ENERGY AUDIT – FINAL REPORT

MIDDLE SCHOOL

CEG PROJECT NO. 9C08140

BRIDGEWATER-RARITAN REGIONAL SCHOOL DISTRICT

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I. EXECUTIVE SUMMARY

This report presents the findings of an energy audit conducted for:

Bridgewater-Raritan School District
Middle School
Merriwood Road
Bridgewater, NJ 08807

Facility Contact Person: Connie Coriell

This audit was performed in connection with the New Jersey Clean Energy Local Government Energy Audit Program. These energy audits are conducted to promote the office of Clean Energy's mission, which is to use innovation and technology to solve energy and environmental problems in a way that improves the State's economy. This can be achieved through the wiser and more efficient use of energy.

The annual energy costs for 2008 at this facility were as follows:

Electricity	$189,289
Natural Gas	$242,065
Total	$431,354

The potential annual energy cost savings are shown below in Table 1. Be aware that the measures are not additive because of the interrelation of several of the measures. The cost of each measure for this level of auditing is ± 20% until detailed engineering, specifications, and hard proposals are obtained.

Table 1
Energy Conservation Measures (ECM's)

ECM NO.	DESCRIPTION	COST	ANNUAL SAVINGS	SIMPLE PAYBACK (YEARS)
1	Lighting Controls	$2,805	$344	8.1
2	Window Film	$81,340	$3,889	20.9
3	Replace Rooftop Units	$15,005	$651	23.0
4	Replace Auditorium H&V Components	$12,000	$570	21.1
5	Replace Modulating HW Valves	$32,000[A]	$3,810	8.4
6	Replace Domestic HW Heater	$4,200	$260	16.2
7	Kitchen Hood Controls	$31,044	$13,148	2.4
8	Premium Efficient Motors	$8,786	$575	15.28
9	T-5 Lighting System - Gyms	$40,950	$7,102	5.8
10	Efficiency Improvements – Walk-in Refrigerator	$1,870	$228	8.2
11	Walk-in Cooler Controls	$1,380	$867	1.6
12	High-Efficiency S/S Heat Pumps	$22,528	$1,181	19.0
13	Low-E Window Systems	$189,000	$14,490	13.0
14	Install Boiler Controllers; Must be implemented with ECM #5	$107,000[B]	$19,764[A]	5.4
15	Install Programmable Thermostats	$250/unit; $25,000	$177/unit; $17,700	1.4
16	Install Full DDC System	$960,000	$43,135	22.3

Notes:
A. ECM #5 and ECM #14 must both be implemented to achieve the total gas savings of 12,430 Therms; $19,764.
B. Cost includes cost of modulating valves noted in ECM#5.

The estimated demand and energy savings are shown below in Table 2. The information in this table corresponds to the ECM's in Table 1.

Table 2
Estimated Energy Savings

ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		KW REDUCED	KWH REDUCED	THERMS REDUCED
1	Lighting Controls	-	2,570	-
2	Window Film	-	-	2,446
3	Replace Rooftop Units	-	4,860	-
4	Replace Auditorium H&V Components	-	-	358
5	Replace Modulating HW Valves	-	-	2,396[A]
6	Replace Domestic HW Heater	-	-	163
7	Kitchen Hood Controls	-	26,092	6,233
8	Premium Efficient Motors	-	4,288	-
9	T-5 Lighting System - Gyms	-	53,002	-
10	Efficiency Improvements – Walk-in Refrigerator	-	1,702	-
11	Walk-in Cooler Controls	-	6,470	-
12	High-Efficiency S/S Heat Pumps	-	8,817	-
13	Low-E Window Systems	-	-	9,114
14	Install Boiler Controllers; Must be implemented with ECM #5	-	-	12,430[A]
15	Install Programmable Thermostats	-	-	-
16	Install Full DDC System	-	-	-

Notes: A. ECM #5 and ECM #14 must both be implemented to achieve the total gas savings of 12,430 Therms.

Concord Engineering Group (CEG) strongly recommends the implementation of all ECM's that provide a calculated simple payback at or under seven (7) years. The potential energy and cost savings from these ECM's are too great to pass upon. The following Energy Conservation Measures are recommended for Bridgewater-Raritan Middle School:

- **ECM #7:** Kitchen Hood Controls
- **ECM #9:** T-5 Lighting System – Gyms
- **ECM #11:** Walk-in Cooler
- **ECM #14:** Install Boiler Controllers
- **ECM #15:** Install Programmable Thermostats

In addition to the above recommendation, CEG also has a secondary suggestion to move forward with ECM #1: Lighting Controls and ECM #10: Efficiency Improvements - Walk-in Refrigerator. ECM #5: Replace Modulating HW Valves, should also be reviewed for implementation if the Owner does not move forward with ECM #14. These measures estimated simple payback is close to the simple payback threshold as noted above; hence why they are recommended.

In regards to facility operation, the Owner should review the possibility of moving forward with ECM #4: Replace Auditorium H&V Components and ECM #16: Install Full DDC System. Although these ECM's do not provide quick return on investment they are beneficial to the operation of the facility for the long range plan. ECM #4 will allow for adequate ventilation and conditioning within the Auditorium. Currently, the Auditorium is partially heated and ventilated by one (1) H&V unit and the other H&V unit is inoperable and missing its internal accessories. ECM #16 will allow the Owner to have access to the operation of all the HVAC equipment within the facility in order to monitor and control the respective equipment. This will allow for minimum run-hours and overall building efficiency.

II. INTRODUCTION

The Bridgewater-Raritan Middle School facility covered by this energy audit consists of 246,000 SF of classrooms, science labs, administrative offices, cafeterias, gyms, auditorium, etc.

The first task was to collect and review two years worth of utility energy data for electricity and natural gas. This information was used to analyze operational characteristics, calculate energy benchmarks for comparison to industry averages, estimate savings potential, and establish a baseline to monitor the effectiveness of implemented measures. A computer spreadsheet was used to enter, sum, and calculate benchmarks and to graph utility information (see Appendix A).

The Energy Use Index (EUI) is expressed in British Thermal Units/square foot/year ($BTU/ft^2/yr$) and can be used to compare energy consumption to similar building types or to track consumption from year to year in the same building. The EUI is calculated by converting annual consumption of all fuels to BTU's then dividing by the area (gross square footage) of the building. EUI is a good indicator of the relative potential for energy savings. A comparatively low EUI indicates less potential for large energy savings. Engineering drawings obtained from the Board of Education were used to calculate the gross area of the school.

Obtaining Architectural and Mechanical drawings, a building profile was created that included age, occupancy, description, and existing conditions of Architectural and Mechanical Systems. The profile noted the major energy consuming equipment or systems and components that are inherently inefficient. Also, by reviewing the mechanical drawings and equipment schedules, questions regarding the lighting systems/controls, HVAC zone controls, and setback operations were noted.

The site visit was spent inspecting the actual systems and answering specific questions from the preliminary review. The School District provided occupancy schedules, O & M practices, and other information that has an impact on energy consumption.

The post-site work included evaluation of the information gathered during the site visit, researching possible conservation opportunities, organizing the audit into a comprehensive report, and making recommendations on mechanical, lighting and building envelope improvements.

III. METHOD OF ANALYSIS

The first step in the energy analysis is the site survey. The auditor walks the entire site to inventory the building envelope (roof, windows, etc.), the heating, ventilation, and air conditioning equipment (HVAC), the lighting equipment, other facility-specific equipment, and to gain an understanding of how each facility is used.

The collected data is then processed using engineering calculations, Microsoft Excel spread sheets and Trane Trace 700™ building simulation software that calculate the anticipated energy usage. The actual energy usage is entered directly from the utility bills. The anticipated energy usage is compared to the actual usage. If necessary, corrections are made to the site-collected data until the anticipated energy usage matches the actual usage. This process develops an end-use baseline for all of the fuels used at the facility. This baseline is used to calculate the energy savings for the measures that are recommended in this report.

The savings in this report are duplicative. The savings for each recommendation will be lower if the individual recommendations were installed instead of the entire project. For example, the lighting module calculates the change in wattage and multiplies it by the existing operating hours instead of the new operating hours (if there was a change in the hours at all). The lighting controls module calculates the change in hours and multiplies it by the old system wattage instead of the new wattage. Therefore, if you chose to install the recommended lighting system but not the lighting controls, the savings achieved with the new lighting system would be lower because there would have been a reduction in the hours of use.

The same principal follows for heating, cooling, and temperature recommendations – even with fuel switching. If there are recommendations to change the temperature settings to reduce fuel use, then the savings for the heating/cooling equipment recommendations are increased, as well.

Our thermal module calculates the savings for temperature reductions utilizing Trane Trace 700™ building simulation software. The savings are calculated in "output" values – meaning energy, not fuel savings. To show fuel savings we multiply the energy values times the fuel conversion factor (these factors are different for electricity, natural gas, fuel oil, etc.) and also take into account the heating/cooling equipment efficiency. The temperature recommendation savings are higher when the heating/cooling equipment is more efficient or is using a cheaper fuel.

Thermal recommendations (insulation, windows, etc.) are evaluated by taking the difference in the thermal load due to reduced heat transfer. Again, the "thermal load" is the thermal load before the other recommendations have been accounted for.

Lastly, installation costs are then applied to each recommendation and simple paybacks are calculated. Costs are derived from Means Cost Data, other industry publications, and local contractors and suppliers. The SmartStart Buildings® incentives are calculated for the appropriate ECM's and subtracted from the installed cost prior to calculation of the simple payback. In addition, where applicable, maintenance cost savings are estimated and applied to the net savings.

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

Table 3 and Figure 1 represent the electrical usage for the surveyed facility from January-08 to December-08. Public Service Electric & Gas (PSE&G) provides electricity to the facility under the Large Power and Lighting Service (LPLS) Rate. This electric rate has a component for consumption that is measured in kilowatt-hours (kWh). It is calculated by multiplying the wattage of the equipment times the hours that it operates. For example, a 1,000 Watt lamp operating for 5 hours would measure 5,000 Watt-hours. Since one kilowatt is equal to 1,000 Watts, the measured consumption would be 5 kWh. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the most current rate structure available.

Table 4 and Figure 2 show the natural gas energy usage for the surveyed facility from January-08 to December-08. Hess Corporation supplies the natural gas from the wellhead to the PSE&G pipelines. PSE&G charges a rate per therm for delivery of the natural gas via their pipelines to the burners.

Description	Average
Electricity	13.4¢/kWh
Natural Gas	$1.59 / Therm

Table 3
Electricity Bill Data

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
1/08	151,083	483	$17,398
2/08	149,421	483	$17,449
3/08	144,929	477	$16,767
4/08	127,529	475	$14,843
5/08	120,414	475	$15,477
6/08	90,095	432	$13,607
7/08	72,796	382	$12,490
8/08	75,829	408	$13,427
9/08	95,453	435	$15364
10/08	119,714	477	$17,176
11/08	133,313	477	$17,747
12/08	131,159	434	$17,544
Totals	**1,411,735**	**483 MAX**	**$189,289.00**

Figure 1
Electricity Usage Profile

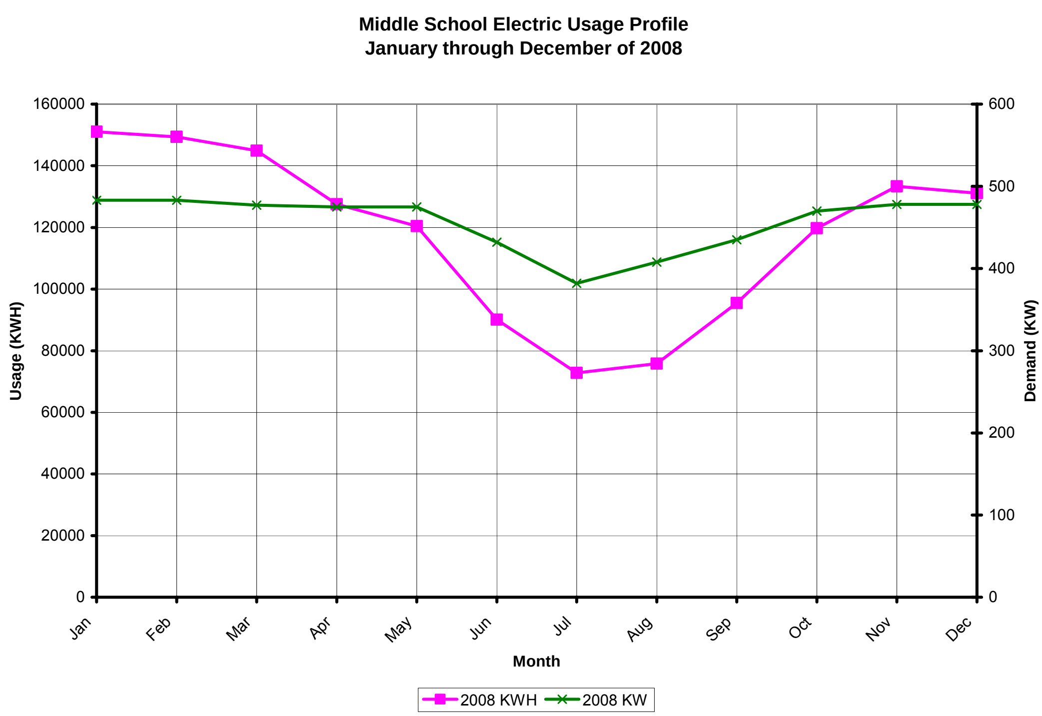
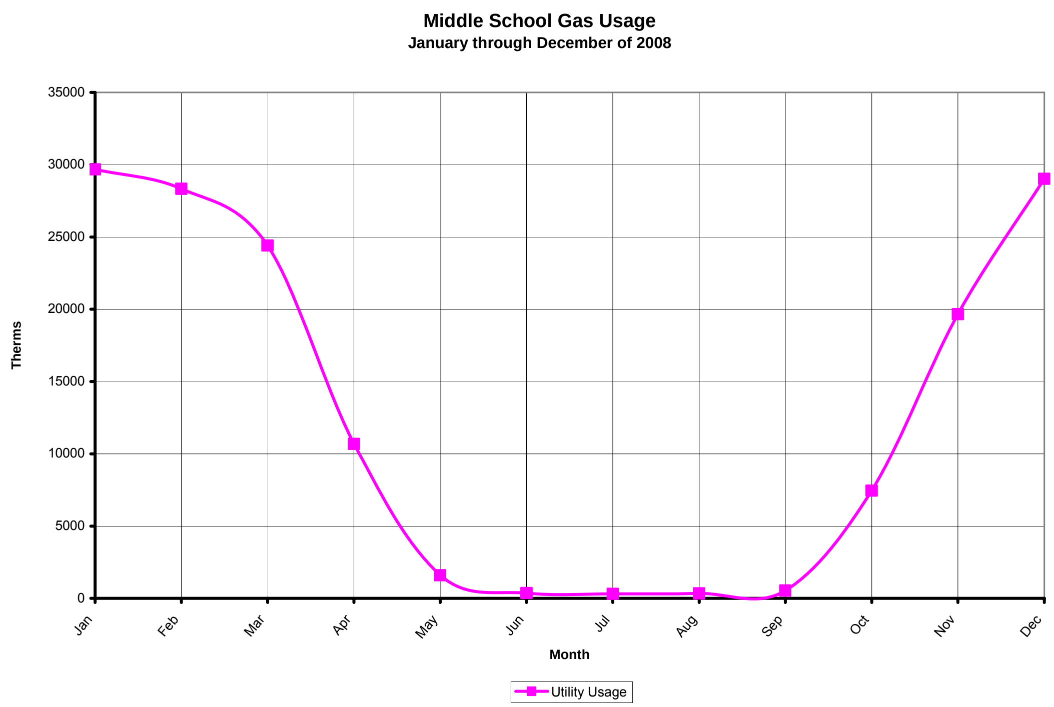


Table 4
Natural Gas Billing Data

MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
1/08	29,680	$50,126
2/08	28,332	$47,644
3/08	24,411	$38,480
4/08	10,688	$15,683
5/08	1,597	$2,443
6/08	364	$674
7/08	315	$615
8/08	338	$587
9/08	537	$791
10/08	7,449	$12,250
11/08	19,659	$29,912
12/08	29,031	$42,860
Totals	**152,401**	**$242,065**

Figure 2
Natural Gas Usage Profile



B. Energy Use Index (EUI)

The Oak Ridge National Laboratory (ORNL) Buildings Technology Center under a contract with the U.S. Department of Energy maintains a Benchmarking Building Energy Performance Program. Their website allows the user to determine how well the client's building energy use intensity (EUI) compares with similar facilities in the U.S. and NJ.

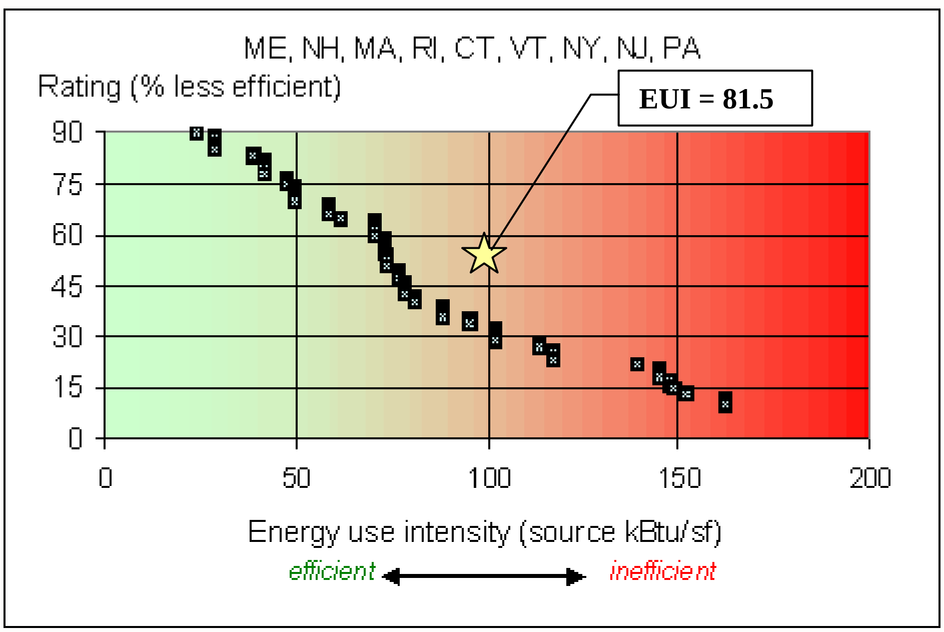
Middle School EUI = (Electric Usage in kWh + Gas Usage in kWh) / SF

= [(1,411,735 kWh) + (152,401 Therms x 29.3 kWh/Therm)] / SF

= (1,411,735 kWh + 4,465,349 kWh) / 246,000 SF

Middle School EUI = 23.89 kWh / SF x 3.412 kBtu/kWh = 81.5 kBtu/sf

Energy Use Intensity Distributions: Middle Schools



C. EPA Energy Benchmarking System

The United States Environmental Protection Agency (EPA) in an effort to promote energy management has created a system for benchmarking energy use amongst various end users. The benchmarking tool utilized for this analysis is entitled Portfolio Manager. The Portfolio Manager tool allows you to track and assess energy consumption via the template forms located on the ENERGY STAR website (www.energystar.gov). The importance of benchmarking for local government municipalities is becoming more important as utility costs continue to increase and more emphasis is being placed throughout multiple arenas on carbon reduction, greenhouse gas emissions and other environmental impacts.

Based on information gathered from the ENERGY STAR website, Government agencies spend more than $10 billion a year on energy to provide public services and meet constituent needs. Furthermore, energy use in commercial buildings and industrial facilities is responsible for more than 50 percent of U.S. carbon dioxide emissions. Therefore, it is vital that local government municipalities assess their energy usage, benchmark this usage utilizing Portfolio Manager, set priorities and goals to lessen their energy usage and move forward with these priorites and goals. Saving energy will in-turn save the environment.

Utilizing the utility bills and other information provided by the School District and entered into Portfolio Manager, the resultant energy performance rating was calculated. The following is a summary of the facility's Portfolio Manager results:

FACILITY DESCRIPTION	**ENERGY PERFORMANCE RATING**	**NATIONAL AVERAGE**
Bridgewater-Raritan Middle School	45	50

Refer to Appendix D for detailed energy benchmarking report entitled "STATEMENT OF ENERGY PERFORMANCE."

V. ENERGY MANAGEMENT PROGRAM

An energy management program involves a suite of activities, which can be grouped into key energy management principles. These principles are good management practices and are similar to management techniques used in other aspects of a business. They include:

- energy policy and plan, adopting a strategic approach, obtaining commitment,
- organization, appointing an energy manager and team,
- understanding energy use and cost, conducting an energy audit,
- staff awareness and training program,
- marketing energy management,
- investing and action, and
- energy monitoring and reporting.

The Bridgewater-Raritan Regional School District has instituted a comprehensive energy management program which includes a written energy policy/plan, developing an energy-efficient culture and support awareness, staff awareness and training, utility reporting software, and externally promotes energy savings. In addition, the School District compares their energy use to previous years, to EPA benchmarks for similar facilities, and sets targets for energy savings.

The next step in energy management for the School District is obtaining updated energy consumption data by installation of an interval metering data system.

Interval metering is when a meter records demand and consumption during a single day to create an energy usage profile. Typical interval lengths are 15, 30 and 60 minutes. This data is typically used in energy management applications when a customer needs to know how much power they are using at various times during the day.

In essence, interval meters allow users to create a fully integrated energy management approach for the targeted facility by:

1. Determining your precise energy consumption
2. Ensuring your LDC has billed you correctly
3. Developing Load Shifting measures to minimize demand charges
4. Engaging in demand response activities when it makes sense
5. Revising your procurement strategy to best suit the facility’s load profile

VI. FACILITY DESCRIPTION

The Middle School is a three-story brick structure that consists of the original building built in 1966 and an addition built in 1999. The facility is approximately 246,000 square feet in size and classes are from 9:30 AM until 3:30 PM during the school year. In addition, the gym is used for sporting events after school and during the summer months.

Heating System

Various sections of the building are heated by three (3) Cleaver Brooks 200 HP (Model CB900X) hot water boilers that are approximately 80% efficient. Hot water is supplied to rooftop units, air handling units, unit ventilators, fin-tube radiators, unit heaters, cabinet unit heaters, etc. The N-wing has four gas-fired heating rooftop units. The School District has funding for replacement of the oldest unit ventilators in Sections B & C of the building. These unit ventilators will have individual, enhanced controls for each classroom.

Domestic Hot Water

Domestic hot water is provided by two (2) A. O. Smith gas-fired hot water heaters. The capacities are as follows: 75-gallon capacity hot water heater rated at 75,000 Btu/hr input and a 98-gallon capacity unit rated at 75,100 Btu/hr input.

Cooling System

Cooling is provided in the Administration Offices by ductless split systems and window air conditioning units. Data closets/rooms are also cooled most of the year using split systems. The Cafeteria B Roof has three (3) A/C units and the Library has six (6) rooftop DX cooling units. The N-wing has four (4) DX cooling rooftop units.

Controls System

All HVAC units in the older section of the school are controlled by local or remote pneumatic thermostats. We could not determine an actual level of accuracy of the pneumatic thermostats without calibrated instrumentation but there are certainly some air leakage in the sensors, field devices and air lines. The noted air leakage leads to inefficient operation of the equipment the thermostat is controlling. The Library cooling is controlled by programmable thermostats. The N-wing is controlled by a full DDC system.

Lighting Systems

All of the classrooms have pendant-mounted, 2-lamp T8 direct/indirect lighting fixtures with electronic ballasts. Offices, storage rooms, stairwells, corridors, etc. are 2-foot by 4-foot, 2-lamp T8 lighting fixtures. The gyms have older style HID fixtures with metal halide lamps.

VII. MAJOR EQUIPMENT LIST

Equipment denoted by a double asterisk indicates an estimate of the equipment ratings due to equipment inaccessibility, worn nameplates, lack of nameplates, etc. Refer to Appendix B for a more detailed major equipment list.

HEATING EQUIPMENT						
Description	Qty	Rated Capacity (Each)	Fuel	Approximate Age (yrs)	ASHRAE Service Life (yrs)	Remaining Life (yrs)
Cleaver-Brooks Boilers	3	8.36 MMBTUH	NG	43	35	(12)

COOLING EQUIPMENT					
Description or Mfg.	Qty	Capacity	Approximate Age (yrs)	ASHRAE Service Life (yrs)	Remaining Life (yrs)
Aaon Rooftop Unit	3	10-Ton	10	15	5
Aaon Rooftop Unit	1	8-Ton	10	15	5
Task Cooling Only	6	2-Ton	4	15	11
Carrier	1	Unknown	43	15	(28)
Unknown	1	**	43	15	(28)
Unknown	1	**	43	15	(28)
Trane	1	10-Ton	3	15	12
RHEEM	1	2-Ton	**	15	**

Note: ** Nameplate information could not be gathered in field.

DOMESTIC HOT WATER SYSTEM						
Description	Qty	Input	Fuel	Approximate Age (yrs)	ASHRAE Service Life (yrs)	Remaining Life (yrs)
A.O. Smith 75-Gallon Capacity	1	75 MBH	NG	10	15	5
A.O. Smith 98-Gallon Capacity	1	75 MBH	NG	2	15	13

HEATING HOT WATER PUMPS					
Description	Qty	Pump HP	Approximate Age (yrs)	ASHRAE Service Life (yrs)	Remaining Life (yrs)
B&G HW Pump	2	25	7	20	13

DOMESTIC HOT WATER CIRCULATING PUMPS					
Description	Qty	HP/Amps	Approximate Age (yrs)	ASHRAE Service Life (yrs)	Remaining Life (yrs)
DHW Pump	1	-	7	10	3
DHW Pump	1	-	7	10	3

VIII. ENERGY CONSERVATION MEASURES

ECM #1: Install Lighting Controls

A common occurrence in buildings of this type is lighting fixtures being left on unnecessarily. There has been a belief that it is better to keep the lights on rather than to continuously switch them on and off. The on/off dilemma was studied and it was determined that the best option is to turn the lights off whenever possible. Although this practice reduces the lamp life, the energy savings far outweigh the lamp replacement costs.

Lighting controls are available in many forms. Lighting controls can be as simplistic as an additional switch. Timeclocks are often used which allows the user to set an on/off schedule. Timeclocks range from a dial clock with on/off indicators to a small box the size of a thermostat with user programs for on/off schedule in a digital format. Occupancy sensors detect motion and will switch the lights on when the room is occupied. They can either be mounted in place of the current wall switch, or they can be mounted on the ceiling to cover large areas. Lastly, photocells are a lighting control that sense light levels and will turn the lights off when there is adequate daylight. These are mostly used outside, but they are becoming much more popular in energy-efficient office designs as well.

To determine an estimated savings for lighting controls, we used ASHRAE 90.1-2004 (NJ Energy Code). Appendix G states that occupancy sensors have a 10% power adjustment factor for daytime occupancies for buildings over 5,000 SF. CEG recommends the installation of dual technology occupancy sensors in all private offices, conference rooms, mechanical rooms, storage rooms, file rooms, teacher rooms, etc. This energy conservation measure can be applied to 51 rooms which amount to 10,200 square feet.

From Appendix C of this report, we calculated the lighting power density (Watts/ft^2) of the existing facility to be 0.90 Watts/SF. Ten percent of this value is the resultant energy savings due to installation of the occupancy sensors:

10% x 0.90 Watts/SF x 10,200 SF x 2,800 hrs/yr. = 2,570 kWh/year

Annual Savings = 2,570 kWh/yr. x $0.134/kWh = $344 / yr

CEG would recommend wall switches for individual rooms, ceiling mount sensors for large office areas or restrooms, and fixture mount box sensors for some applications as manufactured by Sensorswitch, Watt Stopper, etc. Installation cost per dual-technology sensor is $75/unit. The SmartStart Buildings® incentive is $20 per control which equates to an installed cost of $55/unit. Total number of rooms to be retrofitted is 51. Total cost to install sensors is $2,805.

Simple Payback = 8.1 Years.

ECM #2: Install Energy Efficient Window Film

The word "envelope" refers to the "shell" of the building: walls, roof, windows, and doors. To improve the envelope would mean upgrading or adding materials or equipment to enhance the insulation or to reduce the amount of unconditioned outside air that enters the building.

In some cases, envelope improvements require a significant investment. Although the money gets recovered through energy savings, the payback is typically not very attractive. However, other considerations would add a great deal of value to the improvements. For example, in the case of a drafty building, adding insulation or upgrading the windows would improve human comfort. Human comfort affects your bottom line because uncomfortable or unhappy occupants will have a higher absentee rate and/or will require additional time from maintenance personnel as they search for stopgap solutions to the problem. Another example would be an undersized heating system. Instead of installing a new heating system, the building envelope could be improved to the point where the existing heating system is sufficient. These and other considerations must be taken into account when analyzing envelope measures.

Energy savings calculations for the older sections of the facility:

***** Heating Degree Days = 5,539°F – day/yr.

***** Cooling Degree Days = 918°F – day/yr.

***** Obtained from the Morristown, NJ Weather Station

Total window area to be considered = 23,240 SF

U_{exist} = 0.87 Btu/hr – ft^2 - °F

U_{new} with high-efficiency window film = 0.68 Btu/hr – ft^2 - °F

Annual Energy Savings (Heating) =

10 hrs * Window Areas * (U_{exist}-U_{new}) * HDD
Day

= 10 * 23,240 SF * (0.87-0.68) * 5,539 = 244.6 MMBTU = 2,446 Therms

Total Energy Savings = 2,446 Therms x $1.59 = $3,889

Installed Cost of High-Efficiency Window Film = $3.50/SF x 23,240 SF = $81,340

Simple Payback for Upgraded Windows = 20.9 Years

ECM #3: Replace Rooftop Units

The original rooftop units located over Cafeteria B are excellent candidates for replacement. These units look to be original 1966 vintage units, are rusted through the casings, have several of the damper linkages disconnected, and were running even though it was after regular school hours. These units are beyond their expected service life as outlined in Chapter 36 of the 2007 ASHRAE Applications Handbook. Due to escalating owning and maintenance costs, these units should be replaced.

This measure would replace these three rooftop units with energy-efficient gas-fired heating and DX cooling units as manufactured by Trane Model YH060 or equivalent. In addition, these units would feature electronic controls and programmable thermostats.

Note: Sizing indicated within the calculation of this ECM is based on a one for one replacement of the existing equipment. Owner should have a Professional Engineer verify heating and cooling loads prior to moving forward with the ECM if building envelope ECM modifications are implemented.

New Cooling Unit Energy Savings =

[(Tons Refrigeration x 12,000 Btu/Ton) / (1000)/(New-Old EER) x Avg. Load Factor x Hrs. of Cooling] x No. of Units

<u>Existing Rooftop Units</u>

Rated Capacity = 5 Tons per Unit
Condenser Unit Efficiency = 4.0 EER
Cooling Season Hrs. of Operation = 1,800 hrs/yr.

Average Cost of Electricity - $0.134/kWh

<u>Proposed High-Efficiency Condensing Unit</u>

Rated Capacity = 5 Tons per Unit
New Cooling Unit Efficiency = 14.0 EER

Energy Savings = {[(5 Tons x 12,000 Btu/Ton)/1,000 Watts/kW) ÷ (14-4 Btu/Watt)] x 0.15 x 1,800 hrs.} x 3 units = 4,860 kWh/Yr.

Cost Savings = 4,860 kWh x $0.134/kWh = $651 / Yr.

Installed cost of (3) three new 5-Ton rooftop cooling only units = $16,400. The SmartStart Buildings® incentive is $1,395 which equates to a net installed cost of $15,005

Simple Payback for This Measure = 23 Years

ECM #4: Replace Auditorium Heating &Ventilating Units Interior Components

The two (2) heating and ventilating units in the Auditorium are located on the steel platform above the auditorium ceiling. One unit appears to be shut off with the hot water coils removed. The other unit is functioning but does not seem to be under control since the unoccupied auditorium space was at 78ºF at the time of our site inspection. These units are beyond their expected service life as outlined in Chapter 36 of the 2007 ASHRAE Applications Handbook. Due to escalating owning and maintenance costs, these heating and ventilating units should be replaced.

Excess heating and ventilating of the auditorium space due to the equipment age, lack of controls, etc. can be an energy sink. Reducing ventilation air to a safe minimum level; reducing the auditorium exhaust and thus make-up air; closing outdoor air dampers during warm-up or cool-down periods; and tight DDC control of the space temperature along with night-time setback can achieve potential savings.

This measure would replace all the interior components for these two heating and ventilation units (fans, hot water coils, motors, etc.) as manufactured by McQuay or equivalent. Furthermore, these units would be specified to include electronic controls with programmable thermostats and variable frequency drives for the fan motors. The programmable thermostats will allow the School District to program occupied/unoccupied times, nighttime setback temperatures and room temperature setpoints.

Note: Sizing indicated within the calculation of this ECM is based on a one for one replacement of the existing equipment. Owner should have a Professional Engineer verify heating and cooling loads prior to moving forward with the ECM if building envelope ECM modifications are implemented.

Calculated energy savings/unit = [CFM x Cp x DA x (TA-TW) x PD x HY] / ŋ

CFM = air flow rate, CFM
Cp = specific heat of air, 0.24 BTU/lb-Fº
DA = air density, lb/ft^3
TA = ambient temperature, ºF
TW = average outdoor winter temperature, ºF (ASHRAE Weather Files)
PD = fractional decrease in exhaust operating hours during heating season
HY = exhaust operating hours during the heating season
ŋ = heating system efficiency

Energy Savings/Unit = [5,000 x 0.24 x 0.07 x (78 – 14) x 0.50 x 4,000] / 60% = 17,920,000 Btu/hr

= 179.2 Therms x 2 units = 358.4 Therms

Energy cost savings for this ECM = 358.4 Therms x $1.59 / Therm = $570

The cost to replace the interior components for these two heating & ventilating units = $13,850. The SmartStart Buildings® incentive is $1,850 for NEMA premium efficiency motors and variable frequency drives. The net installation cost for these retrofits is $12,000.

Simple payback = $12,000 / $570 = 21.1 years

ECM #5: Replace Hot Water Modulating Valves on Terminal Units

The function of a hot water modulating valve is to meter hot water into the hot water coil as the room temperature drops and to reduce the flow of water into the coil when the room space temperature is satisfied. During the site survey, many spaces were well above the setpoint of 72ºF at 4:00 PM when a minimum number of spaces were occupied. The hot water valves were discovered to be in the open position on several air handlers and fan coil units even though the temperature in the space was well above 72ºF.

This energy conservation measure will replace the existing hot water modulating valves with electronic valves. It must be implemented along with any boiler control upgrades to obtain the full value of the estimated savings (12,430 Therms). If this recommended ECM is implemented without replacement of the heating hot water boiler controls (ECM #14), the estimated cost would be approximately 32 valves x $1,000/valve ($32,000 installed). The annual fuel savings would be $3,810 for a simple payback of 8.4 years.

NOTE 1: ***ECM #5 and ECM #14 must both be implemented to achieve the total gas savings of 12,430 Therms.***

ECM #6: Replace Domestic Hot Water Heater

The domestic hot water heater for the building was installed in 1999. Based on the site survey and manufacturer's performance data, the efficiency of this unit is approximately 70%.

This energy conservation measure will replace the existing gas-fired, 100-gallon capacity domestic hot water heater with a 90% thermal efficient A.O. Smith Cyclone HE domestic hot water heater with 50-gallon storage capacity or equivalent. Due to the high recovery rate and thermal efficiency a smaller storage capacity can be utilized.

Existing Natural Gas-Fired DHW Heater

Rated Capacity = 75 MBH input; 75 gallons storage

Thermal Efficiency = 75%
Radiation Losses = 5%
Net Efficiency = 70%

Proposed Natural Gas-Fired, High-Efficiency DHW Heater

Rated Capacity = 76 MBH input; 50 gallons storage

Thermal Efficiency = 90%
Radiation Losses = 0.5%
Net Efficiency = 89.5%

Operating Data for DHW Heater

Estimated Daily DHW Load = 75 gal/h

DHW Boiler Operating Hrs/Yr. = 1,040 Hrs.

Annual fuel consumption = 585 Therms per year (Based on 90°F rise)

Average cost of natural gas = $1.59/Therm

Energy Savings = 585 Therms x (0.895-0.70/0.70) = 163 Therms

Cost Savings = 163 Therms x $1.59/Therms = $260/Yr.

Installed Cost of A.O. Smith Cyclone DHW Heater = $4,250. The SmartStart Buildings® incentive is $50 per 50 gallon, high-efficiency natural gas water heater. This equates to a net installation cost of $4,200.

Simple Payback = $4,200 / $260/Yr. = 16.2 Years

ECM #7: Kitchen Hood Controls

Standard kitchen hood controls consist of switches and relays that interlock the kitchen grease hood exhaust fan(s) with the 100% outside air unit that provides make-up air for this system. Normal occupation of kitchen hood system is limited to occupied hours. During the site inspection, conducted after hours, one of the two kitchen exhaust hood fans was running continuously along with the 100% outside air unit. The current operation of the system, as witnessed is not necessary and is costing the district many dollars in utility cots for natural gas and electric. Based on the above, there is great potential energy savings thought better controls of the hood exhaust fan(s) and make-up air unit. The two 3 HP kitchen exhaust fans consume large amounts of electricity when operating and if controlled properly, the energy consumption can be greatly reduced.

This energy conservation measure would install a Melink Kitchen Hood Variable Air Volume Controller; variable frequency drive on the make-up air supply fan along with the kitchen hood exhaust fan; and turn off all the kitchen hood exhaust systems when the kitchen is closed. When the cooking appliances are turned on, the hood exhaust fan speed will increase based on the hood exhaust temperature. During actual cooking, the kitchen hood exhaust fan increases to 100% speed until the smoke/vapor is removed. Energy savings are also realized when the kitchen equipment is operating at less than full load due to minimal cooking operations. During these times the fan speed decreases, removing only the necessary about of air, saving energy.

Detailed calculations for the proposed kitchen hood control system can be found in Appendix E. It is pertinent to note that the calculation assumes the exhaust fans and make-up air unit are manually turned off for approximately 11 hours per day.

Installed cost of the kitchen hood control system is $31,044. The calculated energy savings equals approximately $13,148 per year.

Simple Payback = $31,044/$13,148 = 2.4 Years.

ECM #8: Install NEMA Premium Efficient Motors

Existing electric motors equal to or greater than one horsepower ranged from 78 to 81% efficient. The improved efficiency of the NEMA premium efficient motors is primarily due to better designs with use of better materials to reduce losses. Surprisingly, the electricity used to power a motor represents 95 % of its total lifetime operating cost. Because many motors operate 40-80 hours per week, even small increases in efficiency can yield substantial energy and dollar savings.

This energy conservation measure would replace all motors equal to or greater than 1 HP with NEMA Premium® Efficient Motors. NEMA Premium® is the most efficient motor designation in the marketplace today. Using MotorMaster+, Version 4, the energy & cost savings were calculated for the fan/pump motors in this facility that are greater than or equal to 1 HP.

For Example: A 2HP Supply Air Fan Motor with the following:

Existing Motor Efficiency = 80.8%
Annual Hours of Operations = 3,300 (Average)
1 HP = 0.746 Watt
Load Factor = 75%
Cost of electricity = $0.134 / kWh

New NEMA Premium Motor Efficiency = 86.5%

Existing 2HP Motor Operating Cost =

{0.746 Watt/HP x Motor HP x Load Factor x Hours of Operation x Cost of Electricity] ÷ Motor Efficiency

= [0.746 x 2 x 0.75 x 2,800 x 0.134] ÷ 0.808 = $520 / Year

New NEMA Premium Efficiency Motor Operating Cost =

{0.746 x 2 x 0.75 x 2,800 x 0.134} ÷ 0.865 = $485 / Year

Savings = $520 - $485 = $35 / Year

Installed Cost of a 2 HP NEMA Premium® Efficiency Motor = $518 minus the SmartStart Building® incentive of $90 is $428

Simple Payback = $428 / $35 = 12.2 Years

The following table outlines the motor replacement plan for this facility:

MOTOR REPLACEMENT PLAN

MOTOR HP	QTY	ENCL. TYPE	NO. OF POLES	INSTALLED COST **	TOTAL COST	TOTAL SAVINGS	SIMPLE PAYBACK
25	2	ODP	4-Pole	$2,845	$5,690	$504.60	11.35
1	4	ODP	6-Pole	$774	$3,096	$70.40	44
				Totals:	*$8,786*	*$575*	*15.3*

**** Net Cost after the SmartStart Buildings® incentive is applied.**

ECM #9: Install T-5 Lighting System in Gyms

The existing Gymnasium and Auxiliary Gymnasium lighting systems comprise of a total of sixty-three (63) 400-Watt Metal-Halide (MH) fixtures which have poor lumen maintenance (approximately 30% reduction in lighting output at 40% of rated lamp life). Also, the fixture ballast can be very noisy, require up to 10 minutes to re-strike after shutdown, and there is a noticeable color shift as the lamp approaches the end of its life.

This ECM would replace each of the existing Gymnasium and Auxiliary Gymnasium light fixtures with new T-5 high-bay fixtures which would include five, 4-foot T5 High Output (HO) lamps. The T-5 HO lamps are rated for 20,000 hours versus the 10,000 hours for the 400-Watt MH lamps so there would be a savings in replacement cost/labor. In addition, the T-5 HO lamps have better lighting quality and lumen maintenance.

The gym is used 3,800 hours per year by the students (year round) and by the community an additional 900 hours per year. One row of lights per gym is usually turned off except for cloudy days or at night leaving 54 fixtures for the energy savings calculations.

The existing fixtures use 475 Watts per fixture and the new 5-lamp, T-5 HO units will use 296 Watts per fixture.

The annual energy savings = 63 Fixtures x (475W – 296W) x 4,700 hours = 53,002 kWh

Energy Cost Savings = 53,002 kWh x $0.134/kWh = $7,102

The cost of the 5-lamp, 54W T-5 HO fixture with specular reflector is $750 installed.

Total Cost = 63 Fixtures x $750/Fixture = $47,250.

The SmartStart Building® incentive is $100 per fixture which equates to: $100 x 63 fixtures = $6,300

Net Installed Cost = $40,950

Simple Payback = $40,950 / $7,102 = 5.8 years

Refer to Appendix C for a detailed Investment Grade Lighting Audit for the facility.

ECM #10: Efficiency Improvements – Walk-in Refrigerator

The amount of energy consumed by a refrigeration system can be reduced by retrofitting the items described below. The effects of the following energy efficient retrofits are additive. Each one incrementally and independently reduces the load on the compressor. CEG recommends that all three (3) retrofits be completed in order to provide the most efficiency improvements for the refrigeration system.

- High-efficiency refrigeration compressors use more efficient electric motors and have lower compressor losses. The use of high-efficiency compressors can save from 3 to 5 percent in energy costs.
- High-efficiency evaporator fan motors release less heat into the refrigerated room than conventional induction motors. This reduces the energy draw by the fan motor and the compressor. System energy savings are 5 to 10 percent for these motors.
- A high-efficiency condenser fan motor can reduce energy requirements. System energy savings can be from 3 to 5 percent.

Estimated annual energy cost savings for these three measures is as follows:

Measure	Average Saving (%)	Approximate Annual Savings
HE* Compressor	5%	$98
HE Evaporator Fan Motor	4%	$52
HE Condenser Fan Motor	5%	$78
Total**		$228/refrigerator

*****HE = High Efficiency
******Savings are additive

The cost of these three measures is estimated to be $1,870/refrigerator

Simple Payback/Refrigerator = 8.2 Years

ECM #11: Refrigerated Walk-In Cooler Controls Upgrade

The refrigerated walk-in cooler has a bank of evaporator fans that circulate the cold air over and under the food. These banks of evaporator fans (typically 1/3 HP motors) run continuously and give off heat that must be removed by the refrigeration.

This measure would install an evaporator fan controller that features two-speed operation of the evaporator fans – high speed during cooling, and low speed when not cooling. The estimated energy savings assumes that the cooler is not opened for 16 hours of each school day and 24 hours/day for the weekends.

Installing a controller on the two (2) evaporator fan motors would save approximately 540 kWh/month x 12 months = 6,470 kWh. Energy Cost Savings = 6,470 kWh x $0.134/kWh = $867/cooler
The cost of an evaporator fan controller installed = $1,380/cooler

Simple Payback = 1.6 years/cooler

See Appendix F for the detailed energy and installation calculations for this energy conservation measure.

ECM #12: High-Efficiency Split System Heat Pumps

There are several split air-conditioning systems that are beyond their rated service life and are very inefficient. In addition, there are several office window air conditioning units that are also very inefficient.

This measure would replace all small window and aged split air conditioning units with high-efficiency split heat pump units as manufactured by Mitsubishi, Model PKA-A24 or equivalent.

The following assumptions are used in the savings analysis below:

- The existing energy rating of the aged split air conditioning units and window units is an average of 5 EER.
- The energy efficiency rating of the new heat pump units is 12 EER
- The administrative offices, data/phone closets, etc. need cooling approximately 4,000 hours per cooling season.

Method for Calculating Summer Energy Savings:

Gross annual energy savings = Units x Tons/Unit x RLF x [$12/EER_{exist} – 12/EER_{new}$] x CLH

Where:

RLF = the ***rated load factor*** which is the ratio of the peak cooling load imposed on the cooling equipment to the total rated cooling capacity. This factor compensates for oversizing of the air conditioning unit. Recommended value is 0.8.

CLH = ***Cooling load hours*** are defined as the ration of the annual cooling load to the peak cooling load. The cooling load hours for Morristown, NJ area is 492.

Energy Savings = 8 x 2 tons/unit x 0.8 x [12/5 – 12/12] x 492 = 8, 817 kWh

Energy cost savings = 8,817 kWh x $0.134/kWh = $1,181

Cost of eight (8) high-efficiency split heat pumps is $24,000. The SmartStart Buildings® incentive is $1,472 which equates to a net installed cost of $22,528.

Simple Payback = 19.0 years

ECM #13: Install High-Efficiency Low-E Window Systems

The older sections of the school building have single-pane windows which allow heat losses and gains resulting in cooler interior surfaces during the heating season and warmer interior surfaces during the cooling season. In addition, these windows are a source of cold air leakage into the school and often result in condensation-related problems when this cold air contacts warmer surfaces.

High-performance windows can provide many benefits including:

- Improved comfort by reducing radiant heat exchange
- Improved indoor air quality by reducing air leakage that can bring dirt, dust, and other impurities into the building
- Lower utility bills since these windows are better insulated and more air-tight
- Fewer condensation problems since these windows stay warmer in the heating season resulting in drier windows
- Reduced wear on furnishings, carpeting, window treatments, etc. since low-e coatings block up to 98 % of the ultraviolet radiation of the sun.

This energy conservation measure would replace all of the single-pane windows with high performance, low-e window units. CEG estimated the window square footage utilizing floor plans provided by the Owner and assuming a 60% window to wall ratio for the rooms with fenestration based on information gathered during our site survey such as building floor height and window type. Based on an average nominal window size of 4’ x 6’ (24 SF) an estimated 968 windows can be replaced.

Energy savings calculations:

Heating Degree Days = 5,539°F – day/yr.

Cooling Degree Days = 918°F – day/yr.

Total window area to be retrofitted = 23,240 SF

Uexist. = 0.87 Btu/hr – ft^2 - °F

CEG would recommend replacement of the existing single pane windows with a commercial window system that meets or exceeds the following performance characteristics: U-Factor = 0.28, Solar Heat Gain Coefficient = 0.21 and Visible Transmittance = 0.49.

Unew = 0.28 Btu/hr – ft^2 - °F

Annual Energy Savings (Heating) =

12 hrs * Window Areas * (Uexist-Unew) * HDD Day

= 12 * 23,240 * (0.87-0.28) * 5,539 = 911.4 MMBTU = 9,114 Therms

Energy Savings = 9,114 Therms x $1.59 = $14,490

Upgraded Window Cost = $189,000 Lump Sum

Simple Payback for Upgraded Windows = $189,000 / $14,490 = 13 Years

ECM #14: Install Boiler Control Upgrades

The existing heating system is 1966 vintage 200 HP Cleaver Brooks Firetube Hot Water Boilers that were originally designed to burn fuel oil but were later modified to burn natural gas. The boilers are each firing and then cycling off (B-1 then B-2 and then B-3). The boilers do not seem to be under control, not sequencing, nor on any type of outside air temperature reset. During our site inspection on 2/25/09, the outside air temperature was 46ºF at approximately 4 PM. All three boilers were firing with a hot water supply temperature of 155ºF and a hot water return temperature of 145ºF.

The temperature of the water supplied to a building's heating system can be varied, with the warmest water supplied only on the coldest days. This is achieved by resetting the hot water temperature setpoints in the control system. This is normally done as a function of outside air temperature, and is often programmed into the Building Management System (BMS) software or can be controlled by a separate hardware controller.

This measure would install new Cleaver Brooks high- efficiency burners with 10:1 turndown ratios, replace the defective lead/lag boiler controller, and replace the 3-way valve with control off of outside air temperature reset.

<u>Estimated Energy Savings</u>

The analysis is based on the following assumptions for the water tube boilers:

- The boiler combustion efficiency is approximately 85% as shown by the combustion efficiency testing results dated 10/10/07.
- The hot water reset schedule would be as follows:

Outdoor Temperature	Boiler Loop Temperature
20 degrees and lower	180 degrees
50 degrees and higher	140 degrees

- An analysis of the gas bills indicates that the existing B-1 and B-2 boilers consume approximately 124,300 Therms of natural gas per year
- The manufacturer guarantees to reduce fuel consumption by 10% if these three components are upgraded / replaced along with replacement of the defective hot water modulating valves at the terminal units.

NOTE: ***<u>ECM #5 and ECM #14 must both be implemented to achieve the total gas savings of 12,430 Therms</u>***

Total energy savings = 10% x 124,300 = 12,430 Therms

Energy cost savings = 12,430 Therms x $1.59/Therm = $19,764

The installed cost of these energy conservation items along with replacing the hot water modulating valves (see ECM #5) is $107,000 (budget costs obtained from Miller & Chitty Co., Inc.).

Simple payback = 5.4 years

ECM #15: Install Programmable Thermostats

Throughout the building there are standard, manual wall thermostats for various HVAC units and local control with adjustable settings on the unit ventilators. These old, pneumatic indoor temperature controls are inaccurate due to temperature drift, age, and not having been re-calibrated. These units also do not have night time setback features.

This energy conservation measure would replace the various HVAC unit thermostats and unit ventilator local controls with programmable 7-day thermostats and night time setback control.

Based on the following setpoints,

Occupied heating = 70° F
Occupied cooling = 76° F
Unoccupied heating = 60° F
Unoccupied cooling = 85° F

CEG recommends replacement of the existing remote thermostats with Honeywell RTH7500D 7-day programmable thermostat or equivalent.

The energy savings of a 7-day programmable thermostat was calculated by using Energy Star Life Cycle Cost Estimate software for qualified programmable thermostats. The referenced calculator can be found at www.energystar.gov. Refer to Appendix G for the detailed calculation.

Calculated energy savings = $177/Unit

Cost of a 7-day programmable thermostat (installed) = $250/unit

Based on CEG's site survey, an estimated 100 thermostats are required within the Middle School. Therefore, the total energy savings, cost and simple payback are as follows:

Total Energy Savings: $177 x 100 = $17,700

Total Installed Cost: $250 x 100 = $25,000

Simple Payback = $25,000 / $17,700 = 1.4 Years

ECM #16: Install Full DDC System

Throughout the building there are pneumatic manual wall thermostats for various HVAC units and local pneumatic controls with adjustable settings on the heating/cooling units that were installed in 1966. These indoor temperature controls are inaccurate due to temperature drift, age, cost of maintenance of pneumatics and not having been re-calibrated. These units also do not have night time setback features. In addition, pneumatic controls do not have the ability to maintain the temperature at setpoint under changing load conditions.

This energy conservation measure would replace the entire pneumatic temperature control system with Direct Digital Control System with a full Ethernet system and a computer front end. The advantages of a DDC system include deleting the air compressor, air dryer, and controls along with the maintenance costs of pneumatic systems. With a DDC system, it is possible to develop historical records on the operating characteristics of a building; identifying trends which can lead to better performance. The DDC system also allows for comprehensive alarm management in the event of a mechanical system malfunction. DDC saves time by eliminating the need to change various time clocks for holidays and schedule changes. Finally, this system allows remote access to the controllers for trouble shooting or to more easily change setpoints or occupancy schedules.

In addition to the building operation and alarm management functions of the DDC system, CEG also recommends that the DDC system be configured to accept interval metering data. Based on the School District's interest in monitoring their energy use, CEG believes that interval metering is the next step in being able to fully control the operation of their facility. The School District will be able to review their consumption patterns and identify trends. Based on this information, the School District will be able to develop effective strategies to lower their consumption and save money on their electricity and gas bills. Reducing the peak through these types of programs will not only benefit the School District by lowering their electricity bills, but will also benefit the electricity system, by reducing the pressure to build new generation capacity to respond to growing peak loads. It is pertinent to note that the interval meter itself, is something that the Owner will need to request from their utility provider. Based on the facility's utility usage, the School District should not have issue acquiring the interval meter from the utility.

The cost of a full DDC system with new field devices, thermostats, controllers, computer, software, engineering, etc., and the software and wiring to the interval meter is approximately $4 per SF based on recent project cost data and Contractor's estimate pricing.

Cost of Complete DDC System = $960,000

It is estimated that a full DDC system would save an estimated 10% of the total energy costs for this facility.

Annual Savings = 10% x $431,354 = $43,135

Simple Payback = $960,000 / $43,135 = 22.3 years

IX. RENEWABLE/DISTRIBUTED ENERGY MEASURES

Globally, renewable energy has become a priority affecting international and domestic energy policy. The State of New Jersey has taken a proactive approach, and has recently adopted in its Energy Master Plan a goal of 30% renewable energy by 2020. To help reach this goal New Jersey created the Office of Clean Energy under the direction of the Board of Public Utilities and instituted a Renewable Energy Incentive Program to provide additional funding to private and public entities for installing qualified renewable technologies. A renewable energy source can greatly reduce a building's operating expenses while producing clean environmentally friendly energy. CEG has assessed the feasibility of installing renewable energy technologies for Bridgewater-Raritan School District, and concluded that there is potential for solar energy generation.

Solar energy produces clean energy and reduces a building's carbon footprint. This is accomplished via photovoltaic panels which will be mounted on all south and southwestern facades of the building. Flat roof, as well as sloped areas can be utilized; flat areas will have the panels turned to an optimum solar absorbing angle. (A structural survey of the roof is necessary before the installation of PV panels is considered). The state of NJ has instituted a program in which one Solar Renewable Energy Certificate (SREC) is given to the Owner for every 1000 kWh of generation. SREC's can be sold anytime on the market at their current market value. The value of the credit varies upon the current need of the power companies. The average value per credit is around $350, this value was used in our financial calculations. This equates to $0.35 per kWh generated.

CEG has reviewed the existing roof area of the building being audited for the purposes of determining a potential for a roof mounted photovoltaic system. A roof area of 6,528 S.F. can be utilized for a PV system the Middle School Facility. A depiction of the area utilized is shown in Appendix H. Using this square footage it was determined that a system size of 102.12 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 159,363 KWh annually, reducing the overall utility bill by 11.2% percent. A detailed financial analysis can be found in Appendix H. This analysis illustrates the payback of the system over a 25 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

CEG has reviewed financing options for the owner. Two options were studied and they are as follows: Self-financed and direct purchase without finance. Self-finance was calculated with 95% of the total project cost financed at a 7% interest rate over 25 years. Direct purchase involves the local government paying for 100% of the total project cost upfront. Both of these calculations include a utility inflation rate as well as the degradation of the solar panels over time. Based on our calculations the following are the payback periods and internal rate of return for the respective method of payment:

PAYMENT TYPE	SIMPLE PAYBACK	INTERNAL RATE OF RETURN
Self-Finance	11.9 Years	7%
Direct Purchase	11.9 Years	7.2%

Wind energy production is another option available through the Renewable Energy Incentive Program. Small wind turbines can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric usage. CEG has reviewed the applicability of wind energy for the Bridgewater and has determined that the average wind speed is not high enough to produce electricity.

X. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

Load Profile analysis was performed to determine the seasonal energy usage of a facility. Irregularities in the load profile will indicate potential problems within the facility. Consequently based on the profile a recommendation will be made to remedy the irregularity in energy usage. For this report, the facility's energy consumption data was gathered in table format and plotted in graph form to create the load profile. Refer to Section IV, Figures 1 and 2 included within this report to reference the respective electricity and natural gas usage load profile for January through December 2008.

<u>Electricity:</u>

The chart found in Section IV, Figure 1 demonstrates a typical profile for a facility that is not fully air-conditioned. Electric usage is measured in kilowatt-hours (kWh) consumed and this graphic demonstrates a sharp drop off of electric usage in the middle of the summer. A typical summertime usage would show a consistent usage among the cooling months. The graphic demonstrates that between June and August perhaps the school was closed or the lights and equipment were off for long periods of time. Then, as derived from the graphic, all electric consuming items turned on at once in July, thus explaining the sharp rise in electric consumption from July through the winter.

<u>Natural Gas:</u>

The chart found in Section IV, Figure 2 demonstrates a typical heating load (November –March) profile and a complimentary non-heating period (April –October). Consequently there is a clear separation between summer and winter loads consistent with Wholesale Energy Pricing. Heating loads carry a much higher average cost because of the higher demand for natural gas during the winter. The Middle School carries a higher summer time natural gas load than is typical. Summer time programs may explain this. A more consistent energy usage throughout the year provides more competitive energy costs when utilizing a Third Party Supplier (TPS).

Tariff Analysis:

<u>Electricity:</u>

The Bridgewater – Raritan Middle School receives electric service through Public Service Electric and Gas Company (PSE&G) on a LPLS (Large Power and Lighting Service), when not receiving commodity by a Third Party Supplier. The LPLS rates services meter 778014442. This utility tariff is for delivery service for general purposes at secondary distribution voltages where the customers measured peak demand exceeds 150 kilowatts in any month and also at primary distribution charges. The rate schedule has a Delivery Charge, Societal Benefits Charge, Non-utility Generation Charge, Securitization Charge, System Control Charge, Customer Account Services Charge, Standby Fee, Base Rate Distribution Adjustment Charge, Solar Pilot Recovery

Charge and RGGI Charge. The customer can elect to have the Commodity Charge serviced through the utility or by a Third Party Supplier (TPS).

While Bridgewater-Raritan may be on a typical rate structure with the local utility (LPLS), some variations in price do cause some concern, and are worth investigating further.

Natural Gas:

Bridgewater-Raritan receives its Distribution charges only for natural gas service from Public Service Electric and Gas Company (PSE&G). Bridgewater-Raritan receives Third Party Supply for commodity from The Hess Corporation. The meter's served are: # 2209045, which is serviced by the LVG (Large Volume Service) rate class and meter; # 2599663 which is served by the GSG (General Service Gas) rate class. Below is a description of the details of the TPS contract and the associated natural gas tariffs:

- *Alternative Supplier:* The Bridgewater-Raritan School District is utilizing the services of a Third Party Supplier, The Hess Corporation. The contract is administered by The Alliance for Competitive Service (ACES). ACES is the energy aggregation program of the New Jersey School Boards Association of School Administrators. The term per the contract is June 2008 and is expiring on or before May 31, 2010. The process was reviewed and approved by the New Jersey Department of Community Affairs. Per the ACES agreement, the pricing structure that is described is 50% above current market levels.

- *LVG Rate:* This utility tariff is for firm delivery service for general purposes. This rate schedule has a Delivery Charge, Balancing Charge, Societal Benefits Charge, Realignment Adjustment Charge, Margin Adjustment Charge, RGGI Charge and Customer Account Service Charge. The customer can elect to have the Commodity Charge serviced through the utility or by a Third Party Supplier (TPS). It is pertinent to note, should the TPS not deliver, the customer may receive service from PSE&G under Emergency Sales Service. Emergency Sales Service carries an extremely high penalty cost of service.

- *GSG Rate:* The utility tariff is a firm delivery service for general purposes where: 1) customer does not qualify for RSG and 2) customers usage does not exceed 3,000 therms in any month. Customers may either purchase gas supply from a Third Party Supplier (TPS) or from Public Services Basic Gas Supply Service default service as detailed in the rate sheet. This rate schedule has Service Charge, Distribution Charge, Balancing Charge, Societal Benefits Charge, Realignment Adjustment Charge, Margin Adjustment Charge, RGGI Recovery Charge and Customer Account Service Charge. The Commodity Charge is serviced by the Third Party Supplier. It is pertinent to note, should the TPS not deliver, the customer may receive service from PSE&G under Emergency Sales Service. Emergency Sales Service carries an extremely high penalty cost of service.

CEG received an example bill for the Middle School for the period of January 7, 2009 – February 4, 2009 to review current usage and TPS charges. It is pertinent to note, that the date range of this bill is different than the analyzed historical data period for the base analysis. In reviewing this bill, an imbalance charge has been applied to the GSG natural gas account. The imbalance is for a volume of 72 therms. During the same time frame there was an imbalance of 5,926 therms in the LVG account. CEG would question this because imbalances typically occur when TPS's are used to supply natural gas, full-delivery is not made, and when a new supplier is contracted or the customer returns to the utility. It is important when utilizing a TPS, that an experienced regional supplier is used. Otherwise, imbalances can occur, jeopardizing economics and scheduling.

Recommendations:

CEG recommends that the Bridgewater-Raritan School District schedule a meeting with their current utility providers to review their utility charges and current tariff structures for electricity and natural gas. This meeting would provide insight regarding alternative procurement options that might be available to the School System. Further evaluation of the electric and natural gas usage and the resulting costs should be investigated by the Owner and any discrepancies with the billing should be reviewed during the above-recommended meeting.

CEG also recommends that Bridgewater-Raritan School District review the specifics of their ACES agreement for third party supply. In CEG's review, it was noted that Page 1 of the agreement states the term is June 2006 for a 24 month term. However, Page 3 of the agreement states the term of the contract is 24 months from June 2008 through May 2010. CEG has reviewed the price in the ACES Agreement and notes that the price is 50% above current market levels. The Bridgewater-Raritan School District should see if they can re-negotiate the agreement with HESS through the ACES organization. In addition, CEG recommends the District investigate the use of an Energy Advisor in addition to their current efforts and a "Managed Approach" to Energy Procurement. If the District is able to renegotiate their current utility contracts, CEG believes the District will be able to realize approximated energy cost savings as described below:

- *Electricity:* The Middle School has a yearly average price per kWh of $.1144 per kWh. The average annual consumption is 1,411,735 kWh's. The current fixed market price for power is approximately $.095 per kWh. There is an estimated savings of $25,000 by utilizing an alternative supply source.

- *Natural Gas:* The data supplied for the Middle School, demonstrates that the average annual cost for natural gas for the period of January-December 2008 is $14.2 per deka-therm (dTh.) The current baseline 1-year fixed price for natural gas is approximately $6.50 per dTh. Based on the Middle School's annual consumption of 14,485 dTh's, there is an estimated savings of over $100,000 per year.

XI. INSTALLATION FUNDING OPTIONS

CEG has reviewed various funding options for the Owner to utilize in subsidizing the costs for installing the energy conservation measures noted within this report. Below are a few alternative funding methods:

i. *Energy Savings Improvement Program (ESIP)* – Public Law 2009, Chapter 4 authorizes government entities to make energy related improvements to their facilities and par for the costs using the value of energy savings that result from the improvements. The “Energy Savings Improvement Program (ESIP)” law provides a flexible approach that can allow all government agencies in New Jersey to improve and reduce energy usage with minimal expenditure of new financial resources.

ii. *Municipal Bonds* – Municipal bonds are a bond issued by a city or other local government, or their agencies. Potential issuers of municipal bonds include cities, counties, redevelopment agencies, school districts, publicly owned airports and seaports, and any other governmental entity (or group of governments) below the state level. Municipal bonds may be general obligations of the issuer or secured by specified revenues. Interest income received by holders of municipal bonds is often exempt from the federal income tax and from the income tax of the state in which they are issued, although municipal bonds issued for certain purposes may not be tax exempt.

iii. *Power Purchase Agreement* – Public Law 2008, Chapter 3 authorizes contractor of up to fifteen (15) years for contracts commonly known as “power purchase agreements.” These are programs where the contracting unit (Owner) procures a contract for, in most cases, a third party to install, maintain, and own a renewable energy system. These renewable energy systems are typically solar panels, windmills or other systems that create renewable energy. In exchange for the third party’s work of installing, maintaining and owning the renewable energy system, the contracting unit (Owner) agrees to purchase the power generated by the renewable energy system from the third party at agreed upon energy rates.

CEG recommends the Owner review the use of the above-listed funding options in addition to utilizing their standard method of financing for facilities upgrades in order to fund the proposed energy conservation measures.

XII. ADDITIONAL RECOMMENDATIONS

CEG has reviewed the operational characteristics of the facility and believes that the School District should review the implementation of a Retro-Commissioning Plan. Retro-commissioning is a quality-oriented process for verifying and documenting that HVAC systems perform as closely as possible to defined performance criteria. The benefits include documenting accurately the existing system's function and performance; Verifying that system performance meets the facility's requirements; benchmarking the performance of existing systems for future changes; and identifying problems in the system. The following is the estimated energy savings calculations for Retro-Commissioning:

> The cost of retro-commissioning for the Bridgewater Middle School is between $0.15 and $0.30 per Square Foot (Source: Thorne & Nadel "Retro-Commissioning: Program Strategies To Capture Energy Savings in Existing Buildings (2003)" – average Retro-Commissioning costs of $0.22 in TX, TN, CO, MA, AZ, OR, CA).
>
> The energy savings from retro-commissioning critical systems such as HVAC and power systems is approximately 5% of the total energy used (Source: E. Mills et al, "Cost-effectiveness of Commissioning 224 Buildings across 21 states – 2004").
>
> Estimated Cost of Retro-Commissioning = $0.15 x 246,000 SF = $36,900
>
> Estimated Energy Savings = 5% x $431,354 = $21,568
>
> The simple payback for this measure is approximately 1.7 years.

In addition to Retro-Commissioning, CEG also has the following recommendations which include no cost/low cost measures, Operation & Maintenance (O&M) items, and water conservation measures with attractive paybacks. These measures are not eligible for the Smart Start Buildings incentives from the office of Clean Energy but save energy none the less.

A. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.

B. Maintain all weather stripping on windows and doors.

C. Use cog-belts instead of v-belts on all belt-driven fans, etc. These can reduce electrical consumption of the motor by 2-5%.

D. Repair/replace piping and ductwork insulation in the above ceiling spaces.

E. Reduce lighting in specified areas where the foot-candle levels are above 70 in private offices, classrooms, etc. and above 30 foot-candles in corridors, lobbies, etc.

F. Provide more frequent air filter changes to decrease overall fan horsepower requirements and maintain better IAQ. Many of the cabinet unit heaters and unit ventilators air filters are plugged with dust.

G. Recalibrate existing sensors serving the fan coil/air handling units.

H. Install a Vending Miser system to turn off vending machines when not in use.

I. Install LED bulbs in display refrigerators, coolers, or freezers.

J. Repair combustion air damper linkage and replace damper motors in the boiler room. The dampers do not open/shut down when the boilers go online/offline.

K. Correct refrigerant charge on air conditioners and heat pumps can improve unit efficiency by up to 10%.

L. Night covers on refrigerated cases to reduce infiltration into the cases during unoccupied hours.

M. Confirm that outside air economizers on the air handling units and rooftops are functioning properly to take advantage of free cooling.

N. Various water conservation measures can be found in Appendix I.

O. Consider installing on/off controls (time clock and switching) of the kitchen hood equipment (exhaust fans and make-up air unit) that will limit operation of the equipment to occupied times of the school day. In addition, heat sensors should be installed within the hood to override the system operation in accordance with the latest codes.

Electric Cost Summary

Middle School

2006

Account # ……
Meter # …..

Month	Jan-06	Feb-06	Mar-06	Apr-06	May-06	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06	Dec-06	Total	
Billing Days	31	28	31	30	31	30	31	31	30	31	30	31	#REF!	
KWH										162052	155456	158976	476,484	
KW										456	485	485	485	Max
Monthly Load Factor										48%	45%	44%	45%	
Electric Delivery, $													$0	
Delivery $/kwh										$0.000	$0.000	$0.000	$0.000	
Electric Supply, $													$0	
Supply $/kwh										$0.000	$0.000	$0.000	$0.000	
Total Cost, $										$16,448	$15,116	$15,553	$47,116	
$/KWH										$0.1015	$0.0972	$0.0978	$0.0989	

Middle School

2007

Account # ……
Meter # …..

Month	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07	Total	
Billing Days	31	28	31	30	31	30	31	31	30	31	30	31	0	
KWH	174543	165405	164782	146825	157056	120341	90008	101235	133722	149611	142845	144253	1,690,626	
KW	499	531	531	459	518	518	496	515	560	560	467	480	560	Max
Monthly Load Factor	47%	46%	42%	44%	41%	32%	24%	26%	33%	36%	42%	40%	38%	
Electric Delivery, $													$0	
Delivery $/kwh	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	
Electric Supply, $													$0	
Supply $/kwh	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	
Total Cost, $	$17,268	$16,671	$16,889	$15,678	$18,127	$16,065	$13,704	$15,140	$18,173	$18,111	$16,288	$16,347	$198,462	
$/KWH	$0.0989	$0.1008	$0.1025	$0.1068	$0.1154	$0.1335	$0.1523	$0.1496	$0.1359	$0.1211	$0.1140	$0.1133	$0.1174	

Middle School

2008

Account # ……
Meter # …..

Month	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	Total	
Billing Days	31	28	31	30	31	30	31	31	30	31	30	31	0	
KWH	151083	149421	144929	127529	120414	90095	72796	75829	95453	119,714	133,313	131,159	1,411,735	
KW	483	483	477	475	475	432	382	408	435	470	478	478	483	Max
Monthly Load Factor	42%	46%	41%	37%	34%	29%	26%	25%	30%	34%	39%	37%	35%	
Electric Delivery, $													$0	
Delivery $/kwh	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	
Electric Supply, $													$0	
Supply $/kwh	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	
Total Cost, $	$17,398	$17,449	$16,767	$14,843	$15,477	$13,607	$12,490	$13,427	$15,364	$17,176	$17,747	$17,544	$189,288	
$/KWH	$0.1152	$0.1168	$0.1157	$0.1164	$0.1285	$0.1510	$0.1716	$0.1771	$0.1610	$0.1435	$0.1331	$0.1338	$0.1341	

**Numbers in yellow are estimated values.

Summary of Natural Gas Cost

2006

Middle School	Jan-06	Feb-06	Mar-06	Apr-06	May-06	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06	Dec-06	Total
Account# …..	31	28	31	30	31	30	31	31	30	31	30	31	
Meter# ……													
Meter 337507													
Total MCF													0
BTU Factor													0
Therms (Burner Tip)										11251	15106	22353	48,710
Total Distribution Cost													0
Cost per Therm										$0.000	$0.000	$0.000	$0.000
Total Commodity Cost													0
Cost per Therm										$0.00	$0.00	$0.00	$0.00
Total Cost										$20,289	$27,180	$38,125	$85,594
Cost per Therm										$1.80	$1.80	$1.71	$1.76

2007

Middle School	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07	Total
Account# …..	31	28	31	30	31	30	31	31	30	31	30	31	
Meter# ……													
Meter 337507													
Total MCF													0
BTU Factor													0
Therms (Burner Tip)	31049	31527	26691	13818	4205	373	308	325	467	5716	19983	27361	161,823
Total Distribution Cost													0
Cost per Therm	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
Total Commodity Cost													0
Cost per Therm	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total Cost	$51,930	$52,809	$42,556	$20,347	$6,266	$649	$554	$580	$788	$11,681	$34,856	$46,152	$269,168
Cost per Therm	$1.67	$1.68	$1.59	$1.47	$1.49	$1.74	$1.80	$1.78	$1.69	$2.04	$1.74	$1.69	$1.66

2008

Middle School	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	Total
Account# …..	31	28	31	30	31	30	31	31	30	31	30	31	
Meter# ……													
Meter 337507													
Total MCF													0
BTU Factor													0
Therms (Burner Tip)	29680	28332	24411	10688	1597	364	315	338	537	7,449	19,659	29,031	152,401
Total Distribution Cost													0
Cost per Therm	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000	$0.000
Total Commodity Cost													0
Cost per Therm	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total Cost	$50,126	$47,644	$38,480	$15,683	$2,443	$674	$615	$587	$791	$12,250	$29,912	$42,860	$242,063
Cost per Therm	$1.69	$1.68	$1.58	$1.47	$1.53	$1.85	$1.95	$1.74	$1.47	$1.64	$1.52	$1.48	$1.59

BUILDING EQUIPMENT LIST

CONCORD ENGINEERING SERVICES

Bridgewater-Raritan Middle School

Boilers

Location	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Output (MBh)	EWT (degrees F)	LWT (degrees F)	Vintage	Efficiency (%)	Fuel	Notes
Boiler Room	Cleaver Brooks	3	CB900X - 200HP	-	8360	6695	150	180-185	1966	80%	Nat. Gas	Each boiler has 1/3HP circulator pump. Stack temp 202 F. Burner Eff 82-83% on high fire and 85-86% on low fire.

Boiler - Pumps

Location	Manufacturer	Qty.	Model #	Serial #	GPM	Ft. Hd	HP	RPM	Vintage	Frame Size	Volts	Amps	Phase	Notes
Boiler Room	Leland Fareday	2	LFI - 84250C				25		Motors - 2002		208-230/460	60/30		
	B & G		185014											Discharge - 40 PSI / Suction - 7PSI

Domestic Hot Water Heater

Location	Manufacturer	Qty.	Model #	Serial #	Input (Btu/h)	Recovery (gal/h)	Capacity (gal)	Efficiency (%)	Vintage	Volts	Amps	Phase
Boiler Room	AO Smith	1	BT 80 230	MD99-0828902-230	75000	68.3	74.5		1999			
Boiler Room	AO Smith	1	BT 100 112	B07M001485	75100	72.82	98		2007			

Air Handling Units

Location	Manufacturer	Qty.	Model #	Serial #	Vintage	Cooling Coil	Heating Coil	Input (MBh)	Fan HP	Fan RPM	Volts	Phase	Amps	Notes
Café B - Roof	Unknown	1	HO11 L PHVFYA	49128 2 - 09	1966									Broken Louver Linkage
Café B - Roof	Carrier	1	50DA5004744A		1966						208	3	60	
Café B - Roof		1	H11 L PHVFYA	491282 - 08	1966									Broken Louver Linkage
Library Roof	Task	6	TSU023 - 053	TSU024 - 054										All Disconnects in off position during survey.
N Wing Roof	AAON	1	RK-10-3-EO-227	98lkG-J-1867	1998	10 Ton - DX	Nat. Gas	270						Energy Recovery Wheel - Dirty
N Wing Roof	AAON	1	RK-08-3-EO-227	98LKCH584	1998	8 Ton - DX	Nat. Gas							Energy Recovery Wheel - Dirty
N Wing Roof	AAON	1	RK-10-3-EO-227		1998	10 Ton - DX	Nat. Gas	270						Energy Recovery Wheel - Dirty
N Wing Roof	AAON	1	RK-10-3-EO-227		1998	10 Ton - DX	Nat. Gas	270						Energy Recovery Wheel - Dirty
Auditorium	Herman Nelson	2	8570LYS	444295-07						1030				

Exhaust Fans

Location	Manufacturer	Qty.	Model #	Serial #	Fan HP	Fan RPM	Volts	Phase	Amps	Vintage	Notes
Auditorium Roof		4			1		208	3	1.9	1972	
Kitchen Roof		2	484BCRF				208	3	9.3	1966	Running Constantly

Split Systems and AC Condensers

Location	Manufacturer	Qty.	Model #	Serial #	Vintage	Cooling Capacity	Eff.	Refrigerant	Volts	Phase	Amps
Main Guidance Office	Rheem	1	RAC23A			2 Ton	4 Seer		208	1	
Library Roof	Trane	1	TTA120B300EA		2006	10 Ton					

Air Compressor

Location	Manufacturer	Qty.	Model #	Serial #	HP	Pressure	Capacity	Volts	Phase	FLA	Notes
Boiler Room		1			2 - 5HP Motors	60 psi					Two stage compressor

Heating and Ventilation Units

Location	Manufacturer	Qty.	Model #	Serial #	Vintage	Heating Coil	Capacity (Btu/h)	Fan HP	Fan RPM	Volts	Phase	Amps	Notes
Classrooms	Trane			W98G35306		Hot Water							Electric Controls
Classrooms	Herman Nelson AFF		OWAGJXG5061		1966								

Instant Hot Water Heater

Location	Manufacturer	Qty.	Model #	Serial #	Input (W)	Recovery (gal/h)	Capacity (gal)	Efficiency (%)	Vintage	Volts	Amps	Phase
Kitchen	Hobert	1	AM14T	23-1074-761						208	60	3

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENGINEERING GROUP

CEG Job #: 9C08140
Project: Bridgewater-Raritan School District - Middle School
Address: Merriwood Rd., Bridgewater, NJ 08807
City: Bridgewater-Raritan
Building SF: 240120 3 - Story Middle School

DATE: 03/27/2009
KWH COST: **$0.134**

EXISTING LIGHTING										PROPOSED LIGHTING								SAVINGS			
Line No.		Fixture Location	No. eFixts	Fixture eType	Yearly Usage	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. rFixts	Retro-Unit rDescription	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
1		Gym	45	High-bay HID Metal Halide	4700	475	21.38	100463	$13,461.98	45	T-5 High Output High-bay lighting	296	13.32	62604	$8,388.94	$650.00	$29,250.00	8.06	37858.5	$5,073.04	5.8
2		Aux - Gym	18	High-bay HID Metal Halide	4700	475	8.55	40185	$5,384.79	18	T-5 High Output High-bay lighting	296	5.33	25041.6	$3,355.57	$650.00	$11,700.00	3.22	15143.4	$2,029.22	5.8
3		Girl's Locker room	30	Down Light, Recessed Can, Compact FL, 2 Lamp	2100	26	0.78	1638	$219.49	30	No Change Required (NCR)	26	0.78	1638	$219.49	$0.00	$0.00	0.00	0	$0.00	0.0
4		Boy's Locker Room	30	Down Light, Recessed Can, Compact FL, 2 Lamp	2100	26	0.78	1638	$219.49	30	NCR	26	0.78	1638	$219.49	$0.00	$0.00	0.00	0	$0.00	0.0
5		Team Rooms	72	Down Light, Recessed Can, Compact FL, 2 Lamp	2100	26	1.87	3931.2	$526.78	72	NCR	26	1.87	3931.2	$526.78	$0.00	$0.00	0.00	0	$0.00	0.0
6			8	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	0.51	1075.2	$144.08	8	NCR	64	0.51	1075.2	$144.08	$0.00	$0.00	0.00	0	$0.00	0.0
7			2	4', T8 1 lamp, No lens, Electronic ballast	2100	32	0.06	134.4	$18.01	2	NCR	32	0.06	134.4	$18.01	$0.00	$0.00	0.00	0	$0.00	0.0
8		Main Guidance Office	10	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	0.64	1344	$180.10	10	NCR	64	0.64	1344	$180.10	$0.00	$0.00	0.00	0	$0.00	0.0
9			2	4', T8 1 lamp, No lens, Electronic ballast	2100	32	0.06	134.4	$18.01	2	NCR	32	0.06	134.4	$18.01	$0.00	$0.00	0.00	0	$0.00	0.0
10		Library	49	2'x4', T8, 4 Lamp, Electronic ballast, prism Reflector	2100	68	3.33	6997.2	$937.62	49	NCR	68	3.33	6997.2	$937.62	$0.00	$0.00	0.00	0	$0.00	0.0
11			36	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	2.30	4838.4	$648.35	36	NCR	64	2.30	4838.4	$648.35	$0.00	$0.00	0.00	0	$0.00	0.0

12		Library - Office	9	2'x4', T8, 4 Lamp, Electronic ballast, prism Reflector	2100	68	0.61	1285.2	$172.22	9	NCR	68	0.61	1285.2	$172.22	$1.99	$17.91	0.00	0	$0.00	0.0
13		Library - Office	16	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	1.02	2150.4	$288.15	16	NCR	64	1.02	2150.4	$288.15	$0.00	$0.00	0.00	0	$0.00	0.0
14		Library - Office	12	4', T8 1 lamp, No lens, Electronic ballast	2100	32	0.38	806.4	$108.06	12	NCR	32	0.38	806.4	$108.06	$0.00	$0.00	0.00	0	$0.00	0.0
15		Library - Office	4	2'x2', T8, 3 lamp, Electronic ballast	2100	51	0.20	428.4	$57.41	4	NCR	51	0.20	428.4	$57.41	$0.00	$0.00	0.00	0	$0.00	0.0
16		Health Office	11	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	0.70	1478.4	$198.11	11	NCR	64	0.70	1478.4	$198.11	$0.00	$0.00	0.00	0	$0.00	0.0
17		Main Office	30	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	3000	64	1.92	5760	$771.84	30	NCR	64	1.92	5760	$771.84	$0.00	$0.00	0.00	0	$0.00	0.0
18		Office Rest Rooms Adjacent to Health Office	12	4', T8 1 lamp, No lens, Electronic ballast	2100	32	0.38	806.4	$108.06	12	NCR	32	0.38	806.4	$108.06	$0.00	$0.00	0.00	0	$0.00	0.0
19		Cafeteria - A	48	2'x4' T-8, 3-lamp, no reflector, electronic ballast	2100	96	4.61	9676.8	$1,296.69	48	NCR	96	4.61	9676.8	$1,296.69	$0.00	$0.00	0.00	0	$0.00	0.0
20		Cafeteria - B	32	2'x4' T-8, 3-lamp, no reflector, electronic ballast	2100	96	3.07	6451.2	$864.46	32	NCR	96	3.07	6451.2	$864.46	$0.00	$0.00	0.00	0	$0.00	0.0
21		Kitchen	2	4', T8 1 lamp, No lens, Electronic ballast	2100	32	0.06	134.4	$18.01	2	NCR	32	0.06	134.4	$18.01	$0.00	$0.00	0.00	0	$0.00	0.0
22		Kitchen	20	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	1.28	2688	$360.19	20	NCR	64	1.28	2688	$360.19	$0.00	$0.00	0.00	0	$0.00	0.0
23		Auditorium	54	Recessed Can - Incandescent bulbs	2100	100	5.40	11340	$1,519.56	54	NCR	100	5.40	11340	$1,519.56	$0.00	$0.00	0.00	0	$0.00	0.0
24		Auditorium	20	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.28	2688	$360.19	20	NCR	64	1.28	2688	$360.19	$0.00	$0.00	0.00	0	$0.00	0.0
25		Boiler Room	10	4' T-8, 2-lamp, no reflector, electronic ballast	1000	64	0.64	640	$85.76	10	NCR	64	0.64	640	$85.76	$0.00	$0.00	0.00	0	$0.00	0.0
26		Wellness Center - A1&A2	42	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	2.69	5644.8	$756.40	42	NCR	64	2.69	5644.8	$756.40	$0.00	$0.00	0.00	0	$0.00	0.0
27		A-3	4	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.26	537.6	$72.04	4	NCR	64	0.26	537.6	$72.04	$0.00	$0.00	0.00	0	$0.00	0.0
28		A-4	10	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	0.64	1344	$180.10	10	NCR	64	0.64	1344	$180.10	$0.00	$0.00	0.00	0	$0.00	0.0
29		A-4	2	2'x2', T8, 3 lamp, Electronic ballast	2100	51	0.10	214.2	$28.70	2	NCR	51	0.10	214.2	$28.70	$0.00	$0.00	0.00	0	$0.00	0.0

30		A-5	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
31		A-6	12	2'x4' T-8, 3-lamp, prismatic reflector, electronic ballast	2100	96	1.15	2419.2	$324.17	12	NCR	96	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
32		A - Storage	10	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	0.64	1344	$180.10	10	NCR	64	0.64	1344	$180.10	$0.00	$0.00	0.00	0	$0.00	0.0
33		A-18	36	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	2.30	4838.4	$648.35	36	NCR	64	2.30	4838.4	$648.35	$0.00	$0.00	0.00	0	$0.00	0.0
34		A-19	15	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	0.96	2016	$270.14	15	NCR	64	0.96	2016	$270.14	$1.99	$29.85	0.00	0	$0.00	0.0
35		A-20	6	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	0.38	806.4	$108.06	6	NCR	64	0.38	806.4	$108.06	$0.00	$0.00	0.00	0	$0.00	0.0
36		A-21	33	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	2.11	4435.2	$594.32	33	NCR	64	2.11	4435.2	$594.32	$0.00	$0.00	0.00	0	$0.00	0.0
37		A-22	12	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	0.77	1612.8	$216.12	12	NCR	64	0.77	1612.8	$216.12	$0.00	$0.00	0.00	0	$0.00	0.0
38		A-23	5	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	0.32	672	$90.05	5	NCR	64	0.32	672	$90.05	$0.00	$0.00	0.00	0	$0.00	0.0
39		A-24	24	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.54	3225.6	$432.23	24	NCR	64	1.54	3225.6	$432.23	$0.00	$0.00	0.00	0	$0.00	0.0
40		A-25	24	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.54	3225.6	$432.23	24	NCR	64	1.54	3225.6	$432.23	$0.00	$0.00	0.00	0	$0.00	0.0
41		A-26	24	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.54	3225.6	$432.23	24	NCR	64	1.54	3225.6	$432.23	$0.00	$0.00	0.00	0	$0.00	0.0
42		AP Office	4	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	0.26	537.6	$72.04	4	NCR	64	0.26	537.6	$72.04	$0.00	$0.00	0.00	0	$0.00	0.0
43		A-30	24	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.54	3225.6	$432.23	24	NCR	64	1.54	3225.6	$432.23	$0.00	$0.00	0.00	0	$0.00	0.0
44		A-31	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
45		A-44	24	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	1.54	3225.6	$432.23	24	NCR	64	1.54	3225.6	$432.23	$0.00	$0.00	0.00	0	$0.00	0.0
46		A-45	30	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	1.92	4032	$540.29	30	NCR	64	1.92	4032	$540.29	$0.00	$0.00	0.00	0	$0.00	0.0
47		A-46	12	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	0.77	1612.8	$216.12	12	NCR	64	0.77	1612.8	$216.12	$0.00	$0.00	0.00	0	$0.00	0.0

48			2	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.13	268.8	$36.02	2	NCR	64	0.13	268.8	$36.02	$0.00	$0.00	0.00	0	$0.00	0.0
49		A-47	7	2'x4' T-8, 3-lamp, no reflector, electronic ballast	2100	96	0.67	1411.2	$189.10	7	NCR	96	0.67	1411.2	$189.10	$0.00	$0.00	0.00	0	$0.00	0.0
50		A-48	13	2'x4' T-8, 3-lamp, no reflector, electronic ballast	2100	96	1.25	2620.8	$351.19	13	NCR	96	1.25	2620.8	$351.19	$0.00	$0.00	0.00	0	$0.00	0.0
51		A-49	24	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.54	3225.6	$432.23	24	NCR	64	1.54	3225.6	$432.23	$0.00	$0.00	0.00	0	$0.00	0.0
52		A-60	20	2'x4' T-8, 3-lamp, no reflector, electronic ballast	2100	96	1.92	4032	$540.29	20	NCR	96	1.92	4032	$540.29	$0.00	$0.00	0.00	0	$0.00	0.0
53		A-61	12	2'x4' T-8, 3-lamp, no reflector, electronic ballast	2100	96	1.15	2419.2	$324.17	12	NCR	96	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
54		A-62	12	2'x4' T-8, 3-lamp, no reflector, electronic ballast	2100	96	1.15	2419.2	$324.17	12	NCR	96	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
55		A Wing Front Side Restrooms - Men's and Women's	4	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.26	537.6	$72.04	4	NCR	64	0.26	537.6	$72.04	$1.99	$7.96	0.00	0	$0.00	0.0
56		A wing Men's Room	6	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.38	806.4	$108.06	6	NCR	64	0.38	806.4	$108.06	$0.00	$0.00	0.00	0	$0.00	0.0
57		A Wing Women's Room	6	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.38	806.4	$108.06	6	NCR	64	0.38	806.4	$108.06	$0.00	$0.00	0.00	0	$0.00	0.0
58		B-1	24	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.54	3225.6	$432.23	24	NCR	64	1.54	3225.6	$432.23	$0.00	$0.00	0.00	0	$0.00	0.0
59		B-2	2	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.13	268.8	$36.02	2	NCR	64	0.13	268.8	$36.02	$0.00	$0.00	0.00	0	$0.00	0.0
60			7	4', T8 1 lamp, No lens, Electronic ballast	2100	32	0.22	470.4	$63.03	7	NCR	32	0.22	470.4	$63.03	$0.00	$0.00	0.00	0	$0.00	1.0
61		B-3	24	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.54	3225.6	$432.23	24	NCR	64	1.54	3225.6	$432.23	$0.00	$0.00	0.00	0	$0.00	0.0
62		B-4	5	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.32	672	$90.05	5	NCR	64	0.32	672	$90.05	$0.00	$0.00	0.00	0	$0.00	0.0
63		B-5	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
64		B-6	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
65		B-7	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0

66		B-8	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
67		B-9	15	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.96	2016	$270.14	15	NCR	64	0.96	2016	$270.14	$0.00	$0.00	0.00	0	$0.00	0.0
68		B-10	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
69		B-11	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
70		B-12	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
71		B-13	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
72		B-14	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
73		B-15	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
74		B wing Men's Room - 1st Floor	7	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.45	940.8	$126.07	7	NCR	64	0.45	940.8	$126.07	$0.00	$0.00	0.00	0	$0.00	0.0
75		B Wing Women's Room - 1st Floor	7	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.45	940.8	$126.07	7	NCR	64	0.45	940.8	$126.07	$0.00	$0.00	0.00	0	$0.00	0.0
76		B-21	27	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.73	3628.8	$486.26	27	NCR	64	1.73	3628.8	$486.26	$0.00	$0.00	0.00	0	$0.00	0.0
77		B-22 - Chem. storage	4	4', T8 1 lamp, No lens, Electronic ballast	100	32	0.13	12.8	$1.72	4	NCR	32	0.13	12.8	$1.72	$0.00	$0.00	0.00	0	$0.00	0.0
78		B-23	9	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.58	1209.6	$162.09	9	NCR	64	0.58	1209.6	$162.09	$0.00	$0.00	0.00	0	$0.00	0.0
79		B-24	9	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.58	1209.6	$162.09	9	NCR	64	0.58	1209.6	$162.09	$0.00	$0.00	0.00	0	$0.00	0.0
80		B-25 - Storage	3	4', T8, 2-lamp electronic ballast with prism reflector	100	64	0.19	19.2	$2.57	3	NCR	64	0.19	19.2	$2.57	$0.00	$0.00	0.00	0	$0.00	0.0
81		B-26	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
82		B-27	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
83		B-28	12	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.77	1612.8	$216.12	12	NCR	64	0.77	1612.8	$216.12	$0.00	$0.00	0.00	0	$0.00	0.0

84		B-29	15	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.96	2016	$270.14	15	NCR	64	0.96	2016	$270.14	$0.00	$0.00	0.00	0	$0.00	0.0
85		B-30	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
86		B-31	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
87		B-32	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
88		B-33	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
89		B-34	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
90		B-35	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
91		B wing Men's Room - 2nd Floor	7	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.45	940.8	$126.07	7	NCR	64	0.45	940.8	$126.07	$0.00	$0.00	0.00	0	$0.00	0.0
92		B Wing Women's Room - 2nd Floor	7	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.45	940.8	$126.07	7	NCR	64	0.45	940.8	$126.07	$0.00	$0.00	0.00	0	$0.00	0.0
93		B wing - Stairs	2	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	0.13	268.8	$36.02	2	NCR	64	0.13	268.8	$36.02	$0.00	$0.00	0.00	0	$0.00	0.0
94			2	2'x2', T8, 2-lamp, prism reflector, electronic ballast, Below ceiling mount	2100	34	0.07	142.8	$19.14	2	NCR	34	0.07	142.8	$19.14	$0.00	$0.00	0.00	0	$0.00	0.0
95		C-1	24	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.54	3225.6	$432.23	24	NCR	64	1.54	3225.6	$432.23	$0.00	$0.00	0.00	0	$0.00	0.0
96		C-2	2	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.13	268.8	$36.02	2	NCR	64	0.13	268.8	$36.02	$0.00	$0.00	0.00	0	$0.00	0.0
97			7	4', T8 1 lamp, No lens, Electronic ballast	2100	32	0.22	470.4	$63.03	7	NCR	32	0.22	470.4	$63.03	$0.00	$0.00	0.00	0	$0.00	0.0
98		C-3	27	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.73	3628.8	$486.26	27	NCR	64	1.73	3628.8	$486.26	$0.00	$0.00	0.00	0	$0.00	0.0
99		C-4	27	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.73	3628.8	$486.26	27	NCR	64	1.73	3628.8	$486.26	$0.00	$0.00	0.00	0	$0.00	0.0
100		C-5	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
101		C-6	17	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.09	2284.8	$306.16	17	NCR	64	1.09	2284.8	$306.16	$0.00	$0.00	0.00	0	$0.00	0.0

102		C-7	21	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.34	2822.4	$378.20	21	NCR	64	1.34	2822.4	$378.20	$0.00	$0.00	0.00	0	$0.00	0.0
103		C-8	12	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.77	1612.8	$216.12	12	NCR	64	0.77	1612.8	$216.12	$0.00	$0.00	0.00	0	$0.00	0.0
104		C-9	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
105		C-10	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
106		C-11	8	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.51	1075.2	$144.08	8	NCR	64	0.51	1075.2	$144.08	$0.00	$0.00	0.00	0	$0.00	0.0
107		C-12 - Office	7	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	0.45	940.8	$126.07	7	NCR	64	0.45	940.8	$126.07	$0.00	$0.00	0.00	0	$0.00	0.0
108			3	4', T8 1 lamp, No lens, Electronic ballast	2100	32	0.10	201.6	$27.01	3	NCR	32	0.10	201.6	$27.01	$0.00	$0.00	0.00	0	$0.00	0.0
109		C-13 - Office	5	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	0.32	672	$90.05	5	NCR	64	0.32	672	$90.05	$0.00	$0.00	0.00	0	$0.00	0.0
110		C wing Men's Room - 1st Floor	7	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.45	940.8	$126.07	7	NCR	64	0.45	940.8	$126.07	$0.00	$0.00	0.00	0	$0.00	0.0
111		C Wing Women's Room - 1st Floor	7	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.45	940.8	$126.07	7	NCR	64	0.45	940.8	$126.07	$0.00	$0.00	0.00	0	$0.00	0.0
112		C-21	24	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.54	3225.6	$432.23	24	NCR	64	1.54	3225.6	$432.23	$0.00	$0.00	0.00	0	$0.00	0.0
113		C-22	4	4', T8 1 lamp, No lens, Electronic ballast	2100	32	0.13	268.8	$36.02	4	NCR	32	0.13	268.8	$36.02	$0.00	$0.00	0.00	0	$0.00	0.0
114		C-23	24	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.54	3225.6	$432.23	24	NCR	64	1.54	3225.6	$432.23	$0.00	$0.00	0.00	0	$0.00	0.0
115		C-24	24	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.54	3225.6	$432.23	24	NCR	64	1.54	3225.6	$432.23	$0.00	$0.00	0.00	0	$0.00	0.0
116		C-25	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
117		C-26	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
118		C-27	21	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.34	2822.4	$378.20	21	NCR	64	1.34	2822.4	$378.20	$0.00	$0.00	0.00	0	$0.00	0.0
119		C-28	12	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.77	1612.8	$216.12	12	NCR	64	0.77	1612.8	$216.12	$0.00	$0.00	0.00	0	$0.00	0.0

120		C-29	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
121		C-30	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
122		C-31	12	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.77	1612.8	$216.12	12	NCR	64	0.77	1612.8	$216.12	$0.00	$0.00	0.00	0	$0.00	0.0
123		C-32 - Office	7	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	0.45	940.8	$126.07	7	NCR	64	0.45	940.8	$126.07	$0.00	$0.00	0.00	0	$0.00	0.0
124			3	4', T8 1 lamp, No lens, Electronic ballast	2100	32	0.10	201.6	$27.01	3	NCR	32	0.10	201.6	$27.01	$0.00	$0.00	0.00	0	$0.00	0.0
125		C-33 - Office	5	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	0.32	672	$90.05	5	NCR	64	0.32	672	$90.05	$0.00	$0.00	0.00	0	$0.00	0.0
126		C wing Men's Room - 2nd Floor	7	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.45	940.8	$126.07	7	NCR	64	0.45	940.8	$126.07	$0.00	$0.00	0.00	0	$0.00	0.0
127		C Wing Women's Room - 2nd Floor	7	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.45	940.8	$126.07	7	NCR	64	0.45	940.8	$126.07	$0.00	$0.00	0.00	0	$0.00	0.0
128		C wing - Stairs	2	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	0.13	268.8	$36.02	2	NCR	64	0.13	268.8	$36.02	$0.00	$0.00	0.00	0	$0.00	0.0
129			2	2'x2', T8, 2-lamp, prism reflector, electronic ballast, Below ceiling mount	2100	34	0.07	142.8	$19.14	2	NCR	34	0.07	142.8	$19.14	$0.00	$0.00	0.00	0	$0.00	0.0
130		D-1 - Office	5	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	0.32	672	$90.05	5	NCR	64	0.32	672	$90.05	$0.00	$0.00	0.00	0	$0.00	0.0
131		D-2 - Office	7	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	0.45	940.8	$126.07	7	NCR	64	0.45	940.8	$126.07	$0.00	$0.00	0.00	0	$0.00	0.0
132			3	4', T8 1 lamp, No lens, Electronic ballast	2100	32	0.10	201.6	$27.01	3	NCR	32	0.10	201.6	$27.01	$0.00	$0.00	0.00	0	$0.00	0.0
133		D-3	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
134		D-4	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
135		D-5	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
136		D-6	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
137		D-7	24	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.54	3225.6	$432.23	24	NCR	64	1.54	3225.6	$432.23	$0.00	$0.00	0.00	0	$0.00	0.0

138		D-8	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
139		D-9	21	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.34	2822.4	$378.20	21	NCR	64	1.34	2822.4	$378.20	$0.00	$0.00	0.00	0	$0.00	0.0
140		D-10	16	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.02	2150.4	$288.15	16	NCR	64	1.02	2150.4	$288.15	$0.00	$0.00	0.00	0	$0.00	0.0
141		D-11	21	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.34	2822.4	$378.20	21	NCR	64	1.34	2822.4	$378.20	$0.00	$0.00	0.00	0	$0.00	0.0
142		D-12	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
143		D wing Men's Room - 1st Floor	7	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.45	940.8	$126.07	7	NCR	64	0.45	940.8	$126.07	$0.00	$0.00	0.00	0	$0.00	0.0
144		D Wing Women's Room - 1st Floor	7	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.45	940.8	$126.07	7	NCR	64	0.45	940.8	$126.07	$0.00	$0.00	0.00	0	$0.00	0.0
145		D-21 - Office	7	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	0.45	940.8	$126.07	7	NCR	64	0.45	940.8	$126.07	$0.00	$0.00	0.00	0	$0.00	0.0
146			3	4', T8 1 lamp, No lens, Electronic ballast	2100	32	0.10	201.6	$27.01	3	NCR	32	0.10	201.6	$27.01	$0.00	$0.00	0.00	0	$0.00	0.0
147		D-22 - Office	5	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	0.32	672	$90.05	5	NCR	64	0.32	672	$90.05	$0.00	$0.00	0.00	0	$0.00	0.0
148		D-23	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
149		D-24	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
150		D-25	21	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.34	2822.4	$378.20	21	NCR	64	1.34	2822.4	$378.20	$0.00	$0.00	0.00	0	$0.00	0.0
151		D-26	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
152		D-27	5	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	0.32	672	$90.05	5	NCR	64	0.32	672	$90.05	$0.00	$0.00	0.00	0	$0.00	0.0
153		D-28	18	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
154		D-29	12	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.77	1612.8	$216.12	12	NCR	64	0.77	1612.8	$216.12	$0.00	$0.00	0.00	0	$0.00	0.0
155		D-30	21	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.34	2822.4	$378.20	21	NCR	64	1.34	2822.4	$378.20	$0.00	$0.00	0.00	0	$0.00	0.0

156		D-31	24	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.54	3225.6	$432.23	24	NCR	64	1.54	3225.6	$432.23	$0.00	$0.00	0.00	0	$0.00	0.0
157		D-31A	4	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	0.26	537.6	$72.04	4	NCR	64	0.26	537.6	$72.04	$0.00	$0.00	0.00	0	$0.00	0.0
158		D-33	24	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	1.54	3225.6	$432.23	24	NCR	64	1.54	3225.6	$432.23	$0.00	$0.00	0.00	0	$0.00	0.0
159		D wing Men's Room - 2nd Floor	7	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.45	940.8	$126.07	7	NCR	64	0.45	940.8	$126.07	$0.00	$0.00	0.00	0	$0.00	0.0
160		D Wing Women's Room - 2nd Floor	7	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.45	940.8	$126.07	7	NCR	64	0.45	940.8	$126.07	$0.00	$0.00	0.00	0	$0.00	0.0
161		D wing - Stairs	2	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	0.13	268.8	$36.02	2	NCR	64	0.13	268.8	$36.02	$0.00	$0.00	0.00	0	$0.00	0.0
162			2	2'x2', T8, 2-lamp, prism reflector, electronic ballast, Below ceiling mount	2100	34	0.07	142.8	$19.14	2	NCR	34	0.07	142.8	$19.14	$0.00	$0.00	0.00	0	$0.00	0.0
163		E-1	12	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.77	1612.8	$216.12	12	NCR	64	0.77	1612.8	$216.12	$0.00	$0.00	0.00	0	$0.00	0.0
164		E-2	20	4', T8, 2-lamp electronic ballast with prism reflector	2100	64		2688	$360.19	20	NCR	64	1.28	2688	$360.19	$0.00	$0.00	-1.28	0	$0.00	0.0
165		E-2A	12	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	0.77	1612.8	$216.12	12	NCR	64	0.77	1612.8	$216.12	$0.00	$0.00	0.00	0	$0.00	0.0
166		E-6	36	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	2.30	4838.4	$648.35	36	NCR	64	2.30	4838.4	$648.35	$0.00	$0.00	0.00	0	$0.00	0.0
167		Band 1	43	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	2.75	5779.2	$774.41	43	NCR	64	2.75	5779.2	$774.41	$0.00	$0.00	0.00	0	$0.00	0.0
168		Band 2	16	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	1.02	2150.4	$288.15	16	NCR	64	1.02	2150.4	$288.15	$0.00	$0.00	0.00	0	$0.00	0.0
169			30	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	1.92	4032	$540.29	30	NCR	64	1.92	4032	$540.29	$0.00	$0.00	0.00	0	$0.00	0.0
170		Band Men's Room	2	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.13	268.8	$36.02	2	NCR	64	0.13	268.8	$36.02	$0.00	$0.00	0.00	0	$0.00	0.0
171		Band Women's Room	2	4', T8, 2-lamp electronic ballast with prism reflector	2100	64	0.13	268.8	$36.02	2	NCR	64	0.13	268.8	$36.02	$0.00	$0.00	0.00	0	$0.00	0.0
172		Corridor - Classroom Wings - 1st Floor	264	4', T8 1 lamp, No lens, Electronic ballast	2100	32	8.45	17740.8	$2,377.27	264	NCR	32	8.45	17740.8	$2,377.27	$0.00	$0.00	0.00	0	$0.00	0.0
173			18	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0

174			3	2'x2', T8, 3 lamp, Electronic ballast	2100	51	0.15	321.3	$43.05	3	NCR	51	0.15	321.3	$43.05	$0.00	$0.00	0.00	0	$0.00	0.0
175			264	4', T8 1 lamp, No lens, Electronic ballast	2100	32	8.45	17740.8	$2,377.27	264	NCR	32	8.45	17740.8	$2,377.27	$0.00	$0.00	0.00	0	$0.00	0.0
176		Corridor - Classroom Wings - 2nd Floor	18	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	1.15	2419.2	$324.17	18	NCR	64	1.15	2419.2	$324.17	$0.00	$0.00	0.00	0	$0.00	0.0
177			3	2'x2', T8, 3 lamp, Electronic ballast	2100	51	0.15	321.3	$43.05	3	NCR	51	0.15	321.3	$43.05	$0.00	$0.00	0.00	0	$0.00	0.0
178			30	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	1.92	4032	$540.29	30	NCR	64	1.92	4032	$540.29	$0.00	$0.00	0.00	0	$0.00	0.0
179		Corridor - Big Box Side	38	Down Light, Recessed Can, Compact FL, 2 Lamp	2100	26		2074.8	$278.02	38	NCR	26	0.99	2074.8	$278.02	$0.00	$0.00	-0.99	0	$0.00	0.0
180			74	2'x2', T8, 3 lamp, Electronic ballast	2100	51	3.77	7925.4	$1,062.00	74	NCR	51	3.77	7925.4	$1,062.00	$0.00	$0.00	0.00	0	$0.00	0.0
181		N-1	9	2'x4' T-8, 3-lamp, no reflector, electronic ballast	2100	96	0.86	1814.4	$243.13	9	NCR	96	0.86	1814.4	$243.13	$0.00	$0.00	0.00	0	$0.00	0.0
182		N-2	9	2'x4' T-8, 3-lamp, no reflector, electronic ballast	2100	96	0.86	1814.4	$243.13	9	NCR	96	0.86	1814.4	$243.13	$0.00	$0.00	0.00	0	$0.00	0.0
183		N-3	9	2'x4' T-8, 3-lamp, no reflector, electronic ballast	2100	96	0.86	1814.4	$243.13	9	NCR	96	0.86	1814.4	$243.13	$0.00	$0.00	0.00	0	$0.00	0.0
184		N-4	9	2'x4' T-8, 3-lamp, no reflector, electronic ballast	2100	96	0.86	1814.4	$243.13	9	NCR	96	0.86	1814.4	$243.13	$0.00	$0.00	0.00	0	$0.00	0.0
185		N-5	9	2'x4' T-8, 3-lamp, no reflector, electronic ballast	2100	96	0.86	1814.4	$243.13	9	NCR	96	0.86	1814.4	$243.13	$0.00	$0.00	0.00	0	$0.00	0.0
186		N-6	9	2'x4' T-8, 3-lamp, no reflector, electronic ballast	2100	96	0.86	1814.4	$243.13	9	NCR	96	0.86	1814.4	$243.13	$0.00	$0.00	0.00	0	$0.00	0.0
187		N-7	9	2'x4' T-8, 3-lamp, no reflector, electronic ballast	2100	96	0.86	1814.4	$243.13	9	NCR	96	0.86	1814.4	$243.13	$0.00	$0.00	0.00	0	$0.00	0.0
188		N wing Men's Room - 1st Floor	4	2'x4' T-8, 3-lamp, no reflector, electronic ballast	2100	96	0.38	806.4	$108.06	4	NCR	96	0.38	806.4	$108.06	$0.00	$0.00	0.00	0	$0.00	0.0
189		N Wing Custodial - 1st Floor	2	2'x4' T-8, 3-lamp, no reflector, electronic ballast	100	96	0.19	19.2	$2.57	2	NCR	96	0.19	19.2	$2.57	$0.00	$0.00	0.00	0	$0.00	0.0
190		N wing - Stairs	4	2'x4' T-8, 2-lamp, prism reflector, electronic ballast	2100	64	0.26	537.6	$72.04	4	NCR	64	0.26	537.6	$72.04	$0.00	$0.00	0.00	0	$0.00	0.0
191			4	2'x2', T8, 2-lamp, prism reflector, electronic ballast, Below ceiling mount	2100	34	0.14	285.6	$38.27	4	NCR	34	0.14	285.6	$38.27	$0.00	$0.00	0.00	0	$0.00	0.0

192		N-21	9	2'x4' T-8, 3-lamp, no reflector, electronic ballast	2100	96	0.86	1814.4	$243.13	9	NCR	96	0.86	1814.4	$243.13	$0.00	$0.00	0.00	0	$0.00	0.0
193		N-22	9	2'x4' T-8, 3-lamp, no reflector, electronic ballast	2100	96	0.86	1814.4	$243.13	9	NCR	96	0.86	1814.4	$243.13	$0.00	$0.00	0.00	0	$0.00	0.0
194		N-23	9	2'x4' T-8, 3-lamp, no reflector, electronic ballast	2100	96	0.86	1814.4	$243.13	9	NCR	96	0.86	1814.4	$243.13	$0.00	$0.00	0.00	0	$0.00	0.0
195		N-24	9	2'x4' T-8, 3-lamp, no reflector, electronic ballast	2100	96	0.86	1814.4	$243.13	9	NCR	96	0.86	1814.4	$243.13	$0.00	$0.00	0.00	0	$0.00	0.0
196		N-25	9	2'x4' T-8, 3-lamp, no reflector, electronic ballast	2100	96	0.86	1814.4	$243.13	9	NCR	96	0.86	1814.4	$243.13	$0.00	$0.00	0.00	0	$0.00	0.0
197		N-26	9	2'x4' T-8, 3-lamp, no reflector, electronic ballast	2100	96	0.86	1814.4	$243.13	9	NCR	96	0.86	1814.4	$243.13	$0.00	$0.00	0.00	0	$0.00	0.0
198		N-27	9	2'x4' T-8, 3-lamp, no reflector, electronic ballast	2100	96	0.86	1814.4	$243.13	9	NCR	96	0.86	1814.4	$243.13	$0.00	$0.00	0.00	0	$0.00	0.0
199		N-28	9	2'x4' T-8, 3-lamp, no reflector, electronic ballast	2100	96	0.86	1814.4	$243.13	9	NCR	96	0.86	1814.4	$243.13	$0.00	$0.00	0.00	0	$0.00	0.0
200		N-29	9	2'x4' T-8, 3-lamp, no reflector, electronic ballast	2100	96	0.86	1814.4	$243.13	9	NCR	96	0.86	1814.4	$243.13	$0.00	$0.00	0.00	0	$0.00	0.0
201		N wing Women's Room - 2nd Floor	4	2'x4' T-8, 3-lamp, no reflector, electronic ballast	2100	96	0.38	806.4	$108.06	4	NCR	96	0.38	806.4	$108.06	$0.00	$0.00	0.00	0	$0.00	0.0
202		N Wing Custodial - 2nd Floor	2	2'x4' T-8, 3-lamp, no reflector, electronic ballast	100	96	0.19	19.2	$2.57	2	NCR	96	0.19	19.2	$2.57	$0.00	$0.00	0.00	0	$0.00	0.0
		Totals	3527				234.69	575035	$77,054.68	3527			225.68	522033	$69,952.42		$41,005.72	9.01	53001.9	$7,102.25	5.8

STATEMENT OF ENERGY PERFORMANCE
Bridgewater-Raritan Middle School

Building ID: 1372761
For 12-month Period Ending: December 31, 2008[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: April 21, 2009

Facility
Bridgewater-Raritan Middle School
Merriwood Drive
Bridewater, NJ 08807

Facility Owner
Bridgewater-Raritan Regional School District
826 Newmans Lane
Bridgewater, NJ 08807

Primary Contact for this Facility
Connie Coriell
826 Newmans Lane
Bridgewater, NJ 08807

Year Built: 1966
Gross Floor Area (ft²): 240,120

Energy Performance Rating[2] (1-100) 45

Site Energy Use Summary[3]

Electricity (kBtu)	4,816,840
Natural Gas (kBtu)[4]	15,240,100
Total Energy (kBtu)	20,056,940

Energy Intensity[5]

Site (kBtu/ft²/yr)	84
Source (kBtu/ft²/yr)	133

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	1,544

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

National Average Comparison

National Average Site EUI	80
National Average Source EUI	128
% Difference from National Average Source EUI	4%
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
Raymond Johnson
520 South Burnt Mill Rd.
Voorhees, NJ 08043

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.

ENERGY STAR® Data Checklist for Commercial Buildings

In order for a building to qualify for the ENERGY STAR, a Professional Engineer (PE) must validate the accuracy of the data underlying the building's energy performance rating. This checklist is designed to provide an at-a-glance summary of a property's physical and operating characteristics, as well as its total energy consumption, to assist the PE in double-checking the information that the building owner or operator has entered into Portfolio Manager.

Please complete and sign this checklist and include it with the stamped, signed Statement of Energy Performance.
NOTE: You must check each box to indicate that each value is correct, OR include a note.

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Building Name	Bridgewater-Raritan Middle School	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	K-12 School	Is this an accurate description of the space in question?		☐
Location	Merriwood Drive, Bridewater, NJ 08807	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of acute care or children's hospitals) nor can they be submitted as representing only a portion of a building		☐

Bridgewater-Raritan Middle School (K-12 School)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Gross Floor Area	240,120 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Open Weekends?	Yes	Is this building normally open at all on the weekends? This includes activities beyond the work conducted by maintenance, cleaning, and security personnel. Weekend activity could include any time when the space is used for classes, performances or other school or community activities. If the building is open on the weekend as part of the standard schedule during one or more seasons, the building should select ?yes? for open weekends. The ?yes? response should apply whether the building is open for one or both of the weekend days.		☐
Number of PCs	685	Is this the number of personal computers in the K12 School?		☐
Number of walk-in refrigeration/freezer units	3	Is this the total number of commercial walk-in type freezers and coolers? These units are typically found in storage and receiving areas.		☐
Presence of cooking facilities	Yes	Does this school have a dedicated space in which food is prepared and served to students? If the school has space in which food for students is only kept warm and/or served to students, or has only a galley that is used by teachers and staff then the answer is "no".		☐
Percent Cooled	30 %	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	100 %	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐

Months	12 (Optional)	Is this school in operation for at least 8 months of the year?		☐
High School?	No	Is this building a high school (teaching grades 10, 11, and/or 12)? If the building teaches to high school students at all, the user should check 'yes' to 'high school'. For example, if the school teaches to grades K-12 (elementary/middle and high school), the user should check 'yes' to 'high school'.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: PSE&G - Public Service Elec & Gas Co

Fuel Type: Electricity		
Meter: Electricity (kWh) **Space(s):** Entire Facility		
Start Date	**End Date**	**Energy Use (kWh)**
12/01/2008	12/31/2008	131,159.00
11/01/2008	11/30/2008	133,313.00
10/01/2008	10/31/2008	119,714.00
09/01/2008	09/30/2008	95,453.00
08/01/2008	08/31/2008	75,829.00
07/01/2008	07/31/2008	72,796.00
06/01/2008	06/30/2008	90,095.00
05/01/2008	05/31/2008	120,414.00
04/01/2008	04/30/2008	127,529.00
03/01/2008	03/31/2008	144,929.00
02/01/2008	02/29/2008	149,421.00
01/01/2008	01/31/2008	151,083.00
Electricity Consumption (kWh)		**1,411,735.00**
Electricity Consumption (kBtu)		**4,816,839.82**
Total Electricity Consumption (kBtu)		**4,816,839.82**
Is this the total Electricity consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas		
Meter: Natural Gas (therms) **Space(s):** Entire Facility		
Start Date	**End Date**	**Energy Use (therms)**
12/01/2008	12/31/2008	29,031.00
11/01/2008	11/30/2008	19,659.00
10/01/2008	10/31/2008	7,449.00
09/01/2008	09/30/2008	537.00
08/01/2008	08/31/2008	338.00
07/01/2008	07/31/2008	315.00
06/01/2008	06/30/2008	364.00
05/01/2008	05/31/2008	1,597.00
04/01/2008	04/30/2008	10,688.00

03/01/2008	03/31/2008	24,411.00
02/01/2008	02/29/2008	28,332.00
01/01/2008	01/31/2008	29,680.00
Natural Gas Consumption (therms)		**152,401.00**
Natural Gas Consumption (kBtu)		**15,240,100.00**
Total Natural Gas Consumption (kBtu)		**15,240,100.00**
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

Additional Fuels	
Do the fuel consumption totals shown above represent the total energy use of this building? Please confirm there are no additional fuels (district energy, generator fuel oil) used in this facility.	☐

Certifying Professional

(When applying for the ENERGY STAR, this must be the same PE that signed and stamped the SEP.)

Name: ____ Date: ____________

Signature: _____________________________________

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

Please keep this Facility Summary for your own records; do not submit it to EPA. Only the Statement of Energy Performance (SEP), Data Checklist and Letter of Agreement need to be submitted to EPA when applying for the ENERGY STAR.

Facility
Bridgewater-Raritan Middle School
Merriwood Drive
Bridewater, NJ 08807

Facility Owner
Bridgewater-Raritan Regional School District
826 Newmans Lane
Bridgewater, NJ 08807

Primary Contact for this Facility
Connie Coriell
826 Newmans Lane
Bridgewater, NJ 08807

General Information

Bridgewater-Raritan Middle School	
Gross Floor Area Excluding Parking: (ft^2)	240,120
Year Built	1966
For 12-month Evaluation Period Ending Date:	December 31, 2008

Facility Space Use Summary

Bridgewater-Raritan Middle School	
Space Type	K-12 School
Gross Floor Area(ft^2)	240,120
Open Weekends?	Yes
Number of PCs	685
Number of walk-in refrigeration/freezer units	3
Presence of cooking facilities	Yes
Percent Cooled	30
Percent Heated	100
Months[o]	12
High School?	No
School District[o]	N/A

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 12/31/2008)	**Baseline** (Ending Date 09/30/2007)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	45	31	75	N/A	50
Energy Intensity					
Site (kBtu/ft^2)	84	90	63	N/A	80
Source (kBtu/ft^2)	133	151	100	N/A	128
Energy Cost					
$/year	$ 431,351.31	$ 456,905.35	$ 323,423.11	N/A	$ 413,587.05
$/ft^2/year	$ 1.80	$ 1.90	$ 1.35	N/A	$ 1.73
Greenhouse Gas Emissions					
$MtCO_2e$/year	1,544	1,737	1,158	N/A	1,480
$kgCO_2e/ft^2$/year	6	7	5	N/A	6

More than 50% of your building is defined as K-12 School. Please note that your rating accounts for all of the spaces listed. The National Average column presents energy performance data your building would have if your building had an average rating of 50.

Notes:
o - This attribute is optional.
d - A default value has been supplied by Portfolio Manager.

MELINK CORPORATION

INTELLI-HOOD VARIABLE EXHAUST CONTROLLER

ENERGY SAVINGS REPORT

COMPANY:	Concord Engineering Group	RETROFIT
ADDRESS:	520 South Burnt Mill Rd.	
	Voorhees, NJ 08043	5.5.2009
APPLICATION:	Variable Speed Kitchen Exhaust	

- MOTOR OPERATING SAVINGS:		$1,982	/YEAR
- HEATING SAVINGS:		$9,919	/YEAR
- COOLING SAVINGS:		$1,247	/YEAR
- TOTAL SAVINGS:		$13,148	/YEAR
- INSTALLED COST:		$31,044	
- PAYBACK PERIOD:		2.4	YEARS
- RATE OF RETURN -	5 YEARS:	22.5	%
	10 YEARS:	33.4	%

The projected savings shown above are based on the above facility's operating hours, HVAC system, cooking load, and geographic location.

I. MOTOR OPERATING SAVINGS

INPUT DATA:

A Operating Hours Per Day	20	HRS/DAY
B Operating Days Per Week	5	DAYS/WK
C Operating Weeks Per Year	44	WKS/YR
D Horsepower of Fan Motor(s)	6	HP
E Load Factor of Fan Motor(s)	0.88	
F Cost Per Kilowatt Hour	0.1341	$/KWHR

CONSTANT EXHAUST VOLUME ANALYSIS:

G Total Time (A x B x C)	4400	HRS/YR
H Total KWHR/HP/YR (0.746/0.9 x G)	3647.1	KWHR/HP/YR

VARIABLE EXHAUST VOLUME ANALYSIS:

% Rated RPM H	% Run Time I	Time HRS/YR J=FxI	Output KW/HP K	System Effic. L	Input KW/HP M=K/L	KWHR/ HP/YR N=JxM
100	12.5	550	0.746	0.9	0.829	455.9
90	0	0	0.544	0.9	0.604	0.0
80	12.5	550	0.382	0.9	0.424	233.4
70	8.33333333	366.66667	0.256	0.9	0.284	104.3
60	4.16666667	183.33333	0.161	0.9	0.179	32.8
50	0	0	0.093	0.9	0.103	0.0
40	4.16666667	183.33333	0.048	0.9	0.053	9.8
30	12.5	550	0.020	0.9	0.022	12.2
20	0	0	0.015	0.9	0.017	0.0
10	0	0	0.010	0.90	0.011	0.0

O Total KWH/HP/YR (Total of Column N) 848.4

CALCULATION:

SAVINGS = (H - O) x D x E x F = $1,982 /YEAR
============

II. CONDITIONED MAKE-UP AIR - HEATING

INPUT DATA:

A	Previous Net Exhaust Volume	20000	CFM
B	New Net Exhaust Volume (1)	7250	CFM
C	Winter Building Temperature	68	F
D	Previous Net Heat Load (2)	1040503	kBTU
E	New Net Heat Load (2)	377182	kBTU
F	Operating Hours Per Day	20	HRS/DAY
G	Operating Days Per Week	5	DAYS/WK
-	Heating Fuel Type	Natural Gas	
H	Cost Per Fuel Unit (3)	1.62	$/UNIT
J	BTU Per Fuel Unit (4)	100	kBTU/UNIT
K	System Efficiency (4)	0.65	

CALCULATION:

SAVINGS = (D - E) x 0.6 x H / (J x K)

= $9,919 /YEAR
==========

NOTES:

(1) Determine the New Exhaust Volume by completing TABLE 1. The New Exhaust Volume equals the AVG % RPM x the Previous Exhaust Volume.

(2) Using design weather data via the Outdoor Airload Calculator and multiplied by days/year ratio.

(3) Using local energy costs.

(4) Using typical system efficiency.

TABLE 1

% Rated RPM (F)	% Run Time (I)	F x I
100	13	13
90	0	0
80	13	10
70	8	6
60	4	3
50	0	0
40	4	2
30	13	4
20	0	0
10	0	0
AVG % RPM =		36%

III. CONDITIONED MAKE-UP AIR SAVINGS - COOLING

INPUT DATA:

A	Previous Net Exhaust Volume	20000	CFM
B	New Net Exhaust Volume (1)	7250	CFM
C	Previous Net Cooling Load (2)	82987.619	kBTU
D	New Net Cooling Load (2)	30083	kBTU
E	AC Correction Factor (3)	1	
F	Cost Per Fuel Unit (5)	0.1341	$/kWH
G	COP (6)	1	

CALCULATION:

SAVINGS = (C - D) x 0.6 x E x F / (3.413 x G)

= $1,247 /YEAR
============

NOTES:

(1) Using New Exhaust Volume from CONDITIONED MAKE-UP AIR SAVINGS - HEATING on page 2. See Note 1.

(2) Obtained from Outdoor Airload Calculator

(3) Using design weather data.

(4) The multiplier corrects for actual % outside air.

(5) Using local energy costs.

(6) Using typical system efficiency.

AFTER-TAX CASH FLOW ANALYSIS

INPUT DATA:

FIRST YEAR SAVINGS	$13,148 /YEAR
INITIAL COST PLUS INSTALLATION	$31,044
MARGINAL TAX RATE	35%
ESTIMATED ANNUAL INCREASE IN ENERGY COSTS	3%

YEAR	SAVINGS	COST	DEPREC. %	DEPREC. $	NET AFTER-TAX CASH FLOW
0		-31,044			-31,044
1	13148	-	29	9003	11697
2	13542	-	20	6209	10976
3	13949	-	13	4036	10479
4	14367	-	10	3104	10425
5	14798	-	9	2794	10597
6	15242	-	9	2794	10885
7	15699	-	9	2794	11182
8	16170	-			10511
9	16655	-			10826
10	17155	-			11151

CALCULATIONS:

NET PRESENT VALUE = 5 YEARS @ 15%	$4,823 ;	INTERNAL RATE OF RETURN (IRR) =	22.5 %
NET PRESENT VALUE = 10 YEARS @ 15%	$20,631 ;	INTERNAL RATE OF RETURN (IRR) =	33.4 %

NOTE:

Net After-tax Cash Flow is calculated as follows:
NATCF = SAVINGS - COSTS - TAX RATE(SAVINGS - COSTS - DEPRECIATION)

Net Present Value is calculated as follows:
NPV = C(0) + C(1)/(1 + r) + C(2)/(1 + r)^2 + ... + C(n)/(1 + r)^n
(where C(n) is the net cash flow for the nth year
and r is the opportunity cost of capital)

IRR is calculated by trial and error using the formula:
NPV = C(0) + C(1)/(1 + IRR) + C(2)/(1 + IRR)^2 + ... + C(n)/(1 + IRR)^n

Frigitek® Single-Phase Savings Analysis		Analysis Sheet # 1 of	1	
Date -	5.4.2009			
Customer -	Bridgewater-Raritan Middle School			
Room and Evap. Description -	Kitchen Walk-In Box			
Contact -	0			
Phone -	0			
Number of Evaporators on this sheet -	1		Enter one of these -	
Fan motors per Evaporator -	2		Amps/Motor -	3.50
Fan Voltage -	208		or Total Motor Amps -	0.00
Motor Type (S, C or E) (1) -	S		Compressor Type (2)	
Motor Power Factor (1) -	0.58		(S)ingle or (T)hree Phase -	S
Electricity Cost per KwH (3) -	13.4	Cents	Normal Duty Cycle (4) -	40.00 %
Operation time factor (5) -	100	%	Frigitek Duty Cycle (6) -	32.00 %
Fan Motors KwH/Mo -	616.5	Avg	Total Fan Motor Watts (7) -	844.5 W
Frigitek Cost, Quan., Model -	$1,034.00	1	Model	240V - 12A
Tax Rate (%) -	7.00	Tax -	$72.38	
Install, Shipping, other costs -	$272.38			
Total Cost -	$1,378.76			
Total Frigitek KwH Savings (8) -	538.85	/Mo Avg	6,466.19	/Yr
Total Frigitek Dollar Savings (8) -	$72.26	/Mo Avg	$867.12	/Yr
Payback Time (ROI) (9) -	19.08	Months		

Analysis Details --

Before Frigitek				
Full-time High Speed Fan Cost (10) -	$82.67	/Mo Avg	$992.00	/Yr
With Frigitek				
Frigitek Power Reduction Factor (11) -	80	%		
Full-Time Low Speed Cost -	$16.53	/Mo	$198.40	/Yr
Fans KwH Saved -	335.35	/Mo Avg	4,024.23	/Yr
Fan High Speed Cost (12) -	$26.45	/Mo Avg	$317.44	/Yr
Fan Low Speed Cost (13) -	$11.24	/Mo Avg	$134.91	/Yr
Total Fan Cost with Frigitek -	$37.70	/Mo Avg	$452.35	/Yr
Fan Dollar Savings (14) -	$44.97	/Mo Avg	$539.65	/Yr
Compressor Cost Reduction				
Fan Power Reduction (15) -	459.40	Watts	Heat Transfer Factor (16) -	9500
Fan Heat Reduction (17) -	1567.51	BTU/Hr	Comp. Kw/Hp (18) -	1.55
Compressor Hp use Reduction (19) -	0.1650009	Hp/Hr		
Compressor Power use Reduction (20) -	0.25575145	Kw/Hr	Cond. fan Savings (21) -	$2.25 /Mo
Compressor Power use Reduction (20) -	186.69	KwH/Mo		
Compressor Cost reduction (22) -	$27.29	/Mo Avg	$327.47	/Yr

Note - Numbers in parentheses refer to Explanation Sheet.

Sheet version - 02/21/06

Life Cycle Cost Estimate for 1 ENERGY STAR Qualified Programmable Thermostat(s)

This energy savings calculator was developed by the U.S. EPA and U.S. DOE and is provided for estimating purposes only. Actual energy savings may vary based on use and other factors.

Enter your own values in the gray boxes or use our default values.

Number of Units	1
Initial Cost per ENERGY STAR Unit (retail price)	$250
Initial Cost per Conventional Unit (retail price)	$73
Unit Fuel Cost (Cooling) ($/kWh)	$0.134
Unit Fuel Cost (Heating) ($/Therm)	$1.59

24 Hour Typical Usage Patterns*

	Weekday	Weekend
Nighttime Set-Back/Set-Up Hours	14	24
Daytime Set-Back/Set-Up Hours	10	0
Hours without Set-Back/Set-Up	0	0

Choose your city from the drop-down menu → **City**: PA-Philadelphia

Heating Season*

Typical Indoor Temperature w/o Set-Back	70
Nighttime Set-Back Temperature (Average)	60
Daytime Set-Back Temperature (Average)	62
Heating System Type	Gas Boiler

Cooling Season*

Typical Indoor Temperature w/o Set-Up	76
Nighttime Set-Up Temperature (Average)	85
Daytime Set-Up Temperature (Average)	85
Cooling System Type	Central AC

**All temperatures are in degrees Fahrenheit. Setpoint is defined as the temperature setting for any given time period. Set-back temperature is defined as the lower setpoint temperature for the energy-savings periods during the heating season, generally nighttime and daytime. Set-up temperature is defined as the higher setpoint temperature for the energy-savings periods during the cooling season, generally nighttime and daytime.*

Annual and Life Cycle Costs and Savings for 1 Programmable Thermostat(s)

	1 ENERGY STAR Unit(s)	1 Conventional Unit(s)	Savings with ENERGY STAR
Annual Energy Costs			
Heating Energy Cost	$744	$1,037	$293
Heating Energy Consumption (MBTU)	*47*	*65*	*18*
Cooling Energy Cost	$137	$265	$128
Cooling Energy Consumption (MBTU)	*3.5*	*6.7*	*3*
Total	**$882**	**$1,302**	**$420**
Life Cycle Costs			
Energy Costs	$9,801	$14,475	$4,674
Heating Energy Costs	*$8,274*	*$11,527*	*$3,252*
Heating Energy Consumption (MBTU)	702	978	276
Cooling Energy Costs	$1,527	$2,949	$1,422
Cooling Energy Consumption (MBTU)	52	101	49
Purchase Price for 1 Unit(s)	*$250*	*$73*	*-$177*
Total	**$10,051**	**$14,548**	**$4,497**
		Simple payback of initial cost (years)	**0.4**

Summary of Benefits for 1 Programmable Thermostat(s)

Initial cost difference	**$177**
Life cycle savings	**$4,674**
Net life cycle savings (life cycle savings - additional cost)	**$4,497**
Life cycle energy saved (MBTU)-includes both Heating and Cooling	**325**
Simple payback of additional cost (years)	**0.4**
Life cycle air pollution reduction (lbs of CO_2)	**46,590**
Air pollution reduction equivalence (number of cars removed from the road for a year)	**4**
Air pollution reduction equivalence (acres of forest)	**5**
Savings as a percent of retail price	**1799%**

Assumptions for Programmable Thermostats

Category	Value		Data Source
Heating/Cooling System Efficiencies			
Gas Furnace	84.0		LBNL 2004, Average of ENERGY STAR and Conventional
Gas Boiler	82.5		LBNL 2004, Average of ENERGY STAR and Conventional
Oil Furnace	84.0		LBNL 2004, Average of ENERGY STAR and Conventional
Oil Boiler	82.5		LBNL 2004, Average of ENERGY STAR and Conventional
Baseline Energy Consumption (MBTU)			
Gas Furnace	54.1		DOE 2001
Gas Boiler	56.1		DOE 2001
Oil Furnace	68.7		DOE 2001
Oil Boiler	71.2		DOE 2001
Central Air Conditioner	9.5		DOE 2001
Reference Degree Days (Heating/Cooling)			
Gas Furnace	4,255		DOE 2001
Gas Boiler	4,255		DOE 2001
Oil Furnace	5,339		DOE 2001
Oil Boiler	5,339		DOE 2001
Central Air Conditioner		1701	DOE 2001
Typical Indoor Temperature (Heating Season)	70		ENERGY STAR Programmable Thermostat Eligibility Criteria. Pre-programmed settings for heating include a morning and evening temperature ≤70°F and an adjustment of at least 8 °F (≤62°F) during daytime and nighttime.
Typical Indoor Temperature (Cooling Season)	78		ENERGY STAR Programmable Thermostat Eligibility Criteria. Pre-programmed settings for cooling include a morning and evening temperature ≥78°F and an adjustment of at least 7 °F (≥85°F) during daytime and an adjustment of at least 4°F (≥82°F) at nighttime.
Energy Prices			
Natural Gas ($/Therm)	$1.2700	$/Therm	EIA 2008
Fuel Oil ($/Gallon)	$2.6800	$/gal	EIA 2008
Electric Price (Residential)	$0.1059	$/kWh	EIA 2008
Usage			
Nighttime Hours	8		Default shipped setting, ENERGY STAR specification
Daytime Hours	10		Default shipped setting, ENERGY STAR specification
Carbon Dioxide Emissions Factors			
Oil Carbon Emission Factor	161.27	lbs CO_2/MBtu	EPA 2007
Gas Carbon Emission Factor	116.97	lbs CO_2/MBtu	EPA 2007
Electricity Carbon Emission Factor	1.54	lbs CO_2/kWh	EPA 2008
Thermostat Savings			
Savings per Degree of Setback (Heating Season)	3%		Industry Data 2004
Savings per Degree of Setback (Cooling Season)	6%		Industry Data 2004
Thermostat Lifetime	15	years	LBNL 2007
Initial Cost			
ENERGY STAR Programmable Thermostat	$92		Industry Data 2008
Conventional Thermostat	$73		Industry Data 2008
CO_2 Equivalents			
Annual CO_2 sequestration per forested acre	9,700	lbs CO_2/acre-yr	EPA 2007
Annual CO_2 emissions for "average" passenger car	12,037	lbs CO_2/acre-yr	EPA 2007
Discount Rate			
Commercial and Residential Discount Rate (real)	4%		A real discount rate of 4 percent is assumed, which is roughly equivalent to the nominal discount rate of 7 percent (4 percent real discount rate + 3 percent inflation rate).

Project Name: LGEA Solar PV Project - Middle School
Location: Bridewater, NJ
Description: Photovoltaic System 95% Financing - 25 year

Simple Payback Analysis

	Photovoltaic System 95% Financing - 25 year
Total Construction Cost	$919,080
Annual kWh Production	159,363
Annual Energy Cost Reduction	$21,371
Annual SREC Revenue	$55,777
First Cost Premium	**$919,080**
Simple Payback:	**11.91** Years

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	95%
Financing Term (mths):	240	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.134**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	7.00%	SREC Value ($/kWh)	$0.350

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Cumulative Cash Flow
0	$45,954	0	0	0	$0	0	0	(45,954)	0
1	$0	159,363	$21,371	$0	$55,777	$60,461	$20,771	($4,084)	($50,038)
2	$0	158,566	$22,012	$0	$55,498	$58,959	$22,273	($3,722)	($53,761)
3	$0	157,773	$22,672	$0	$55,221	$57,349	$23,883	($3,339)	($57,100)
4	$0	156,984	$23,352	$0	$54,945	$55,623	$25,609	($2,935)	($60,035)
5	$0	156,200	$24,053	$1,609	$54,670	$53,771	$27,461	($4,118)	($64,154)
6	$0	155,419	$24,774	$1,601	$54,396	$51,786	$29,446	($3,662)	($67,816)
7	$0	154,641	$25,518	$1,593	$54,125	$49,658	$31,574	($3,183)	($70,998)
8	$0	153,868	$26,283	$1,585	$53,854	$47,375	$33,857	($2,680)	($73,678)
9	$0	153,099	$27,072	$1,577	$53,585	$44,928	$36,305	($2,153)	($75,831)
10	$0	152,333	$27,884	$1,569	$53,317	$42,303	$38,929	($1,601)	($77,432)
11	$0	151,572	$28,720	$1,561	$53,050	$39,489	$41,743	($1,023)	($78,454)
12	$0	150,814	$29,582	$1,553	$52,785	$36,471	$44,761	($419)	($78,873)
13	$0	150,060	$30,469	$1,546	$52,521	$33,236	$47,997	$213	($78,661)
14	$0	149,309	$31,383	$1,538	$52,258	$29,766	$51,466	$872	($77,789)
15	$0	148,563	$32,325	$1,530	$51,997	$26,045	$55,187	$1,560	($76,229)
16	$0	147,820	$33,295	$1,523	$51,737	$22,056	$59,176	$2,277	($73,952)
17	$0	147,081	$34,293	$1,515	$51,478	$17,778	$63,454	$3,025	($70,927)
18	$0	146,346	$35,322	$1,507	$51,221	$13,191	$68,041	$3,804	($67,123)
19	$0	145,614	$36,382	$1,500	$50,965	$8,272	$72,960	$4,615	($62,508)
20	$0	144,886	$37,473	$1,492	$50,710	$2,998	$78,234	$5,459	($57,049)
21	$0	144,161	$38,598	$1,485	$50,456	$2,542	$71,921	$13,107	($43,943)
22	$0	143,441	$39,756	$1,477	$50,204	$1,740	$59,184	$27,558	($16,384)
23	$0	142,723	$40,948	$1,470	$49,953	$0	$0	$89,431	$73,047
24	$0	142,010	$42,177	$1,463	$49,703	$0	$0	$90,417	$163,465
25	$0	141,300	$43,442	$1,455	$49,455	$0	$0	$91,441	$254,906
	Totals:	3,040,311	$574,235	$24,799	$1,064,109	$751,515	$873,126	$1,004,231	($941,317)
				Net Present Value (NPV)				**($68)**	
				Internal Rate of Return (IRR)				**7.0%**	

Project Name: LGEA Solar PV Project - Middle School
Location: Bridewater, NJ
Description: Photovoltaic System

Simple Payback Analysis

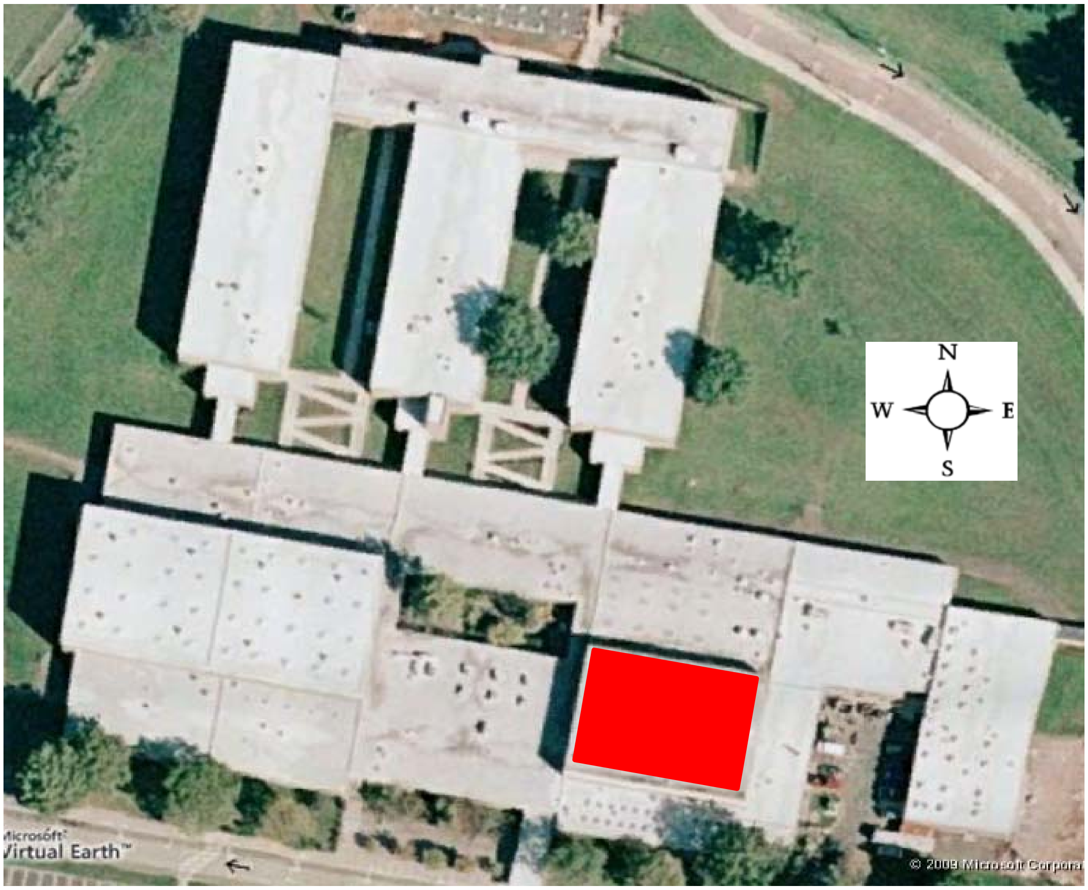
	Photovoltaic System
Total Construction Cost	$919,080
Annual kWh Production	159,363
Annual Energy Cost Reduction	$21,371
Annual SREC Revenue	$55,777
First Cost Premium	**$919,080**
Simple Payback:	**11.91** Years

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.134**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/kWh)	$0.350

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Net Cash Flow	Cumulative Cash Flow
0	$919,080	0	0	0	$0	(919,080)	0
1	$0	159,363	$21,371	$0	$55,777	$77,148	($841,932)
2	$0	158,566	$22,012	$0	$55,498	$77,510	($764,423)
3	$0	157,773	$22,672	$0	$55,221	$77,893	($686,530)
4	$0	156,984	$23,352	$0	$54,945	$78,297	($608,233)
5	$0	156,200	$24,053	$1,609	$54,670	$77,114	($531,119)
6	$0	155,419	$24,774	$1,601	$54,396	$77,570	($453,549)
7	$0	154,641	$25,518	$1,593	$54,125	$78,049	($375,500)
8	$0	153,868	$26,283	$1,585	$53,854	$78,552	($296,948)
9	$0	153,099	$27,072	$1,577	$53,585	$79,079	($217,869)
10	$0	152,333	$27,884	$1,569	$53,317	$79,631	($138,237)
11	$0	151,572	$28,720	$1,561	$53,050	$80,209	($58,028)
12	$0	150,814	$29,582	$1,553	$52,785	$80,813	$22,785
13	$0	150,060	$30,469	$1,546	$52,521	$81,445	$104,230
14	$0	149,309	$31,383	$1,538	$52,258	$82,104	$186,334
15	$0	148,563	$32,325	$1,530	$51,997	$82,792	$269,126
16	$0	147,820	$33,295	$1,523	$51,737	$83,509	$352,635
17	$0	147,081	$34,293	$1,515	$51,478	$84,257	$436,892
18	$0	146,346	$35,322	$1,507	$51,221	$85,036	$521,928
19	$0	145,614	$36,382	$1,500	$50,965	$85,847	$607,775
20	$0	144,886	$37,473	$1,492	$50,710	$86,691	$694,466
21	$1	144,161	$38,598	$1,485	$50,456	$87,569	$782,035
22	$2	143,441	$39,756	$1,477	$50,204	$88,482	$870,517
23	$3	142,723	$40,948	$1,470	$49,953	$89,431	$959,949
24	$4	142,010	$42,177	$1,463	$49,703	$90,417	$1,050,366
25	$5	141,300	$43,442	$1,455	$49,455	$91,441	$1,141,808
	Totals:	3,040,311	$574,235	$24,799	$1,064,109	$2,060,888	$1,613,546
			Net Present Value (NPV)			**$1,141,833**	
			Internal Rate of Return (IRR)			**7.2%**	

Building	Roof Area (sq ft)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW	Total Annual kWh	Panel Weight (33 lbs)	W/SQFT
Middle School	6528	Sunpower SPR230	444	14.7	6,529	102.12	159,363	14,652	15.64



.= Proposed PV Layout

Notes:

1. Estimated kWH based on 4.68 hours full output per day per 365 day year. Actual kWH will vary day to day.

Water Conservation Savings Calculations

Concord Engineering Group

"Bridgewater-Raritan Middle School"

Middle School Faucets
Install 0.5 GPM Neoperl Faucet Aerators from existing Faucets
Assume occupants have 10 minutes/day sink usage at 50 degrees F rise

Number of Occupants: 1630

Q=GAL * 60%(MIX) * 8.34 lb/gal * dT
$16.20 per MMbtu Nat. Gas
$3.80 per kGal

LOCATION	EXIST. GPM	PROP. GPM	MIN/DAY	DAYS/YR	OCC RATE	# FAUCETS	EXISTING GPY	PROPOSED GPY	EXISTING W/S COST	EXISTING Water Heating MMbtu Annual	EXISTING Water Heating Cost	PROP. W/S COST	PROP. Water Heating MMbtu Annual	PROP. Water Heating Cost	TOT SAVINGS	TOT SAV (GPY)
Rest Rooms	2.5	0.5	2	180	10.00%	52	7,628,400	1,525,680	$28,988	2,290.35	$37,104	$5,798	458.07	$7,421	$52,873	6,102,720
Total							7,628,400	1,525,680	$28,988	2,290.35	$37,104	$5,798	458.07	$7,421	**$52,873**	6,102,720

Middle School Water Closets
Replace existing EPACT 1992 1.6 GPF Toilets with Pressure Assisted Kohler Model K-3393 Dual Flush Mode Toilet 0.9 GPF or 1.4 GPF
Assumes 2 Guests per room with 2.5 uses per day per guest, and that one of the flushes is 1 GPF and 3 are 1.4 GPF

$3.80 per kGal

LOCATION	EXIST. GPF	PROP. GPF	# TOILETS	OCCUP. RATE	USES PER DAY PER GUEST	DAYS/YR	Gallons per Year (Existing)	Annual Cost of Water (Existing)	Gallons per Year (Proposed)	Annual Cost of Water (Proposed)	TOT SAV	TOT SAV (GPY)
Rest Rooms	1.8	1.3	50	20.00%	2	180	10,562,400	$40,137	7,628,400	$28,988	$11,149	2,934,000
Total							10,562,400	40,137	$7,628,400	28,988	**$11,149**	2934000

Middle School Urinals
Replace existing EPACT 1992 1 GPF Urinal with a 0.5 GPF American Standard Flowise Urinal Flush Valve Model 6063505.002

$3.80 per kGal

LOCATION	# of Urinals	Existing GPF	Proposed GPF	OCCUP. RATE	USES PER DAY PER PERSON	Days per Year	Gallons per Year (Existing)	Annual Cost of Water (Existing)	Gallons per Year (Proposed)	Annual Cost of Water (Proposed)	TOT SAV	TOT SAV (GPY)
Rest Rooms	22	1	0.5	33.00%	5	180	10,650,420	$40,472	5,325,210	$20,236	$20,236	5325210
Total							10,650,420	$40,472.00	5,325,210	$20,236.00	**$20,236**	5325210

Water Fixture Retrofit	Annual Water Use Savings, Gallons	Annual Water Savings, $	Annual Water Heating Reduction, MMbtu	Annual Water Heating Savings, $	Material Cost	Labor Cost	Total Cost	Simple Payback, years
Faucets	6,102,720	$52,873	1,832	$29,683	$159	$1,950	$2,109	0.03
Water Closets	2,934,000	$11,149	0	$0	$56,573	$15,000	$71,573	6.42
Urinals	5,325,210	$20,236	0	$0	$9,790	$2,805	$12,595	0.62
TOTAL	14,361,930	$84,258	1,832	$29,683	$66,521	$19,755	$86,276	0.76

Concord Engineering Group, Inc.

520 BURNT MILL ROAD
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SmartStart Building Incentives

The NJ SmartStart Buildings Program offers financial incentives on a wide variety of building system equipment. The incentives were developed to help offset the initial cost of energy-efficient equipment. The following tables show the current available incentives as of January, 2009:

Electric Chillers

Water-Cooled Chillers	$12 - $170 per ton
Air-Cooled Chillers	$8 - $52 per ton

Gas Cooling

Gas Absorption Chillers	$185 - $400 per ton
Gas Engine-Driven Chillers	Calculated through custom measure path)

Desiccant Systems

	$1.00 per cfm – gas or electric

Electric Unitary HVAC

Unitary AC and Split Systems	$73 - $93 per ton
Air-to-Air Heat Pumps	$73 - $92 per ton
Water-Source Heat Pumps	$81 per ton
Packaged Terminal AC & HP	$65 per ton
Central DX AC Systems	$40- $72 per ton
Dual Enthalpy Economizer Controls	$250

Ground Source Heat Pumps

Closed Loop & Open Loop	$370 per ton

Gas Heating

Gas Fired Boilers < 300 MBH	$300 per unit
Gas Fired Boilers ≥ 300 - 1500 MBH	$1.75 per MBH
Gas Fired Boilers ≥1500 - ≤ 4000 MBH	$1.00 per MBH
Gas Fired Boilers > 4000 MBH	(Calculated through Custom Measure Path)
Gas Furnaces	$300 - $400 per unit

Variable Frequency Drives

Variable Air Volume	$65 - $155 per hp
Chilled-Water Pumps	$60 per hp
Compressors	$5,250 to $12,500 per drive

Natural Gas Water Heating

Gas Water Heaters ≤ 50 gallons	$50 per unit
Gas-Fired Water Heaters >50 gallons	$1.00 - $2.00 per MBH
Gas-Fired Booster Water Heaters	$17 - $35 per MBH

Premium Motors

Three-Phase Motors	$45 - $700 per motor

Prescriptive Lighting

T-5 and T-8 Lamps w/Electronic Ballast in Existing Facilities	$10 - $30 per fixture, (depending on quantity)
Hard-Wired Compact Fluorescent	$25 - $30 per fixture
Metal Halide w/Pulse Start	$25 per fixture
LED Exit Signs	$10 - $20 per fixture
T-5 and T-8 High Bay Fixtures	$16 - $284 per fixture

Lighting Controls – Occupancy Sensors

Wall Mounted	$20 per control
Remote Mounted	$35 per control
Daylight Dimmers	$25 per fixture
Occupancy Controlled hi-low Fluorescent Controls	$25 per fixture controlled

Lighting Controls – HID or Fluorescent Hi-Bay Controls

Occupancy hi-low	$75 per fixture controlled
Daylight Dimming	$75 per fixture controlled

Other Equipment Incentives

Performance Lighting	$1.00 per watt per SF below program incentive threshold, currently 5% more energy efficient than ASHRAE 90.1-2004 for New Construction and Complete Renovation
Custom Electric and Gas Equipment Incentives	not prescriptive