessed	M	4'T12	2	4	40	Sw	4	190	12	344	261	T8	Recessed	4'T8	E	Sw	2	4	32	4	190	5	266	202	59	0	59
263	1	Football Coach Office Bathroom	Wall Mounted	S	CFL	1	2	13	Sw	2	190	0	26	10	N/A	Wall Mounted	CFL	S	Sw	1	2	13	2	190	0	26	10	0	0	0
264	1	Hallway	Recessed	E	4'T8	6	4	32	Sw	24	35	5	798	670	N/A	Recessed	4'T8	E	Sw	6	4	32	24	35	5	798	670	0	0	0
265	1	Hallway	Exit Sign	E	FL	1	1	15	N	24	365	2	17	145	LEDex	Exit Sign	LED	E	N	1	1	5	24	365	1	6	48	96	0	96
266	1	Storage Room	Ceiling Suspended	S	CFL	2	1	23	Sw	2	261	0	46	24	N/A	Ceiling Suspended	CFL	S	Sw	2	1	23	2	261	0	46	24	0	0	0
267	1	Storage Room	Ceiling Suspended	S	Inc	2	1	150	Sw	2	261	0	300	157	CFL	Ceiling Suspended	CFL	S	Sw	2	1	50	2	261	0	100	52	104	0	104
268	1	Storage Room	Ceiling Suspended	S	Inc	2	1	150	Sw	2	261	0	300	157	CFL	Ceiling Suspended	CFL	S	Sw	2	1	50	2	261	0	100	52	104	0	104
269	1	Storage Room	Ceiling Suspended	S	CFL	4	1	23	Sw	2	261	0	92	48	N/A	Ceiling Suspended	CFL	S	Sw	4	1	23	2	261	0	92	48	0	0	0
270	1	Hallway	Recessed	E	4'T8	5	4	32	Sw	24	365	5	665	5,825	N/A	Recessed	4'T8	E	Sw	5	4	32	24	365	5	665	5825	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)
271	1	Vestibule	Ceiling Mounted	M	4'T12	1	2	40	Sw	8	365	12	92	269	T8	Ceiling Mounted	4'T8	E	Sw	1	2	32	8	365	5	69	201	67	0	67
272	1	Classroom	Recessed	E	4'T8	15	4	32	Sw	8	190	5	1,995	3,032	N/A	Recessed	4'T8	E	Sw	15	4	32	8	190	5	1995	3032	0	0	0
273	1	Office	Ceiling Mounted	M	4'T12	2	2	40	Sw	8	190	12	184	280	T8	Ceiling Mounted	4'T8	E	Sw	2	2	32	8	190	5	138	210	70	0	70
274	1	Office	Ceiling Mounted	M	4'T12	6	2	40	Sw	8	190	12	552	839	T8	Ceiling Mounted	4'T8	E	Sw	6	2	32	8	190	5	414	629	210	0	210
275	1	Classroom	Recessed	E	4'T8	19	4	32	Sw	8	190	5	2,527	3,841	N/A	Recessed	4'T8	E	Sw	19	4	32	8	190	5	2527	3841	0	0	0
276	1	Storage Room	Ceiling Suspended	S	Inc	2	1	150	Sw	2	261	0	300	157	CFL	Ceiling Suspended	CFL	S	Sw	2	1	50	2	261	0	100	52	104	0	104
277	1	Storage Room	Ceiling Suspended	S	Inc	2	1	150	Sw	2	261	0	300	157	CFL	Ceiling Suspended	CFL	S	Sw	2	1	50	2	261	0	100	52	104	0	104
278	1	Storage Room	Ceiling Mounted	M	4'T12	2	2	40	Sw	2	261	12	184	96	T8	Ceiling Mounted	4'T8	E	Sw	2	2	32	2	261	5	138	72	24	0	24
279	1	Storage Room	Ceiling Mounted	M	4'T12	2	2	40	Sw	2	261	12	184	96	T8	Ceiling Mounted	4'T8	E	Sw	2	2	32	2	261	5	138	72	24	0	24
280	1	Storage Room	Ceiling Mounted	M	4'T12	2	2	40	Sw	2	261	12	184	96	T8	Ceiling Mounted	4'T8	E	Sw	2	2	32	2	261	5	138	72	24	0	24
281	1	Storage Room	Ceiling Mounted	M	4'T12	3	2	40	Sw	2	261	12	276	144	T8	Ceiling Mounted	4'T8	E	Sw	3	2	32	2	261	5	207	108	36	0	36
282	1	Corridor	Recessed	E	4'T8	2	4	32	Sw	8	190	5	266	404	N/A	Recessed	4'T8	E	Sw	2	4	32	8	190	5	266	404	0	0	0
283	1	Office	Recessed	E	4'T8	2	4	32	Sw	8	190	5	266	404	N/A	Recessed	4'T8	E	Sw	2	4	32	8	190	5	266	404	0	0	0
284	1	Bathroom Men	Recessed	E	4'T8	1	4	32	Sw	4	190	5	133	101	N/A	Recessed	4'T8	E	Sw	1	4	32	4	190	5	133	101	0	0	0
285	1	Office	Recessed	E	4'T8	4	4	32	Sw	8	190	5	532	809	C	Recessed	4'T8	E	OS	4	4	32	6	190	5	532	606	0	202	202
286	1	Bathroom Men	Recessed	E	4'T8	2	4	32	Sw	4	190	5	266	202	N/A	Recessed	4'T8	E	Sw	2	4	32	4	190	5	266	202	0	0	0
287	1	Bathroom Men	Recessed	E	4'T8	3	4	32	Sw	8	190	5	399	606	N/A	Recessed	4'T8	E	Sw	3	4	32	8	190	5	399	606	0	0	0
288	1	Showers Men	Recessed	E	4'T8	2	4	32	Sw	4	190	5	266	202	N/A	Recessed	4'T8	E	Sw	2	4	32	4	190	5	266	202	0	0	0
289	1	Bathroom Men	Recessed	E	4'T8	2	4	32	Sw	4	190	5	266	202	N/A	Recessed	4'T8	E	Sw	2	4	32	4	190	5	266	202	0	0	0
290	1	Bathroom Women	Recessed	E	4'T8	2	4	32	Sw	4	190	5	266	202	N/A	Recessed	4'T8	E	Sw	2	4	32	4	190	5	266	202	0	0	0
291	1	Janitor's Closet	Ceiling Suspended	S	Inc	1	1	150	Sw	2	261	0	150	78	CFL	Ceiling Suspended	CFL	S	Sw	1	1	50	2	261	0	50	26	52	0	52
292	1	Lobby	Recessed	E	4'T8	12	4	32	Sw	24	365	5	1,596	13,981	N/A	Recessed	4'T8	E	Sw	12	4	32	24	365	5	1596	13981	0	0	0
293	1	Lobby	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
294	1	Storage Room	Recessed	M	4'T12	1	2	40	Sw	2	261	12	92	48	T8	Recessed	4'T8	E	Sw	1	2	32	2	261	5	69	36	12	0	12
295	1	Storage Room	Wall Mounted	S	Inc	2	1	150	Sw	2	261	0	300	157	CFL	Wall Mounted	CFL	S	Sw	2	1	50	2	261	0	100	52	104	0	104
296	1	Gymnasium	High Bay	S	PSMH	40	1	400	Sw	8	190	80	19,200	29,184	N/A	High Bay	PSMH	S	Sw	40	1	400	8	190	80	19200	29184	0	0	0
297	1	Hallway	Recessed	M	4'T12 U-Shaped	8	2	40	Sw	24	365	12	736	6,447	T8	Recessed	4'T8 U-Shaped	E	Sw	8	2	32	24	365	5	552	4836	1612	0	1612
298	1	Hallway	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
299	1	Team Room Women	Ceiling Mounted	E	4'T8	8	2	32	Sw	8	190	5	552	839	C	Ceiling Mounted	4'T8	E	OS	8	2	32	6	190	5	552	629	0	210	210
300	1	Showers Women	Recessed	S	CFL	5	1	23	N	4	190	0	115	87	N/A	Recessed	CFL	S	N	5	1	23	4	190	0	115	87	0	0	0
301	1	Showers Women	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
302	1	Classroom (C126)	Recessed	M	4'T12	12	4	40	Sw	8	190	12	2,064	3,137	T8	Recessed	4'T8	E	Sw	12	4	32	8	190	5	1596	2426	711	0	711
303	1	Storage Closet (C126)	Recessed	S	Inc	1	1	150	N	2	261	0	150	78	CFL	Recessed	CFL	S	N	1	1	50	2	261	0	50	26	52	0	52
304	1	Gymnasium	High Bay	S	PSMH	16	1	250	Sw	8	190	50	4,800	7,296	N/A	High Bay	PSMH	S	Sw	16	1	250	8	190	50	4800	7296	0	0	0
305	1	Corridor	Ceiling Mounted	M	4'T12	2	2	40	Sw	4	365	12	184	269	T8	Ceiling Mounted	4'T8	E	Sw	2	2	32	4	365	5	138	201	67	0	67
306	Mezz	Mechanical Room	Ceiling Suspended	M	4'T12	7	2	40	Sw	2	261	12	644	336	T8	Ceiling Suspended	4'T8	E	Sw	7	2	32	2	261	5	483	252	84	0	84
307	1	Gymnasium	Exit Sign	E	Fl.	4	1	15	N	24	365	2	68	578	LEDex	Exit Sign	LED	E	N	4	1	5	24	365	1	22	193	385	0	385
308	1	Hallway	Recessed	E	4'T8	5	2	32	Sw	24	365	5	345	3,022	N/A	Recessed	4'T8	E	Sw	5	2	32	24	365	5	345	3022	0	0	0
309	1	Classroom (C128)	Parabolic Ceiling Suspended	E	4'T8	3	12	32	Sw	8	190	5	1,167	1,774	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	3	12	32	8	190	5	1167	1774	0	0	0
310	1	Classroom (C128)	Parabolic Ceiling Suspended	E	4'T8	1	10	32	Sw	8	190	5	325	494	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	1	10	32	8	190	5	325	494	0	0	0
311	1	Classroom (C130)	Parabolic Ceiling Suspended	E	4'T8	3	12	32	Sw	8	190	5	1,167	1,774	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	3	12	32	8	190	5	1167	1774	0	0	0
312	1	Classroom (C130)	Parabolic Ceiling Suspended	E	4'T8	1	10	32	Sw	8	190	5	325	494	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	1	10	32	8	190	5	325	494	0	0	0
313	1	Gymnasium	High Bay	S	PSMH	32	1	250	Sw	8	190	50	9,600	14,592	N/A	High Bay	PSMH	S	Sw	32	1	250	8	190	50	9600	14592	0	0	0
314	1	Hallway	Recessed	E	4'T8	10	4	32	Sw	24	365	5	1,330	11,651	N/A	Recessed	4'T8	E	Sw	10	4	32	24	365	5	1330	11651	0	0	0
315	1	Hallway	Recessed	E	4'T8 U-Shaped	1	2	32	Sw	24	365	5	69	604	N/A	Recessed	4'T8 U-Shaped	E	Sw	1	2	32	24	365	5	69	604	0	0	0
316	1	Office	Recessed Parabolic	S	4'T8	9	3	32	Sw	8	190	5	909	1,382	N/A	Recessed Parabolic	4'T8	S	Sw	9	3	32	8	190	5	909	1382	0	0	0
317	1	Fitness Center	High Bay	S	MV	5	1	150	Sw	4	190	24	870	661	CFL	Flood	CFL	S	OS	5	1	100	3	190	0	500	285	281	95	376
318	1	Fitness Center	Recessed	M	4'T12	2	4	40	Sw	4	190	12	344	261	T8	Recessed	4'T8	E	Sw	2	4	32	4	190	5	266	202	59	0	59
319	1	Fitness Center	Exit Sign	S	Inc	2	1	20	N	24	365	0	40	350	LEDex	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	254	0	254
320	1	Locker Room Women	Recessed	E	4'T8	1	4	32	Sw	8	190	5	133	202	N/A	Recessed	4'T8	E	Sw	1	4	32	8	190	5	133	202	0	0	0
321	1	Locker Room Men	Recessed	E	4'T8	1	4	32	Sw	8	190	5	133	202	N/A	Recessed	4'T8	E	Sw	1	4	32	8	190	5	133	202	0	0	0
322	1	Locker Room Men	Recessed	E	4'T8	21	4	32	Sw	8	190	5	2,793	4,245	N/A	Recessed	4'T8	E	Sw	21	4	32	8	190	5	2793	4245	0	0	0
323	1	Locker Room Men	Recessed	E	2'T8	4	1	17	Sw	8	190	2	76	116	N/A	Recessed	2'T8	E	Sw	4	1	17	8	190	2	76	116	0	0	0
324	1	Locker Room Men	Recessed	E	4'T8	6	4	32	Sw	8	190	5	798	1,213	N/A	Recessed	4'T8	E	Sw	6	4	32	8	190	5	798	1,213	0	0	0
325	1	Locker Room Men	Recessed	E	4'T8	1	4	32	Sw	8	190	5	133	202	N/A	Recessed	4'T8	E	Sw	1	4	32	8	190	5	133	202	0	0	0
326	1	Locker Room Men Office	Recessed	E	4'T8	4	4	32	Sw	4	190	5	532	404	N/A	Recessed	4'T8	E	Sw	4	4	32	4	190	5	532	404	0	0	0
327	1	Locker Room Men Bathroom	Recessed	E	4'T8	1	2	32	Sw	4	190	5	69	52	N/A	Recessed	4'T8	E	Sw	1	2	32	4	190	5	69	52	0	0	0
328	1	Showers Men	Ceiling Mounted	S	CFL	6	2	23	Sw	4	190	0	276	210	N/A	Ceiling Mounted	CFL	S	Sw	6	2	23	4	190	0	276	210	0	0	0
329	1	Bathroom Men	Parabolic Ceiling Suspended	E	4'T8	1	4	32	Sw	4	190	5	133	101	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	1	4	32	4	190	5	133	101	0	0	0
330	1	Bathroom Men	Parabolic Ceiling Suspended	E	4'T8	1	4	32	Sw	4	190	5	133	101	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	1	4	32	4	190	5	133	101	0	0	0
331	1	Hallway	Recessed	E	4'T8	22	4	32	Sw	24	365	5	2,926	25,632	N/A	Recessed	4'T8	E	Sw	22	4	32	24	365	5	2926	25632	0	0	0
332	1	Hallway	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
333	1	Hallway	Recessed	M	4'T12 U-Shaped	5	2	40	Sw	24	365	12	460	4,030	T8	Recessed	4'T8 U-Shaped	E	Sw	5	2	32	24	365	5	345	3022	1007	0	1007
334	1	Hallway	Recessed	E	4'T8	6	2	32	Sw	24	365	5	414	3,627	N/A	Recessed	4'T8	E	Sw	6	2	32	24	365	5	414	3627	0	0	0
335	1	Hallway	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
336	1	Hallway	Recessed	E	4'T8	8	2	32	N	24	365	5	552	4,836	N/A	Recessed	4'T8	E	N	8	2	32	24	365	5	552	4836	0	0	0
337	1	Hallway	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
338	1	Bathroom Women	Recessed	E	4'T8	1	2	32	Sw	4	190	5	69	52	N/A	Recessed	4'T8	E	Sw	1	2	32	4	190	5	69	52	0	0	0
339	1	Bathroom Men	Recessed	E	4'T8	1	2	32	Sw	4	190	5	69	52	N/A	Recessed	4'T8	E	Sw	1	2	32	4	190	5	69	52	0	0	0
340	1	Hallway	Recessed	E	4'T8	9	4	32	Sw	24	365	5	1,197	10,486	N/A	Recessed	4'T8	E	Sw	9	4	32	24	365	5	1197	10486	0	0	0
341	1	Hallway	Recessed	E	4'T8	8	4	32	Sw	24	365	5	1,064	9,321	N/A	Recessed	4'T8	E	Sw	8	4	32	24	365	5	1064	9321	0	0	0
342	1	Hallway	Exit Sign	E	Fl.	1	1	15	N	24	365	2	17	145	LEDex	Exit Sign	LED	E	N	1	1	5	24	365	1	6	48	96	0	96
343	1	Hallway	Exit Sign	E	Fl.	1	1	15	N	24	365	2	17	145	LEDex	Exit Sign	LED	E	N	1	1	5	24	365	1	6	48	96	0	96
344	1	Resource Room Office	Recessed	E	4'T8	2	2	32	Sw	9	261	5	138	324	N/A	Recessed	4'T8	E	Sw	2	2	32	9	261	5	138	324	0	0	0
345	1	Resource Room Bathroom	Wall Mounted	S	CFL	1	1	13	Sw	2	261	0	13	7	N/A	Wall Mounted	CFL	S	Sw	1	1	13	2	261	0	13	7	0	0	0
346	1	Trainers Station	Recessed	E	4'T8	7	3	32	Sw	4	190	5	707	537	N/A	Recessed	4'T8	E	Sw	7	3	32	4	190	5	707	537	0	0	0
347	1	Bathroom	Recessed	E	4'T8	1	2	32	Sw	8	190	5	69	105	N/A	Recessed	4'T8	E	Sw	1	2	32	8	190	5	69	105	0	0	0
348	1	Storage Room	Ceiling Suspended	M	4'T12	6	2	40	Sw	2	261	12	552	288	T8	Ceiling Suspended	4'T8	E	Sw	6	2	32	2	261	5	414	216	72	0	72
349	1	Classroom (B107)	Recessed	E	4'T8	27	4	32	Sw	8	190	5	3,591	5,458	N/A	Recessed	4'T8	E	Sw	27	4	32	8	190	5	3591	5458	0	0	0
350	1	Office (B107)	Ceiling Mounted	M	4'T12	4	2	40	N	8	190	12	368	559	T8	Ceiling Mounted	4'T8	E	N	4	2	32	8	190	5	276	420	140	0	140
351	1	Storage Room (B107)	Parabolic Ceiling Suspended	M	4'T12	4	2	40	Sw	2	190	12	368	140	T8	Parabolic Ceiling Suspended	4'T8	E	Sw	4	2	32	2	190	5	276	105	35	0	35
352	1	Classroom Wood Shop (B109)	Ceiling Suspended	M	4'T12	42	2	40	Sw	8	190	12	3,864	5,873	T8	Ceiling Suspended	4'T8	E	Sw	42	2	32	8	190	5	2898	4405	1468	0	1468
353	1	Storage Room (B109)	Ceiling Suspended	M	4'T12	2	2	40	Sw	2	190	12	184	70	T8	Ceiling Suspended	4'T8	E	Sw	2	2	32	2	190	5	138	52	17	0	17
354	1	Janitor's Closet	Ceiling Suspended	E	4'T8	1	4	32	Sw	2	190	5	133	51	N/A	Ceiling Suspended	4'T8	E	Sw	1	4	32	2	190	5	133	51	0	0	0
355	1	Hallway	Recessed	E	4'T8	5	4	32	Sw	24	365	5	665	5,825	N/A	Recessed	4'T8	E	Sw	5	4	32	24	365	5	665	5825	0	0	0
356	1	Classroom (B111)	Recessed	E	4'T8	15	4	32	Sw	8	190	5	1,995	3,032	N/A	Recessed	4'T8	E	Sw	15	4	32	8	190	5	1995	3032	0	0	0
357	1	Classroom (B111)	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
358	1	Classroom (B113)	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
359	1	Classroom (B113)	Recessed	E	4'T8	15	4	32	Sw	8	190	5	1,995	3,032	N/A	Recessed	4'T8	E	Sw	15	4	32	8	190	5	1995	3032	0	0	0
360	1	Office (B113)	Recessed	E	4'T8	2	4	32	Sw	8	190	5	266	404	N/A	Recessed	4'T8	E	Sw	2	4	32	8	190	5	266	404	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)
361	1	Classroom (B110)	Recessed	E	4'T8	12	4	32	Sw	8	190	5	1,596	2,426	N/A	Recessed	4'T8	E	Sw	12	4	32	8	190	5	1596	2426	0	0	0
362	1	Office (B110)	Recessed	E	4'T8	2	4	32	Sw	8	190	5	266	404	N/A	Recessed	4'T8	E	Sw	2	4	32	8	190	5	266	404	0	0	0
363	1	Classroom (B108)	Recessed	E	4'T8	20	4	32	Sw	8	190	5	2,660	4,043	N/A	Recessed	4'T8	E	Sw	20	4	32	8	190	5	2660	4043	0	0	0
364	1	Classroom (B108)	Recessed	E	4'T8 U-Shaped	1	2	32	Sw	8	190	5	69	105	N/A	Recessed	4'T8 U-Shaped	E	Sw	1	2	32	8	190	5	69	105	0	0	0
365	1	Computer Lab (B106)	Recessed	E	4'T8	18	4	32	Sw	8	190	5	2,394	3,639	N/A	Recessed	4'T8	E	Sw	18	4	32	8	190	5	2394	3639	0	0	0
366	1	Computer Lab (B106)	Ceiling Mounted	E	4'T8	1	4	32	Sw	8	190	5	133	202	N/A	Ceiling Mounted	4'T8	E	Sw	1	4	32	8	190	5	133	202	0	0	0
367	1	Storage Room (B106)	Ceiling Suspended	S	Inc	2	1	60	Sw	2	190	0	120	46	CFL	Ceiling Suspended	CFL	S	Sw	2	1	20	2	190	0	40	15	30	0	30
368	1	Dark room (B106)	Ceiling Mounted	E	4'T8	5	2	32	Sw	1	190	5	345	66	N/A	Ceiling Mounted	4'T8	E	Sw	5	2	32	1	190	5	345	66	0	0	0
369	1	Dark room (B106)	Ceiling Mounted	E	4'T8	1	1	32	Sw	1	190	5	37	7	N/A	Ceiling Mounted	4'T8	E	Sw	1	1	32	1	190	5	37	7	0	0	0
370	1	Classroom (B101)	Recessed Parabolic	E	4'T8	12	4	32	Sw	8	190	5	1,596	2,426	N/A	Recessed Parabolic	4'T8	E	Sw	12	4	32	8	190	5	1596	2426	0	0	0
371	1	Mechanical Room	Recessed Parabolic	S	Inc	14	1	150	Sw	2	190	0	2,100	798	CFL	Recessed Parabolic	CFL	S	Sw	14	1	50	2	190	0	700	266	532	0	532
372	1	Bathroom	Recessed Parabolic	S	Inc	2	1	150	Sw	4	190	0	300	228	CFL	Recessed Parabolic	CFL	S	Sw	2	1	50	4	190	0	100	76	152	0	152
373	1	Electrical Room	Recessed Parabolic	S	Inc	1	1	150	Sw	2	190	0	150	57	CFL	Recessed Parabolic	CFL	S	Sw	1	1	50	2	190	0	50	19	38	0	38
374	1	Storage Room	Ceiling Suspended	S	Inc	3	1	60	Sw	2	190	0	180	68	CFL	Ceiling Suspended	CFL	S	Sw	3	1	20	2	190	0	60	23	46	0	46
375	1	Storage Room	Ceiling Suspended	M	4'T12	1	4	40	Sw	2	190	12	172	65	T8	Ceiling Suspended	4'T8	E	Sw	1	4	32	2	190	5	133	51	15	0	15
376	1	Electrical Room	Ceiling Suspended	M	4'T12	1	4	40	Sw	2	190	12	172	65	T8	Ceiling Suspended	4'T8	E	Sw	1	4	32	2	190	5	133	51	15	0	15
377	1	Lunch Room	Ceiling Suspended	M	4'T12	4	4	40	Sw	8	190	12	688	1,046	T8	Ceiling Suspended	4'T8	E	OS	4	4	32	6	190	5	532	606	237	202	439
378	1	Classroom	Recessed	E	4'T8	2	4	32	Sw	8	190	5	266	404	N/A	Recessed	4'T8	E	Sw	2	4	32	8	190	5	266	404	0	0	0
379	1	Bathroom Men	Recessed	M	4'T12	1	4	40	Sw	4	190	12	172	131	T8	Recessed	4'T8	E	Sw	1	4	32	4	190	5	133	101	30	0	30
380	1	Bathroom Women	Recessed	M	4'T12	1	4	40	Sw	4	190	12	172	131	T8	Recessed	4'T8	E	Sw	1	4	32	4	190	5	133	101	30	0	30
381	Str	Staircase	Recessed	E	4'T8	7	4	32	Sw	24	365	5	931	8,156	N/A	Recessed	4'T8	E	Sw	7	4	32	24	365	5	931	8156	0	0	0
382	Str	Staircase	Recessed	E	4'T8 U-Shaped	1	2	32	Sw	24	365	5	69	604	T8-BL	Recessed	4'T8 U-Shaped	E	BL	1	2	32	0	365	5	69	352	0	252	252
383	Str	Staircase	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
384	Str	Classroom (A201)	Recessed	E	4'T8	12	4	32	Sw	8	190	5	1,596	2,426	N/A	Recessed	4'T8	E	Sw	12	4	32	8	190	5	1596	2426	0	0	0
385	Str	Storage Room (A201)	Ceiling Suspended	S	CFL	1	1	36	N	2	190	0	36	13	N/A	Ceiling Suspended	CFL	S	N	1	1	36	2	190	0	36	13	0	0	0
386	Str	Storage Room (A201)	Ceiling Suspended	S	CFL	1	1	36	N	2	190	0	36	13	N/A	Ceiling Suspended	CFL	S	N	1	1	36	2	190	0	36	13	0	0	0
387	Str	Classroom (A202)	Recessed	E	4'T8	12	4	32	Sw	8	190	5	1,596	2,426	N/A	Recessed	4'T8	E	Sw	12	4	32	8	190	5	1596	2426	0	0	0
388	2	Hallway	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
389	2	Hallway	Recessed	E	4'T8	5	4	32	Sw	24	365	5	665	5,825	N/A	Recessed	4'T8	E	Sw	5	4	32	24	365	5	665	5825	0	0	0
390	2	Hallway	Recessed	E	4'T8 U-Shaped	1	2	32	Sw	24	365	5	69	604	N/A	Recessed	4'T8 U-Shaped	E	Sw	1	2	32	24	365	5	69	604	0	0	0
391	2	Classroom (A204)	Recessed	E	4'T8	12	4	32	Sw	8	190	5	1,596	2,426	N/A	Recessed	4'T8	E	Sw	12	4	32	8	190	5	1596	2426	0	0	0
392	2	Classroom (A206)	Recessed	E	4'T8	12	4	32	Sw	8	190	5	1,596	2,426	N/A	Recessed	4'T8	E	Sw	12	4	32	8	190	5	1596	2426	0	0	0
393	2	Classroom (A203)	Recessed	E	4'T8	12	4	32	Sw	8	190	5	1,596	2,426	N/A	Recessed	4'T8	E	Sw	12	4	32	8	190	5	1596	2426	0	0	0
394	2	Classroom (A205)	Recessed	E	4'T8	12	4	32	Sw	8	190	5	1,596	2,426	N/A	Recessed	4'T8	E	Sw	12	4	32	8	190	5	1596	2426	0	0	0
395	2	Classroom (A208)	Recessed	E	4'T8	12	4	32	Sw	8	190	5	1,596	2,426	N/A	Recessed	4'T8	E	Sw	12	4	32	8	190	5	1596	2426	0	0	0
396	2	Classroom (A207)	Recessed	E	4'T8	12	4	32	Sw	8	190	5	1,596	2,426	N/A	Recessed	4'T8	E	Sw	12	4	32	8	190	5	1596	2426	0	0	0
397	2	Classroom (A209)	Recessed	E	4'T8	12	4	32	Sw	8	190	5	1,596	2,426	N/A	Recessed	4'T8	E	Sw	12	4	32	8	190	5	1596	2426	0	0	0
398	2	Classroom (A210)	Recessed	E	4'T8	12	4	32	Sw	8	190	5	1,596	2,426	N/A	Recessed	4'T8	E	Sw	12	4	32	8	190	5	1596	2426	0	0	0
399	2	Storage Room (A210)	Ceiling Suspended	S	CFL	1	1	36	N	2	190	0	36	13	N/A	Ceiling Suspended	CFL	S	N	1	1	36	2	190	0	36	13	0	0	0
400	2	Hallway	Recessed	E	4'T8	5	4	32	Sw	24	365	5	665	5,825	N/A	Recessed	4'T8	E	Sw	5	4	32	24	365	5	665	5825	0	0	0
401	2	Hallway	Recessed	E	4'T8 U-Shaped	1	2	32	Sw	24	365	5	69	604	N/A	Recessed	4'T8 U-Shaped	E	Sw	1	2	32	24	365	5	69	604	0	0	0
402	2	Hallway	Recessed	E	4'T8	2	4	32	Sw	24	365	5	266	2,330	N/A	Recessed	4'T8	E	Sw	2	4	32	24	365	5	266	2330	0	0	0
403	2	Hallway	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
404	2	Janitor's Closet	Ceiling Suspended	S	Inc	1	1	150	Sw	2	261	0	150	78	CFL	Ceiling Suspended	CFL	S	Sw	1	1	50	2	261	0	50	26	52	0	52
405	2	Janitor's Closet	Ceiling Suspended	S	Inc	1	1	150	Sw	2	261	0	150	78	CFL	Ceiling Suspended	CFL	S	Sw	1	1	50	2	261	0	50	26	52	0	52
406	2	Bathroom Women	Recessed	E	4'T8 U-Shaped	2	2	32	Sw	4	190	5	138	105	N/A	Recessed	4'T8 U-Shaped	E	Sw	2	2	32	4	190	5	138	105	0	0	0
407	2	Bathroom Men	Recessed	E	4'T8 U-Shaped	2	2	32	Sw	4	190	5	138	105	N/A	Recessed	4'T8 U-Shaped	E	Sw	2	2	32	4	190	5	138	105	0	0	0
408	Str	Staircase	Recessed	E	4'T8	3	4	32	Sw	24	365	5	399	3,495	T8-BL	Recessed	4'T8	E	BL	3	4	32	0	365	5	399	2045	0	1451	1451
409	Str	Staircase	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
410	Str	Classroom (A213)	Recessed	E	4'T8	12	4	32	Sw	8	190	5	1,596	2,426	N/A	Recessed	4'T8	E	Sw	12	4	32	8	190	5	1596	2426	0	0	0
411	Str	Classroom (A211)	Recessed	E	4'T8	12	4	32	Sw	8	190	5	1,596	2,426	N/A	Recessed	4'T8	E	Sw	12	4	32	8	190	5	1596	2426	0	0	0
412	2	Office	Recessed	E	4'T8	2	4	32	Sw	8	190	5	266	404	N/A	Recessed	4'T8	E	Sw	2	4	32	8	190	5	266	404	0	0	0
413	2	Bathroom Men	Recessed	E	4'T8	1	4	32	Sw	4	190	5	133	101	N/A	Recessed	4'T8	E	Sw	1	4	32	4	190	5	133	101	0	0	0
414	2	Bathroom Women	Recessed	E	4'T8	1	4	32	Sw	4	190	5	133	101	N/A	Recessed	4'T8	E	Sw	1	4	32	4	190	5	133	101	0	0	0
415	2	Hallway	Recessed	E	4'T8	16	4	32	Sw	24	365	5	2,128	18,641	N/A	Recessed	4'T8	E	Sw	16	4	32	24	365	5	2128	18641	0	0	0
416	2	Classroom (A215)	Ceiling Suspended	M	4'T12	14	2	40	Sw	8	190	12	1,288	1,958	T8	Ceiling Suspended	4'T8	E	Sw	14	2	32	8	190	5	966	1468	489	0	489
417	2	Classroom (A217)	Ceiling Suspended	M	4'T12	14	2	40	Sw	8	190	12	1,288	1,958	T8	Ceiling Suspended	4'T8	E	Sw	14	2	32	8	190	5	966	1468	489	0	489
418	2	Classroom (A215)	Ceiling Mounted	M	4'T12	4	2	40	Sw	8	190	12	368	559	T8	Ceiling Mounted	4'T8	E	Sw	4	2	32	8	190	5	276	420	140	0	140
419	2	Classroom (A217)	Ceiling Mounted	M	4'T12	4	2	40	Sw	8	190	12	368	559	T8	Ceiling Mounted	4'T8	E	Sw	4	2	32	8	190	5	276	420	140	0	140
420	2	Hallway	Recessed	E	4'T8	1	4	32	Sw	24	365	5	133	1,165	N/A	Recessed	4'T8	E	Sw	1	4	32	24	365	5	133	1165	0	0	0
421	2	Hallway	Recessed	E	4'T8 U-Shaped	1	2	32	Sw	24	365	5	69	604	N/A	Recessed	4'T8 U-Shaped	E	Sw	1	2	32	24	365	5	69	604	0	0	0
422	2	Classroom (A219)	Recessed	E	4'T8	18	3	32	Sw	8	190	5	1,818	2,763	N/A	Recessed	4'T8	E	Sw	18	3	32	8	190	5	1818	2763	0	0	0
423	2	Hallway	Recessed	E	4'T8	9	4	32	Sw	24	365	5	1,197	10,486	N/A	Recessed	4'T8	E	Sw	9	4	32	24	365	5	1197	10486	0	0	0
424	2	Hallway	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
425	Str	Staircase	Recessed	M	4'T12 U-Shaped	10	2	40	Sw	24	365	12	920	8,059	T8	Recessed	4'T8 U-Shaped	E	Sw	10	2	32	24	365	5	690	6044	2015	0	2015
426	Str	Bathroom Men	Recessed	M	4'T12 U-Shaped	4	2	40	Sw	8	190	12	368	559	T8	Recessed	4'T8 U-Shaped	E	Sw	4	2	32	8	190	5	276	420	140	0	140
427	Str	Bathroom Women	Recessed	M	4'T12 U-Shaped	4	2	40	Sw	8	190	12	368	559	T8	Recessed	4'T8 U-Shaped	E	Sw	4	2	32	8	190	5	276	420	140	0	140
428	Str	Janitor's Closet	Ceiling Suspended	S	Inc	1	1	150	N	2	365	0	150	110	CFL	Ceiling Suspended	CFL	S	N	1	1	50	2	365	0	50	37	73	0	73
429	Str	Storage Room	Ceiling Suspended	M	4'T12	1	2	40	Sw	24	365	12	92	806	T8	Ceiling Suspended	4'T8	E	OS	1	2	32	18	365	5	69	453	201	151	353
430	Str	Staircase	Recessed Parabolic	E	4'T8	6	2	32	Sw	24	365	5	414	3,627	T8-BL	Recessed Parabolic	4'T8	E	BL	6	2	32	0	365	5	414	2113	0	1514	1514
431	Str	Staircase	Wall Mounted	E	4'T8	2	1	32	Sw	24	365	5	74	648	T8-BL	Recessed	4'T8	E	BL	2	1	32	0	365	5	74	375	0	273	273
432	Str	Staircase	Recessed	E	4'T8	8	2	32	Sw	24	365	5	552	4,836	T8-BL	Recessed	4'T8	E	BL	8	2	32	0	365	5	552	2817	0	2018	2018
433	2	Hallway	Recessed	E	4'T8	11	2	32	Sw	24	365	5	759	6,649	N/A	Recessed	4'T8	E	Sw	11	2	32	24	365	5	759	6649	0	0	0
434	2	Hallway	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
435	2	Classroom (E217)	Recessed	E	4'T8	15	4	32	Sw	8	190	5	1,995	3,032	N/A	Recessed	4'T8	E	Sw	15	4	32	8	190	5	1995	3032	0	0	0
436	2	Classroom (A213)	Recessed	E	4'T8	9	4	32	Sw	8	190	5	1,197	1,819	N/A	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	0	0	0
437	2	Classroom (E217A)	Recessed	E	4'T8	4	4	32	Sw	8	190	5	532	809	N/A	Recessed	4'T8	E	Sw	4	4	32	8	190	5	532	809	0	0	0
438	2	Classroom (E219)	Recessed	E	4'T8	15	4	32	Sw	8	190	5	1,995	3,032	N/A	Recessed	4'T8	E	Sw	15	4	32	8	190	5	1995	3032	0	0	0
439	2	Prep Room (E219A)	Recessed	E	4'T8	4	4	32	Sw	4	190	5	532	404	N/A	Recessed	4'T8	E	Sw	4	4	32	4	190	5	532	404	0	0	0
440	2	Prep Room (E221)	Recessed	E	4'T8	15	4	32	Sw	4	190	5	1,995	1,516	N/A	Recessed	4'T8	E	Sw	15	4	32	4	190	5	1995	1516	0	0	0
441	2	Storage Room	Recessed	E	4'T8	4	4	32	Sw	2	190	5	532	202	N/A	Recessed	4'T8	E	Sw	4	4	32	2	190	5	532	202	0	0	0
442	2	Storage Room (E208)	Recessed	E	4'T8	4	4	32	Sw	2	190	5	532	202	N/A	Recessed	4'T8	E	Sw	4	4	32	2	190	5	532	202	0	0	0
443	2	Storage Room (E208)	Recessed	E	4'T8	2	4	32	Sw	2	190	5	266	101	N/A	Recessed	4'T8	E	Sw	2	4	32	2	190	5	266	101	0	0	0
444	2	Hallway	Recessed	E	4'T8	7	4	32	Sw	24	365	5	931	8,156	N/A	Recessed	4'T8	E	Sw	7	4	32	24	365	5	931	8156	0	0	0
445	2	Office (E10)	Recessed	E	4'T8	3	4	32	Sw	8	190	5	399	606	N/A	Recessed	4'T8	E	Sw	3	4	32	8	190	5	399	606	0	0	0
446	2	Storage Room (E210)	Ceiling Suspended	S	Inc	1	1	150	N	2	190	0	150	57	CFL	Ceiling Suspended	CFL	S	N	1	1	50	2	190	0	50	19	38	0	38
447	2	Janitor's Closet	Ceiling Suspended	S	Inc	1	1	150	Sw	2	261	0	150	78	CFL	Ceiling Suspended	CFL	S	Sw	1	1	50	2	261	0	50	26	52	0	52
448	2	Storage Closet	Ceiling Suspended	S	Inc	1	1	150	Sw	2	261	0	150	78	CFL	Ceiling Suspended	CFL	S	Sw	1	1	50	2	261	0	50	26	52	0	52
449	2	Bathroom Men	Recessed	E	4'T8	2	4	32	Sw	4	190	5	266	202	N/A	Recessed	4'T8	E	Sw	2	4	32	4	190	5	266	202	0	0	0
450	2	Bathroom Women	Recessed	E	4'T8	2	4	32	Sw	4	190	5	266	202	N/A	Recessed	4'T8	E	Sw	2	4	32	4	190	5	266	202	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)
451	2	Storage Room	Ceiling Suspended	S	Inc	2	1	150	Sw	2	190	0	300	114	CFL	Ceiling Suspended	CFL	S	Sw	2	1	50	2	190	0	100	38	76	0	76
452	2	Science Room / Laboratory (A227	Recessed	E	4'T8	17	4	32	Sw	8	190	5	2,261	3,437	N/A	Recessed	4'T8	E	Sw	17	4	32	8	190	5	2261	3437	0	0	0
453	2	Prep room	Recessed	E	4'T8	4	4	32	Sw	4	190	5	532	404	N/A	Recessed	4'T8	E	Sw	4	4	32	4	190	5	532	404	0	0	0
454	2	Classroom (A226)	Recessed	E	4'T8	15	4	32	Sw	8	190	5	1,995	3,032	N/A	Recessed	4'T8	E	Sw	15	4	32	8	190	5	1995	3032	0	0	0
455	2	Classroom (A228)	Recessed	E	4'T8	16	4	32	Sw	8	190	5	2,128	3,235	N/A	Recessed	4'T8	E	Sw	16	4	32	8	190	5	2128	3235	0	0	0
456	2	Classroom (A223)	Recessed	E	4'T8	15	4	32	Sw	8	190	5	1,995	3,032	N/A	Recessed	4'T8	E	Sw	15	4	32	8	190	5	1995	3032	0	0	0
457	2	Classroom (A221)	Recessed	E	4'T8	15	4	32	Sw	8	190	5	1,995	3,032	N/A	Recessed	4'T8	E	Sw	15	4	32	8	190	5	1995	3032	0	0	0
458	2	Classroom (A229)	Recessed	E	4'T8	15	4	32	Sw	8	190	5	1,995	3,032	N/A	Recessed	4'T8	E	Sw	15	4	32	8	190	5	1995	3032	0	0	0
459	2	Science Room / Laboratory (A230	Recessed	E	4'T8	9	4	32	Sw	8	190	5	1,197	1,819	N/A	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	0	0	0
460	2	Prep Room (A230)	Recessed	E	4'T8	4	4	32	Sw	4	190	5	532	404	N/A	Recessed	4'T8	E	Sw	4	4	32	4	190	5	532	404	0	0	0
461	2	Classroom (A232)	Recessed	E	4'T8	9	4	32	Sw	8	190	5	1,197	1,819	N/A	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	0	0	0
462	2	Science Room / Laboratory (A231	Recessed	E	4'T8	12	4	32	Sw	8	190	5	1,596	2,426	N/A	Recessed	4'T8	E	Sw	12	4	32	8	190	5	1596	2426	0	0	0
463	2	Science Room / Laboratory (A233	Recessed	E	4'T8	12	4	32	Sw	8	190	5	1,596	2,426	N/A	Recessed	4'T8	E	Sw	12	4	32	8	190	5	1596	2426	0	0	0
464	2	Science Room / Laboratory (A233	Wall Mounted	M	4'T12	4	1	40	Sw	8	190	12	208	316	T8	Recessed	4'T8	E	Sw	4	1	32	8	190	5	148	225	91	0	91
465	2	Science Room / Laboratory (A231	Wall Mounted	E	4'T8	4	1	32	Sw	8	190	5	148	225	N/A	Recessed	4'T8	E	Sw	4	1	32	8	190	5	148	225	0	0	0
466	2	Prep room (A231)	Ceiling Suspended	M	4'T12	6	2	40	Sw	4	190	12	552	420	T8	Ceiling Suspended	4'T8	E	Sw	6	2	32	4	190	5	414	315	105	0	105
467	2	Hallway	Recessed	E	4'T8	14	4	32	Sw	24	365	5	1,862	16,311	N/A	Recessed	4'T8	E	Sw	14	4	32	24	365	5	1862	16311	0	0	0
468	2	Hallway	Exit Sign	E	FL	1	1	15	N	24	365	2	17	145	LEDex	Exit Sign	LED	E	N	1	1	5	24	365	1	6	48	96	0	96
469	2	Classroom (A234)	Recessed	E	4'T8	9	4	32	Sw	8	190	5	1,197	1,819	N/A	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	0	0	0
470	2	Hallway	Recessed	E	4'T8	5	4	32	Sw	24	365	5	665	5,825	N/A	Recessed	4'T8	E	Sw	5	4	32	24	365	5	665	5825	0	0	0
471	2	Hallway	Recessed	E	4'T8	8	2	32	Sw	24	365	5	552	4,836	N/A	Recessed	4'T8	E	Sw	8	2	32	24	365	5	552	4836	0	0	0
472	2	Hallway	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
473	Str	Staircase	Recessed	E	4'T8	5	2	32	Sw	24	365	5	345	3,022	T8-BL	Recessed	4'T8	E	BL	5	2	32	0	365	5	345	1761	0	1261	1261
474	Str	Staircase	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
475	2	Hallway	Recessed	E	4'T8	6	2	32	Sw	24	365	5	414	3,627	N/A	Recessed	4'T8	E	Sw	6	2	32	24	365	5	414	3627	0	0	0
476	2	Classroom (D202)	Parabolic Ceiling Suspended	E	4'T8	7	10	32	Sw	8	190	5	2,275	3,458	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	7	10	32	8	190	5	2275	3458	0	0	0
477	2	Classroom (D202)	Exit Sign	S	LED	2	1	5	N	24	8	1	11	2	N/A	Exit Sign	LED	S	N	2	1	5	24	8	1	11	2	0	0	0
478	2	Prep Room (D202)	Recessed	E	4'T8	6	2	32	Sw	4	190	5	414	315	N/A	Recessed	4'T8	E	Sw	6	2	32	4	190	5	414	315	0	0	0
479	2	Prep Room (D202)	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
480	2	Bathroom Men	Recessed	E	4'T8	4	2	32	Sw	8	190	5	276	420	N/A	Recessed	4'T8	E	Sw	4	2	32	8	190	5	276	420	0	0	0
481	2	Bathroom Women	Recessed	E	4'T8	4	2	32	Sw	8	190	5	276	420	N/A	Recessed	4'T8	E	Sw	4	2	32	8	190	5	276	420	0	0	0
482	2	Janitor's Closet	Ceiling Suspended	S	Inc	1	1	150	Sw	2	261	0	150	78	CFL	Ceiling Suspended	CFL	S	Sw	1	1	50	2	261	0	50	26	52	0	52
483	2	Hallway	Recessed	E	4'T8	20	3	32	Sw	24	365	5	2,020	17,695	N/A	Recessed	4'T8	E	Sw	20	3	32	24	365	5	2020	17695	0	0	0
484	2	Hallway	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
485	Str	Staircase	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
486	Str	Staircase	Recessed	E	4'T8	12	2	32	Sw	24	365	5	828	7,253	T8-BL	Recessed	4'T8	E	BL	12	2	32	0	365	5	828	4226	0	3027	3027
487	Str	Science Room / Laboratory (E201	Parabolic Ceiling Suspended	E	4'T8	7	10	32	Sw	8	190	5	2,275	3,458	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	7	10	32	8	190	5	2275	3458	0	0	0
488	Str	Science Room / Laboratory (E203	Parabolic Ceiling Suspended	E	4'T8	7	10	32	Sw	8	190	5	2,275	3,458	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	7	10	32	8	190	5	2275	3458	0	0	0
489	Str	Science Room / Laboratory (E204	Parabolic Ceiling Suspended	E	4'T8	7	10	32	Sw	8	190	5	2,275	3,458	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	7	10	32	8	190	5	2275	3458	0	0	0
490	Str	Science Room / Laboratory (E206	Parabolic Ceiling Suspended	E	4'T8	7	10	32	Sw	8	190	5	2,275	3,458	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	7	10	32	8	190	5	2275	3458	0	0	0
491	Str	Science Room / Laboratory (E204	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
492	Str	Science Room / Laboratory (E203	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
493	Str	Science Room / Laboratory (E201	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
494	Str	Prep room (E201)	Recessed	E	4'T8	6	2	32	Sw	4	190	5	414	315	N/A	Recessed	4'T8	E	Sw	6	2	32	4	190	5	414	315	0	0	0
495	Str	Prep room (E201)	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
496	Str	Prep Room (E206)	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
497	Str	Prep room (E206)	Recessed	E	4'T8	6	2	32	Sw	4	365	5	414	604	N/A	Recessed	4'T8	E	Sw	6	2	32	4	365	5	414	604	0	0	0
498	2	Electrical Room	Ceiling Mounted	E	4'T8	3	2	32	Sw	2	261	5	207	108	N/A	Ceiling Mounted	4'T8	E	Sw	3	2	32	2	261	5	207	108	0	0	0
499	2	Storage Room	Recessed	E	4'T8	3	2	32	Sw	2	261	5	207	108	N/A	Recessed	4'T8	E	Sw	3	2	32	2	261	5	207	108	0	0	0
500	2	Office (D206)	Parabolic Ceiling Suspended	E	4'T8	3	10	32	Sw	8	190	5	975	1,482	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	3	10	32	8	190	5	975	1482	0	0	0
501	2	Science Room / Laboratory (D208	Parabolic Ceiling Suspended	E	4'T8	7	10	32	Sw	8	190	5	2,275	3,458	N/A	Parabolic Ceiling Suspended	4'T8	E	Sw	7	10	32	8	190	5	2275	3458	0	0	0
502	2	Science Room / Laboratory (D208	Exit Sign	S	LED	2	1	5	N	8	190	1	11	17	N/A	Exit Sign	LED	S	N	2	1	5	8	190	1	11	17	0	0	0
503	2	Prep Rom (D208)	Recessed	E	4'T8	4	2	32	Sw	4	190	5	276	210	N/A	Recessed	4'T8	E	Sw	4	2	32	4	190	5	276	210	0	0	0
504	2	Prep room (D208)	Exit Sign	S	LED	1	1	5	N	4	190	1	6	4	N/A	Exit Sign	LED	S	N	1	1	5	4	190	1	6	4	0	0	0
505	Str	Staircase	Recessed	E	4'T8	10	2	32	Sw	24	365	5	690	6,044	T8-BL	Recessed	4'T8	E	BL	10	2	32	0	365	5	690	3522	0	2523	2523
506	Str	Staircase	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
507	2	Hallway	Recessed	E	4'T8	10	2	32	Sw	24	365	5	690	6,044	N/A	Recessed	4'T8	E	Sw	10	2	32	24	365	5	690	6044	0	0	0
508	2	Hallway	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
509	2	Classroom (E211)	Recessed	E	4'T8	9	4	32	Sw	8	190	5	1,197	1,819	N/A	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	0	0	0
510	2	Storage Room (E211)	Ceiling Mounted	E	Inc	2	1	150	Sw	2	261	0	300	157	CFL	Ceiling Mounted	CFL	E	Sw	2	1	50	2	261	0	100	52	104	0	104
511	2	Classroom (E211)	Ceiling Mounted	E	4'T12	5	1	40	Sw	8	190	12	260	395	T8	Ceiling Mounted	4'T8	E	Sw	5	1	32	8	190	5	185	281	114	0	114
512	2	Classroom (E213)	Recessed	E	4'T8	9	4	32	Sw	8	190	5	1,197	1,819	N/A	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	0	0	0
513	2	Storage Room (E213)	Ceiling Mounted	E	Inc	2	1	150	Sw	2	261	0	300	157	CFL	Ceiling Mounted	CFL	E	Sw	2	1	50	2	261	0	100	52	104	0	104
514	2	Classroom (E213)	Ceiling Mounted	E	4'T12	3	1	40	Sw	8	190	12	156	237	T8	Ceiling Mounted	4'T8	E	Sw	3	1	32	8	190	5	111	169	68	0	68
515	2	Classroom (E215)	Recessed	E	4'T8	9	4	32	Sw	8	190	5	1,197	1,819	N/A	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	0	0	0
516	2	Storage Room (E215)	Ceiling Mounted	E	Inc	2	1	150	Sw	2	261	0	300	157	CFL	Ceiling Mounted	CFL	E	Sw	2	1	50	2	261	0	100	52	104	0	104
517	2	Classroom (E200)	Recessed	E	4'T8	9	4	32	Sw	8	190	5	1,197	1,819	N/A	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	0	0	0
518	2	Storage Room (E200)	Ceiling Mounted	E	Inc	2	1	150	Sw	2	261	0	300	157	CFL	Ceiling Mounted	CFL	E	Sw	2	1	50	2	261	0	100	52	104	0	104
519	2	Classroom (E202)	Recessed	E	4'T8	9	4	32	Sw	8	190	5	1,197	1,819	N/A	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	0	0	0
520	2	Storage Room (E202)	Ceiling Mounted	E	Inc	2	1	150	Sw	2	261	0	300	157	CFL	Ceiling Mounted	CFL	E	Sw	2	1	50	2	261	0	100	52	104	0	104
521	2	Classroom (E204)	Recessed	E	4'T8	9	4	32	Sw	8	190	5	1,197	1,819	N/A	Recessed	4'T8	E	Sw	9	4	32	8	190	5	1197	1819	0	0	0
522	2	Storage Room (E204)	Ceiling Mounted	E	Inc	2	1	150	Sw	2	261	0	300	157	CFL	Ceiling Mounted	CFL	E	Sw	2	1	50	2	261	0	100	52	104	0	104
523	2	Classroom (E204)	Ceiling Mounted	E	4'T12	5	1	40	Sw	8	190	12	260	395	T8	Ceiling Mounted	4'T8	E	Sw	5	1	32	8	190	5	185	281	114	0	114
523	Ext	Exterior	Pole Mounted	E	MH	34	1	250	T	10	365	70	10,880	39,712	N/A	Pole Mounted	MH	E	T	34	1	250	10	365	70	10880	39712	0	0	0
524	Ext	Exterior	Wallpack	E	MH	12	1	250	T	10	365	70	3,840	14,016	PSMH	Wallpack	PSMH	E	T	12	1	150	10	365	30	2160	7884	6132	0	6132
524	Ext	Exterior	Wallpack	E	MH	12	1	400	T	10	365	112	6,144	22,426	PSMH	Wallpack	PSMH	E	T	12	1	250	10	365	50	3600	13140	9286	0	9286
525	Ext	Exterior	Wallpack	E	HPS	9	1	75	T	10	365	15	810	2,957	N/A	Wallpack	HPS	E	T	9	1	75	10	365	15	810	2957	0	0	0
525	Ext	Exterior	Recessed	E	4'T8	6	1	32	T	10	365	5	222	810	N/A	Recessed	4'T8	E	T	6	1	32	10	365	5	222	810	0	0	0
526	Ext	Exterior	Wall Mounted	E	CFL	8	1	32	T	10	365	0	256	934	N/A	Wall Mounted	CFL	E	T	8	1	32	10	365	0	256	934	0	0	0
526	Ext	Exterior	Recessed	E	CFL	16	1	23	T	10	365	0	368	1,343	N/A	Recessed	CFL	E	T	16	1	23	10	365	0	368	1343	0	0	0
527	Ext	Exterior	Wall Mounted	E	Inc	1	1	150	T	10	365	0	150	548	CFL	Wall Mounted	CFL	E	T	1	1	50	10	365	0	50	183	365	0	365
		Totals:				2,972	1,588	24,040				3,080	397,972	981,842						2,972	1,588	17,341			2,261	362,072	904,173	57,779	19,890	77,669

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

Proposed Lighting Summary Table

Total Gross Floor Area (SF)	264,000		
Average Power Cost ($/kWh)	0.1540		
Exterior Lighting	**Existing**	**Proposed**	**Savings**
Exterior Annual Consumption (kWh)	82,746	66,963	**15,783**
Exterior Power (watts)	22,670	18,346	**4,324**
Total Interior Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	899,096	837,210	**61,886**
Lighting Power (watts)	375,302	343,726	**31,576**
Lighting Power Density (watts/SF)	1.42	1.30	**0.12**
Estimated Cost of Fixture Replacement ($)	113,856		
Estimated Cost of Controls Improvements ($)	12,215		
Total Consumption Cost Savings ($)	**17,662**		

Legend

Fixture Type		Lamp Type			Control Type	Ballast Type	Retrofit Category
Ceiling Suspended	Recessed	CFL	3T12	8T5	Autom. Timer (T)	S (Self)	N/A (None)
Exit Sign	Sconce	Inc	3T12 U-Shaped	8T5 U-Shaped	Bi-Level (BL)	E (Electronic)	T8 (Install new T8)
High Bay	Spotlight	LED	3T5	8T8	Contact (Ct)	M (Magnetic)	T5 (Install new T5)
Parabolic Ceiling Mounted	Track	HPS	3T5 U-Shaped	8T8 U-Shaped	Daylight & Motion (M)		CFL (Install new CFL)
Parabolic Ceiling Suspended	Vanity	MH	3T8	Circline - T5	Daylight & Switch (DLSw)		LEDex (Install new LED Exit)
Pendant	Wall Mounted	MV	3T8 U-Shaped	Circline - T8	Daylight Sensor (DL)		LED (Install new LED)
Recessed Parabolic	Wall Suspended	1T12	4T5	Circline - T12	Delay Switch (DSw)		D (Delamping)
Ceiling Mounted	Wallpack	1T12 U-Shaped	4T5 U-Shaped	Fl.	Dimmer (D)		C (Controls Only)
Chandelier		1T5	6T12	Hal	Motion Sensor (MS)		PSMH (Install new Pulse-Start Metal Halide)
Equipment / Fume Hood		1T5 U-Shaped	6T12 U-Shaped	Induction	Motion& Switch (MSw)		
Flood		1T8	6T5	Infrared	None (N)		
Landscape		1T8 U-Shaped	6T5 U-Shaped	LPS	Occupancy Sensor (OS)		
Low Bay		2T12 U-Shaped	6T8	Mixed Vapor	Occupancy Sensor - CM (OSCM)		
Parabolic Wall Mounted		2T5	6T8 U-Shaped	Neon	Photocell (PC)		
Pole Mounted		2T5 U-Shaped	8T12	Quartz Halogen	Switch (Sw)		
Pole Mounted Off Building		2T8 U-Shaped	8T12 U-Shaped				

APPENDIX C: 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

Third Party Electric Suppliers for JCPL Service Territory	Telephone & Web Site
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 NJNG 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
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
NJ Gas & Electric 1 Bridge Plaza, Fl. 2 Fort Lee, NJ 07024	(866) 568-0290 www.NewJerseyGasElectric.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

Third Party Gas Suppliers for NJNG Service Territory	Telephone & Web Site
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 D: 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 measure (such as LED lighting versus fluorescent) the operating savings will factor in the cost of replacing the units to match the lifetime of the ECM. In this case or in one where one-time repairs are made, the total replacement / repair sum is averaged over the lifetime of the ECM.

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

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

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

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

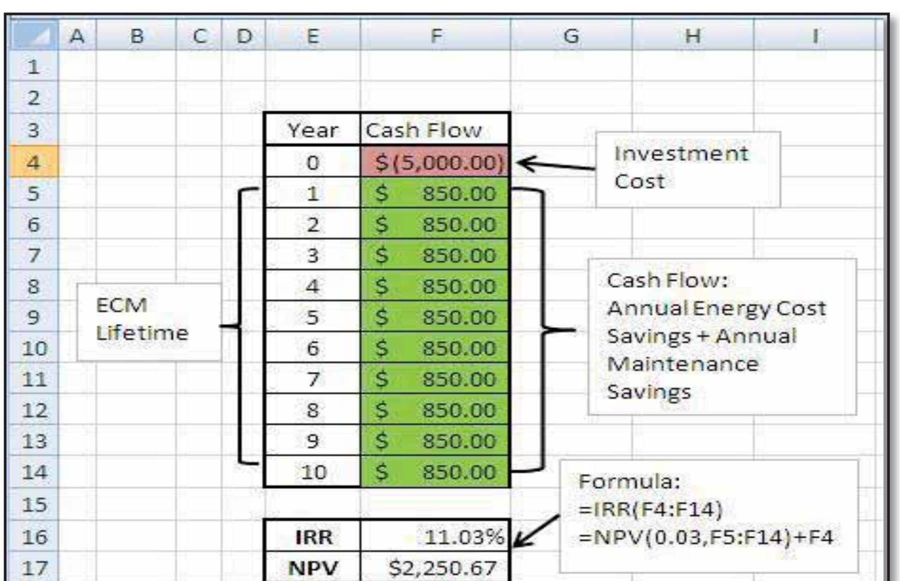
Calculation References

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

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

Excel NPV and IRR Calculation

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



Year	Cash Flow
0	$(5,000.00)
1	$ 850.00
2	$ 850.00
3	$ 850.00
4	$ 850.00
5	$ 850.00
6	$ 850.00
7	$ 850.00
8	$ 850.00
9	$ 850.00
10	$ 850.00

IRR	11.03%
NPV	$2,250.67

Solar PV ECM Calculation

There are several components to the calculation:

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

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

ECM and Equipment Lifetimes

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

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

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

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

New Jersey Clean Energy Program Commercial & Industrial Lifetimes

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

APPENDIX E: STATEMENT OF ENERGY PERFORMANCE FROM ENERGY STAR®

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Freehold Regional HS District - Marlboro High School

Building ID: 2304202
For 12-month Period Ending: February 28, 2010[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: July 20, 2010

Facility
Freehold Regional HS District - Marlboro High School
95 North Main Street
Marlboro, NJ 07746

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1968
Gross Floor Area (ft²): 264,000

Energy Performance Rating[2] (1-100) 30

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	9,408,360
Natural Gas (kBtu)[4]	14,275,068
Total Energy (kBtu)	23,683,428
Energy Intensity[5]	
Site (kBtu/ft²/yr)	90
Source (kBtu/ft²/yr)	176
Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	2,192
Electric Distribution Utility	
FirstEnergy - Jersey Central Power & Lt Co	
National Average Comparison	
National Average Site EUI	75
National Average Source EUI	147
% Difference from National Average Source EUI	19%
Building Type	K-12 School

Stamp of Certifying Professional

Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this statement is accurate.

Meets Industry Standards[6] for Indoor Environmental Conditions:

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

Certifying Professional
N/A

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Natural Gas values in units of volume (e.g. cubic feet) are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, annualized to a 12-month period.
6. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

EPA Form 5900-16

APPENDIX F: INCENTIVE PROGRAMS

New Jersey Clean Energy Pay for Performance

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

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

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

Direct Install 2010 Program*

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

Eligibility:

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

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

Smart Start

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

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

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

Renewable Energy Incentive Program*

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

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

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

Utility Sponsored Programs

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

Energy Efficiency and Conservation Block Grant Rebate Program

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

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

Other Federal and State Sponsored Programs

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

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

APPENDIX G: VendingMiser™, CoolerMiser™, and SnackMiser™ Energy Savings Calculations

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)	.154
Facility Occupied Hours per Week	40
Number of Cold Drink Vending Machines	5
Number of Non-refrigerated Snack Machines	0
Power Requirements of Cold Drink Machine (Watts; 400 typical)	100
Power Requirements of Snack Machine (Watts; 80 typical)	0
VendingMiser® Sale Price (for cold drink machines)	199
SnackMiser™ Sale Price (for snack machines)	0

Calculate Savings!

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

COLD DRINK MACHINES	Current	Projected	Total Savings	% Savings
kWh	4368	1595	2773	63%
Cost of Operation	$672.67	$245.58	$427.09	63%

SNACK MACHINES	Current	Projected	Total Savings	% Savings
kWh	0	0	0	NaN%
Cost of Operation	$0	$0	$0	NaN%

Location's Total Annual Savings

	Current	Projected	Total Savings	% Savings
kWh	4368	1595	2773	63%
Cost of Operation	$672.67	$245.58	$427.09	63%

Total Project Cost	Break Even (Months)
$995	27.96

Estimated Five Year Savings on ALL Machines = $2,135.47

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)	.154
Facility Occupied Hours per Week	40
Number of Cold Drink Vending Machines	3
Number of Non-refrigerated Snack Machines	5
Power Requirements of Cold Drink Machine (Watts; 400 typical)	100
Power Requirements of Snack Machine (Watts; 80 typical)	40
VendingMiser® Sale Price (for cold drink machines)	199
SnackMiser™ Sale Price (for snack machines)	99

Calculate Savings!

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

COLD DRINK MACHINES	Current	Projected	Total Savings	% Savings
kWh	2621	957	1664	63%
Cost of Operation	$403.60	$147.35	$256.26	63%

SNACK MACHINES	Current	Projected	Total Savings	% Savings
kWh	1747	416	1331	76%
Cost of Operation	$269.07	$64.06	$205	76%

Location's Total Annual Savings

	Current	Projected	Total Savings	% Savings
kWh	4368	1373	2995	69%
Cost of Operation	$672.67	$211.41	$461.26	69%

Total Project Cost	Break Even (Months)
$1,092	28.41

Estimated Five Year Savings on ALL Machines = $2,306.30

APPENDIX H: 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
0-5 Year Payback Measures	1	Install One Hundred and Sixty-Four (164) New CFL Fixtures	1,476	none at this time	1,476	12,919	2.7	0	0.2	767	2,756	5	13,782	0.5	834	167	186	11,075	23,131
	2	**Retrofit Five (5) Existing Vending Machines with SnackMiser™ Devices**	495	0	495	1,664	0.3	0	0.0	0	256	15	3,844	1.9	677	45	52	2,520	2,979
	3	**Retrofit Three (3) Refrigerated Vending Machines with VendingMiser ™ Devices**	597	0	597	1,664	0.3	0	0.0	0	256	15	3,844	2.3	544	36	43	2,418	2,979
	4	**Install (47) New bi-level T8 Fluorescent Fixtures in Stairwells**	7,790	1,175	6,615	12,320	2.6	0	0.2	0	1,897	15	28,459	3.5	330	22	28	15,711	22,059
	5	**Install Premium Efficiency Motors on Four (4) 10 HP Heating Hot Water Circulators**	2,704	360	2,344	4,354	0.9	0	0.1	0	671	20	13,410	3.5	472	24	28	7,632	5,965
	6	**Install Premium Efficiency Motors on Two (2) 5 HP Heating Hot Water Circulators**	808	108	700	1,127	0.2	0	0.0	0	174	20	3,471	4.0	396	20	24	1,882	1,544

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
7	**Install Variable Frequency Drives on Four (4) 10 HP Motors of Heating Hot Water Circulators**	21,200	0	21,200	32,226	6.7	0	0.4	0	4,963	20	99,256	4.3	368	18	23	52,634	44,150
8	**Install Premium Efficiency Motors on Two (2) 3 HP Heating Hot Water Circulators**	714	108	606	890	0.2	0	0.0	0	137	20	2,741	4.4	352	18	22	1,433	1,219
9	**Install Twenty-Eight (28) New Occupancy Sensors**	6,160	560	5,600	7,570	1.6	0	0.1	0	1,166	15	17,487	4.8	212	14	19	8,118	13,554
10	**Install Twelve (12) New LED Exit Signs**	1,806	240	1,566	1,218	0.3	0	0.0	128	316	15	4,736	5.0	202	13	19	2,149	2,180

5-10 Year Payback 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
11	**Install Variable Frequency Drives on Two (2) 5 HP Motors of Heating Hot Water Circulators**	7,900	0	7,900	8,056	1.7	0	0.1	0	1,241	20	24,812	6.4	214	11	15	10,557	11,037
12	**Install Twenty-Four (24) New Pulse Start Metal Halide Fixtures**	19,200	600	18,600	15,418	3.2	0	0.2	60	2,434	15	36,515	7.6	96	6	10	10,045	27,605
14	**Replace Five (5) Compact Refrigerators with 2.7 Cu. Ft. ENERGY STAR® Models**	495	0	495	400	0.1	0	0.0	0	62	12	739	8.0	49	4	9	230	716
16	**Replace Three (3) Cast Iron Boilers with Six (6) 95% AFUE High Efficiency Condensing Boilers**	273,000	12,000	261,000	0	0.0	20,575	7.8	0	31,788	25	794,709	8.2	204	8	11	292,536	240,728

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
17	**Replace Ten (10) Large Refrigerators with ENERGY STAR® Units**	4,500	0	4,500	3,000	0.6	0	0.0	34	496	12	5,952	9.1	32	3	7	1,336	5,372
18	**Replace Four (4) Washing Machines with ENERGY STAR® Units**	3,200	0	3,200	2,000	0.4	0	0.0	34	342	12	4,104	9.4	28	2	7	824	3,581
19	**Retrofit Five (5) Existing Refrigerated Coolers and Commercial Refrigerators with CoolerMiser™ Devices**	1,990	0	1,990	1,331	0.3	0	0.0	0	205	15	3,075	9.7	55	4	6	422	2,383
20	**Install Variable Frequency Drives on Two (2) 3 HP Motors of Heating Hot Water Circulators**	7,300	0	7,300	4,834	1.0	0	0.1	0	744	20	14,889	9.8	104	5	8	3,775	6,623
21	**Install Five Hundred and Sixty-Four (564) New T8 Fluorescent Fixtures**	92,997	8,460	84,537	28,225	5.9	0	0.4	4,235	8,581	15	128,720	9.9	52	3	6	16,441	50,536

Category	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
	22	**Install Premium Efficiency Motors on Walk-In Box Evaporator Fans**	3,500	0	3,500	2,283	0.5	0	0.0	0	352	20	7,032	10.0	101	5	329	682,207	3,128
10 Years or Greater Payback Measures	23	Replace Trane 4-ton Packaged DX Cooling Only Rooftop HVAC Unit Serving the Main Offices with a 14.8 SEER High Efficiency Unit	10,000	368	9,632	3,308	0.7	0	0.0	0	509	15	7,890	18.9	-18	-1	-3	-3,550	4,532
	24	Replace 5-ton DX Cooling Condensing Unit with 14 SEER High Efficiency Unit	12,500	460	12,040	3,857	0.8	0	0.0	0	594	20	12,265	20.3	2	0	-4	-4,949	5,284

	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
	25	Replace Trane 7.5-Ton Packaged DX Cooling Only Rooftop HVAC Unit Serving the Main Offices with a 13 SEER High Efficiency Unit	18,750	547.50	18,203	5,192	1.1	0	0.1	0	800	15	12,383	22.8	-32	-2	-5	-8,657	7,113
Renewable Measures	13	Install 48.30 kW PV rooftop system with incentives	362,250	22,500	339,750	59,098	48	0	0.8	0	44,501	25	227,527	7.6	123.3	4.9	10.6	241,332	80,964
	15	Install 148.12 kW PV rooftop system without incentives	1,110,900	0	1,110,900	178,742	148	0	2.3	0	134,326	25	688,157	8.3	106.2	4.2	9.3	643,390	244,877

APPENDIX I: METHOD OF ANALYSIS

Assumptions and tools

Energy modeling tool:	Established/standard industry assumptions, E-Quest
Cost estimates:	RS Means 2009 (Facilities Maintenance & Repair Cost Data) RS Means 2009 (Building Construction Cost Data) RS Means 2009 (Mechanical Cost Data) Published 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.