Steven Winter Associates, Inc.
Architects and Engineers

293 Route 18 South, Suite 330
East Brunswick, NJ 08816
www.swinter.com

Telephone: (866) 676-1972
E-mail: swinter@swinter.com

February 7, 2010

Local Government Energy Program
Energy Audit Final Report

For

Livingston Mount Pleasant Schools
Livingston, NJ 07039

Project Number: LGEA37

TABLE OF CONTENTS

INTRODUCTION

On October 13th, 15th, 16th, 20th, 21st, 22nd, 27th and 28th Steven Winter Associates, Inc. (SWA) performed an energy audit and assessment for the Livingston Public School buildings. The audit included a review of the:

- Administrative Offices
- Burnet Hill Elementary
- Collins Elementary
- Harrison Elementary
- Hillside Elementary
- Riker Hill Elementary
- Mount Pleasant Schools
- Heritage Middle School
- Livingston High School

The buildings are located in Livingston, NJ. A separate energy audit report is issued for each of the referenced buildings.

This report addresses the Livingston Mount Pleasant Schools building located at 11 Broadlawn Drive, Livingston, NJ 07039. The current conditions and energy-related information were collected in order to analyze and facilitate the implementation of energy conservation measures for the building.

The mostly two-story Mount Pleasant Schools building was built in 1956 with renovations and additions in 1958, 1964 and 2002. It houses an elementary school on one side and a middle school on the other. Besides various types of classrooms and administrative offices for both schools, the building has multipurpose rooms, gymnasiums, kindergarten, activity rooms, cafeteria, media centers, and a boiler and utility rooms. The building consists of 135,507 square feet of conditioned space. The building is occupied on weekdays by 113 teachers / staff employees and 871 students from 8:00 am to 3:30 pm with the YMCA running an afterschool program from 2:30 pm to 6:00 pm and periodic evening meetings and recreational programs. There is Saturday Chinese teaching school during the school year and a YMCA summer program.

SWA was informed by the Livingston Board of Education that there is a plan for the Livingston Public Schools to upgrade the envelopes, interior spaces, mechanical and electrical systems, install photovoltaic systems and comply with ADA requirements, which will be presented in a two bond referendum for approval by the township voters on December 8, 2009.

The goal of this Local Government Energy Audit (LGEA) is to provide sufficient information to the Livingston Board of Education to make decisions regarding the implementation of the most appropriate and most cost effective energy conservation measures for the Mount Pleasant Schools building.

Launched in 2008, the LGEA Program provides subsidized energy audits for municipal and local government-owned facilities, including offices, courtrooms, town halls, police and fire stations, sanitation buildings, transportation structures, schools and community centers. The Program will subsidize 75% of the cost of the audit. If the net cost of the installed measures recommended by the audit, after applying eligible NJ SmartStart Buildings incentives, exceeds the remaining cost of the audit, then that additional 25% will also be paid by the program. The Board of Public Utilities (BPUs) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

EXECUTIVE SUMMARY

The energy audit performed by Steven Winter Associates (SWA) encompasses the Mount Pleasant Schools building located at 11 Broadlawn Drive, Livingston, NJ 07039. The Mount Pleasant Schools building is a mostly two-story building with a floor area of 135,507 square feet. The original structure was built in 1956 with renovations and additions in 1958, 1964 and 2002.

Based on the field visits performed by the SWA staff on October 13th, 15th, 16th, 20th, 21st, 22nd, 27th and 28th and the results of a comprehensive energy analysis, this report describes the site's current conditions and recommendations for improvements. Suggestions for measures related to energy conservation and improved comfort are provided in the scope of work. Energy and resource savings are estimated for each measure that results in a reduction of heating, cooling, and electric usage.

From March 2008 to February 2009 the Mount Pleasant Schools building consumed 798,200 kWh or $126,831worth of electricity at an approximate rate of $0.159/kWh and 109,124 therms or $166,356 worth of natural gas at an approximate rate of $1.524/therm . The joint energy consumption for the building, including both electricity and natural gas, was 13,636 MMBtu of energy that cost a total of $293,187.

SWA has entered energy information about the Mount Pleasant Schools building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The building performance rating received is a score of 37 when compared to other buildings of its kind. This indicates that there are opportunities for the Mount Pleasant Schools building to decrease energy consumption (natural gas or electric use or a combination thereof) to reach a more favorable Energy Star benchmark rating. SWA encourages the Livingston Board of Education to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time.

The Site Energy Use Intensity is 106 kBtu/ft^{2}yr compared to the national average of a school building consuming 94 kBtu/ft^{2}yr. Implementing this report's recommendations will reduce use by approximately 34.4 kBtu/ft^{2}yr, which when implemented would make the building energy consumption better than the national average. There may be energy procurement opportunities for the Mount Pleasant Schools to reduce annual utility costs, which are $4,347 higher, when compared to the average estimated NJ commercial utility rates.

Based on the assessment of the Mount Pleasant Schools building, SWA has separated the recommendations into three categories (See Section 4 for more details). These are summarized as follows:

Category I Recommendations: Capital Improvement Measures

- Replace unit ventilators
- Replace common area heating emitters
- Replace window air conditioners
- Upgrade Building Management System (BMS)
- Replace H&V units serving the Elementary School Gym
- Replace H&V units serving the Middle School Gym
- Replace H&V units serving the Auditorium
- Replace dust collection system and associated ductwork in Tech Education classroom
- Replace original windows
- Insulate exterior walls and roof and re-point exterior brick walls
- Upgrade building per ADA requirements
- Install premium motors when replacements are required

Category II Recommendations: Operations and Maintenance

- Replace steam traps
- Insulate boiler room and building piping
- Inspect and replace gaskets around Kitchen walk-in refrigeration box doors
- Asbestos abatement
- Maintain roofs
- Maintain downspouts
- Provide weather stripping / air sealing, especially around window air conditioning units
- Repair / seal wall cracks and penetrations
- Provide water efficient fixtures and controls
- Use Energy Star labeled appliances
- Use smart power electric strips
- Create an energy educational program

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

At this time, SWA highly recommends a total of **5** Energy Conservation Measures (ECMs) for the Mount Pleasant Schools building that are summarized in the following Table 1. The total investment cost for these ECMs with incentives is **$111,072**. SWA estimates a first year savings of **$27,558** with a simple payback of **4.0 years**. SWA estimates that implementing the highly recommended ECMs will reduce the carbon footprint of the Mount Pleasant Schools building by **77,264 lbs of CO_2**, which is equivalent to removing approximately 6 cars from the roads each year or avoiding the need of 188 trees to absorb the annual CO_2 generated. SWA also recommends **4** ECMs with a total first year savings of **$212,672** that is summarized in Table 2 and **4** End of Life Cycle ECMs with a total first year savings of **$4,334** that are summarized in Table 3.

There are various incentives that the Livingston Board of Education could apply for that could also help lower the cost of installing the ECMs. SWA recommends that the Livingston Board of Education apply for the NJ SmartStart program through the New Jersey Office of Clean Energy. This incentive can help provide technical assistance for the building in the implementation phase of any energy conservation project. A new NJ Clean Power program, Direct Install, rolled out recently, could also assist to cover 80% of the capital investment.

Institutional buildings with an average annual peak demand over 200 kW (Mount Pleasant Schools is 218 kW) are eligible to participate in the NJ Clean Energy Pay for Performance program. Incentives for electricity and natural gas savings will be paid based on actual savings, provided that the minimum performance threshold of 15% savings has been achieved. To participate, select a Program Partner from an approved partner list and submit Application Package with your Partner's assistance.

Renewable ECMs require application approval and negotiations with the utility and proof of performance. There is also a utility-sponsored loan program through PSE&G that would allow the building to pay for the installation of the PV system through a loan issued by PSE&G. When the Livingston Bond Proposal #2 referendum passes on December 2009, the state of NJ will aid the school by paying 40% of the debt service (interest and principal) for the PV system installation.

The following three tables summarize the proposed Energy Conservation Measures (ECM) and their economic relevance.

Table 1 - Highly Recommended 0-5 Year Payback ECMs																			
ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1	install 1 Drinks, 2 Snacks vending machine and 4 reach-in Drink cooler energy misers - in cafeteria	www.usatech.com and established costs	1,753	none at this time	1,753	8,834	2.4	0	0.2	0	1,405	12	16,855	1.2	862	72	80	12,228	12,103
2	replace (3) 1 Hp cond fan and (3) frac Hp motors with Premium Efficiency on walk-in refrigerated box	similar projects, DOE Motor Master + International	1,662	135	1,527	3,350	0.9	0	0.1	0	533	20	10,653	2.9	598	30	35	6,397	4,590
3.1	replace (1) 3 Hp hot water circulator pump motors with Premium Efficiency	similar projects, DOE Motor Master + International	360	54	306	556	0.2	0	0.0	0	88	20	1,768	3.5	478	24	29	1,009	762
4.1	replace gym Metal Halide lamps with (24) T5 fixtures	RS Means, Lit Search, NJ Clean Energy Program	6,240	384	5,856	15,677	4.3	0	1.1	140	2,633	15	37,390	2.2	574	38	45	25,572	21,477
5	retro commission-ing	similar projects	101,630	none at this time	101,630	27,980	7.7	10,912	8.8	1,820	22,899	12	252,952	4.4	170	14	20	126,310	38,333
	TOTALS		**111,645**	**573**	**111,072**	**56,397**	**15.5**	**10,912**	**10.2**	**1,960**	**27,558**	**-**	**319,618**	**4.0**	**-**	**-**	**-**	**171,517**	**77,264**

Assumptions: Discount Rate: 3% per DOE FEMP; Energy Price Escalation Rate: 0% per DOE FEMP Guidelines
Note: A 0.0 electrical demand reduction / month indicates that it is very low / negligible

Table 2 - Recommended 5-10 Year Payback ECMs																		
ECM #	ECM description	Source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
without additional state aid																			
6a	install 248 kW PV rooftop system with incentives	similar projects	1,925,000	0	1,925,000	281,790	248	N/A	7.1	0	211,714	25	1,077,846	9.1	87.4	3.5	7.8	838,484	386,052
renewable PV system below, with additional 40% state aid for debt service																			
6b	install 248 kW PV rooftop system with incentives	similar projects	1,925,000	770,000	1,155,000	281,790	248	N/A	7.1	0	211,714	25	1,077,846	5.5	212.3	8.5	16.8	1,608,484	386,052
4.2	install (27) occupancy sensors	RS Means, Lit Search, NJ Clean Energy Program	5,940	540	5,400	5,110	1.4	0	0.4	0	812	12	9,750	6.6	81	7	11	2,688	7,001
3.2	replace (1) 2 Hp hot water circulator pump motors with Premium Efficiency	similar projects, DOE Motor Master + International	325	54	271	330	0.1	0	0.0	0	52	20	1,049	5.2	287	14	19	510	452
3.3	replace (2) 1-1/2 Hp hot water circulator pump motors with Premium Efficiency	similar projects, DOE Motor Master + International	610	108	502	584	0.2	0	0.0	0	93	20	1,857	5.4	270	13	18	879	800
	TOTALS		**1,931,875**	**770,702**	**1,161,173**	**287,814**	**250.1**	**0**	**7.5**	**0**	**212,672**	**-**	**1,090,503**	**5.5**	**-**	**-**	**-**	**1,612,560**	**394,305**

Table 3 - Recommended End of Life Cycle ECMs																			
ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
7.1	replace 3 old refrig with Energy Star models	Energy Star purchasing and procurement site, similar projects	2,250	0	2,250	1,050	0.3	0	0.0	0	167	12	2,003	13.5	-11	-1	-2	-588	1,439
7.2	replace reach-in ice cream freezer with a 24 cu ft Energy Star freezer	Energy Star purchasing and procurement site, similar projects	2,700	0	2,700	311	0.1	0	0.0	150	199	12	593	13.5	-11	-1	-2	-715	426
8	replace 50 exhaust fans with premium efficiency units	similar projects, DOE Motor Master + International	142,500	2,700	139,800	12,750	3.5	0	0.3	1,820	3,847	10	20,273	36.3	-72	-7	<0	-106,982	17,468
9	replace 1 condensate receiver including a 2 HP vacuum pump motor	similar projects, DOE Motor Master + International	5,000	54	4,946	94	0.0	0	0.0	105	120	20	299	41.2	-51	-3	<0	-3,162	129
	TOTALS		**152,450**	**2,754**	**149,696**	**14,205**	**3.9**	**0**	**0.4**	**2,075**	**4,334**	**-**	**23,168**	**34.5**	**-**	**-**	**-**	**-111,447**	**19,461**

1. HISTORIC ENERGY CONSUMPTION

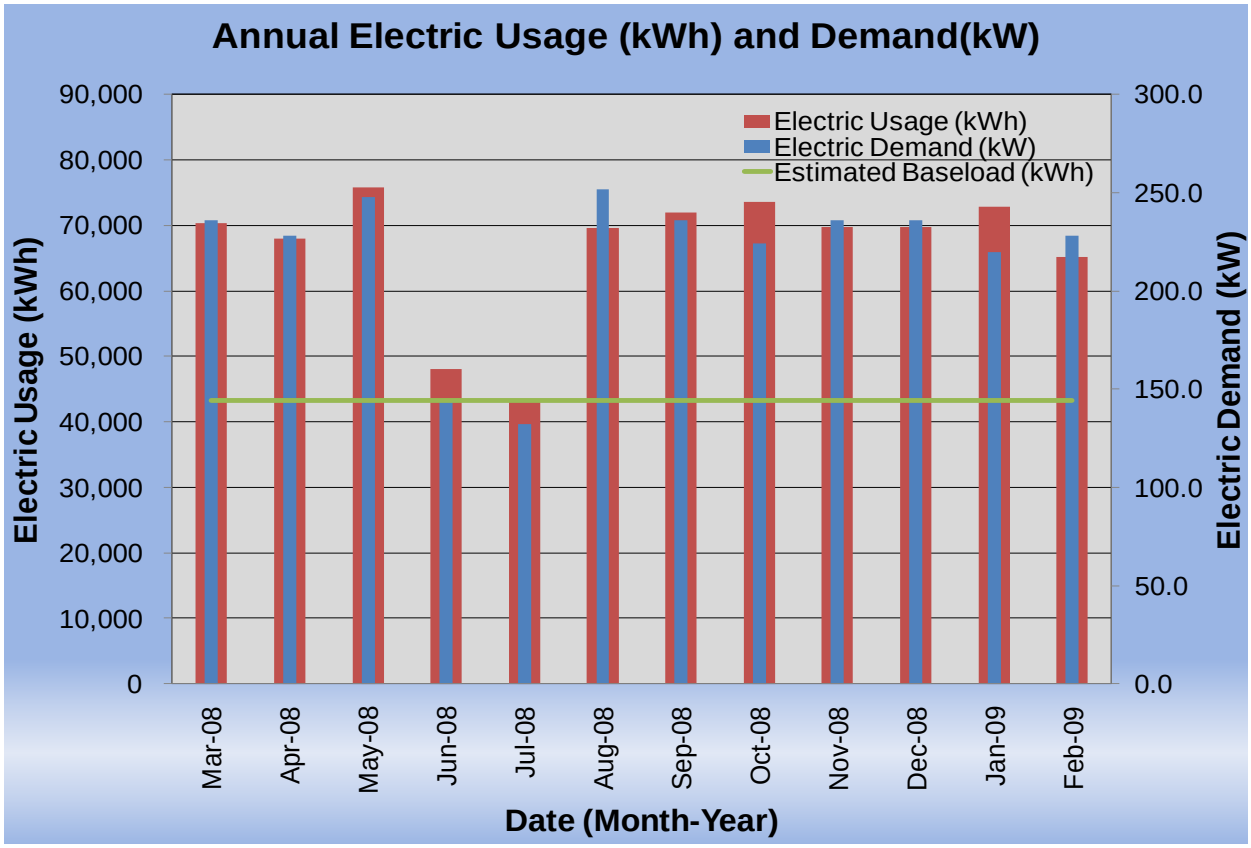
1.1. Energy usage and cost analysis

SWA analyzed utility bills from March 2007 through March 2009 that were received from the utility companies supplying the Mount Pleasant Schools building with electric and natural gas.

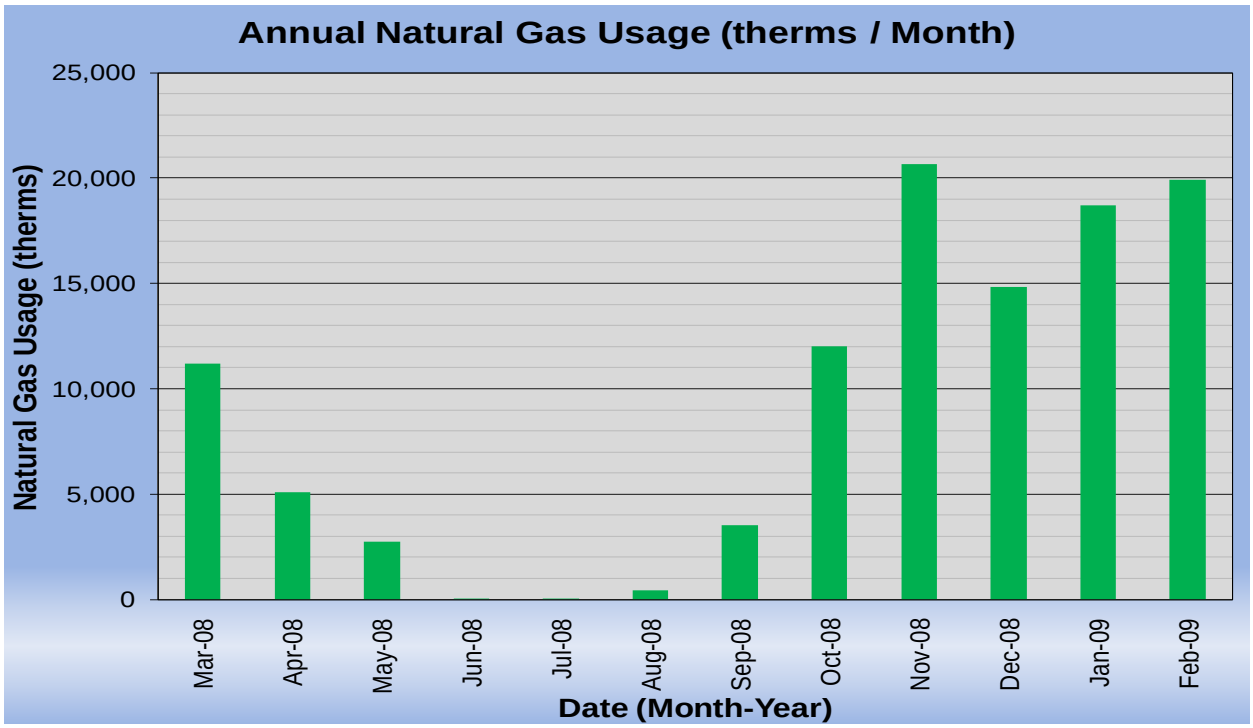
Electricity - The Mount Pleasant Schools building is currently served by one electric meter. The Mount Pleasant Schools building currently buys electricity from PSE&G at **an average rate of $0.159/kWh** based on 12 months of utility bills from March 2008 to February 2009. The Mount Pleasant Schools building purchased **approximately 798,200 kWh or $126,831 worth of electricity** in the previous year. The average monthly demand was 218 kW.

Natural gas - The Livingston Mount Pleasant Schools building is currently served by one meter for natural gas. The Livingston Mount Pleasant Schools building currently buys natural gas from PSE&G (supplied by the Hess Corporation) at **an average aggregated rate of $1.524/therm** based on 12 months of utility bills for March 2008 to February 2009. The Livingston Mount Pleasant Schools building purchased **approximately 109,124 therms or $166,356 worth of natural gas** in the previous year.

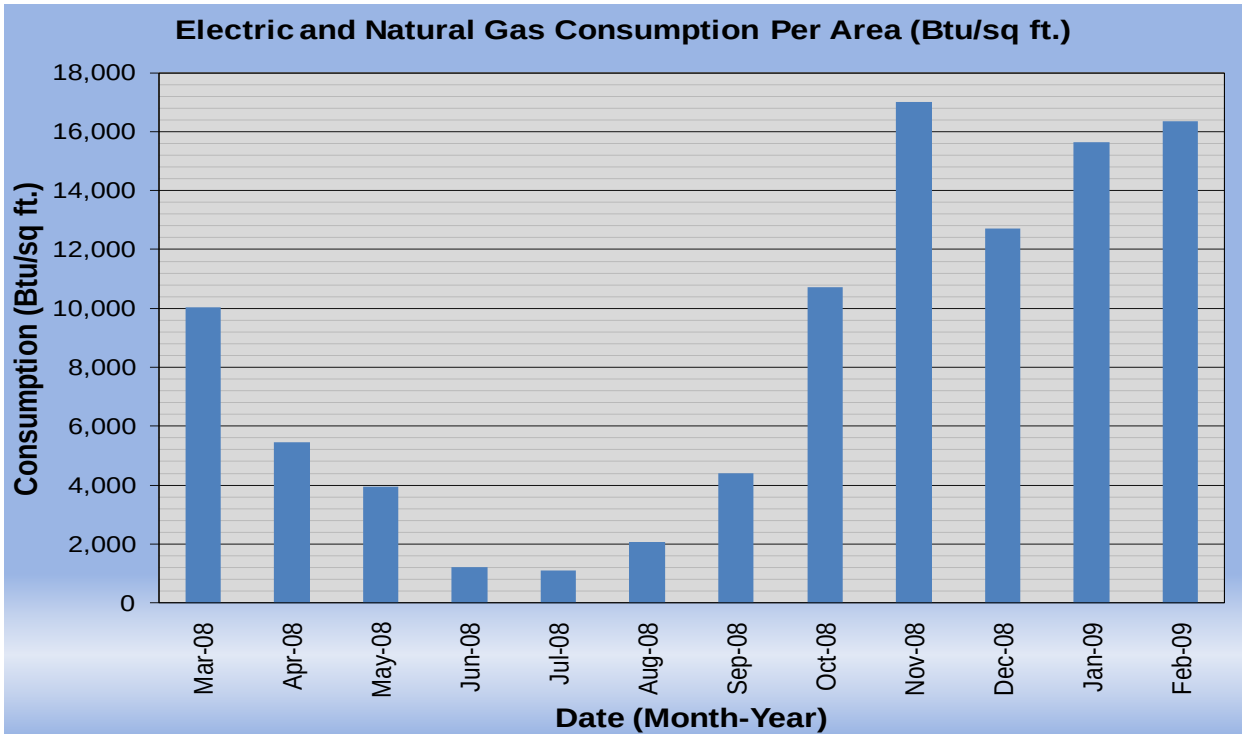
The following chart shows electricity use for the Mount Pleasant Schools building based on utility bills for the 12 month period of March 2008 to February 2009. The chart shows low electric usage in June and July when the school is mostly closed.



The following chart shows the natural gas consumption for the Mount Pleasant Schools building based on natural gas bills for the 12 month period of March 2008 to February 2009.

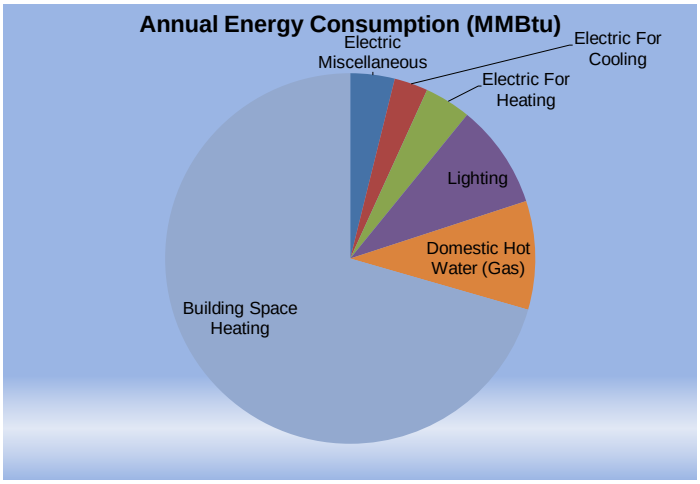


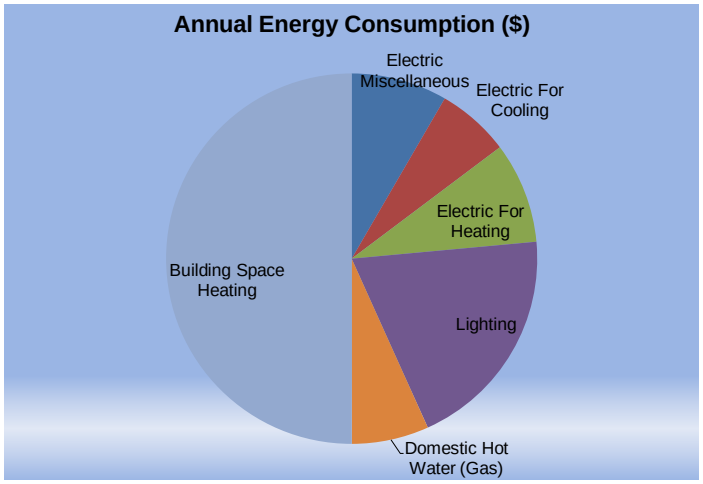
The following chart shows combined natural gas and electric consumption in Btu/sq ft for the Mount Pleasant Schools building based on utility bills for the 12 month period of March 2008 to February 2009.



The following table and chart pies show energy use for the Mount Pleasant Schools building based on utility bills for the 12 month period of March 2008 to February 2009. Note electrical cost at $47/MMBtu of energy is 3 times as expensive to use as natural gas at $15/MMBtu.

2008 Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	527	4%	$24,561	8%	47
Electric For Cooling	401	3%	$18,654	6%	47
Electric For Heating	554	4%	$25,805	9%	47
Lighting	1,241	9%	$57,810	20%	47
Domestic Hot Water (Gas)	1,294	9%	$19,722	7%	15
Building Space Heating	9,619	71%	$146,634	50%	15
Totals	13,636	100%	$293,187	100%	22
Total Electric Usage	2,724	20%	$126,831	43%	47
Total Gas Usage	10,912	80%	$166,356	57%	15
Totals	13,636	100%	$293,187	100%	22





1.2. Utility rate

The Mount Pleasant Schools building currently purchases electricity from PSE&G at a general service market rate for electricity use (kWh) with a separate (kW) demand charge. The Mount Pleasant Schools building currently pays an average rate of approximately $0.159/kWh based on the 12 months of utility bills of March 2008 to February 2009.

The Mount Pleasant Schools building currently purchases natural gas supply from the Hess Corporation at a general service market rate for natural gas (therms). PSE&G acts as the transport company. There is one gas meter that provides natural gas service to the Mount Pleasant Schools building currently. The average aggregated rate (supply and transport) for the meter is approximately $1.524/therm based on 12 months of utility bills for March 2008 to February 2009.

Some of the minor unusual utility fluctuations that showed up for a couple of months on the utility bills may be due to adjustments between estimated and actual meter readings.

1.3. Energy benchmarking

SWA has entered energy information about the Mount Pleasant Schools building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The building performance rating received is a score of 37 when compared to other school buildings of its kind. This indicates that there are good opportunities for the Mount Pleasant Schools building to decrease energy (natural gas or electric use or a combination thereof) use to reach a more desirable Energy Star.

The Site Energy Use Intensity is 106 kBtu/sq ft yr compared to the national average of a School building consuming 94 kBtu/sq ft yr. Implementing this report's highly recommended Energy Conservations Measures (ECMs) will reduce use by approximately 10.2 kBtu/sqft yr, with an additional 7.5 kBtu/sq ft yr from the recommended ECMs, 0.4 kBtu/sq ft yr from the recommended End of Life Cycle ECMs, and 16.4 kBtu/sq ft yr from improved window and roof insulation upgrades. These recommendations could account for at least 34.4 kBtu/sq ft yr reduction, which when implemented would make the building energy consumption better than the national average.

Per the LGEA program requirements, SWA has assisted the Livingston Board of Education to create an *Energy Star Portfolio Manager* account and share the Mount Pleasant School facilities information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager site information with the Livingston Board of Education (user name: "livingstonboe", with same password administered by Steven K. Robinson, Business Administrator / Board Secretary - Livingston Public Schools) and TRC Energy Services (user name: TRC-LGEA).

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Livingston BOE - Mount Pleasant

Building ID: 1878513
For 12-month Period Ending: February 28, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: November 09, 2009

Facility
Livingston BOE - Mount Pleasant
11 Broadlawn Drive
Livingston, NJ 07039

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1956
Gross Floor Area (ft²): 135,507

Energy Performance Rating[2] (1-100) 37

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	2,857,066
Natural Gas (kBtu)[4]	11,440,180
Total Energy (kBtu)	14,297,246

Energy Intensity[5]

Site (kBtu/ft²/yr)	106
Source (kBtu/ft²/yr)	159

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	1,044

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

National Average Comparison

National Average Site EUI	94
National Average Source EUI	142
% Difference from National Average Source EUI	12%
Building Type	K-12 School

Stamp of Certifying Professional

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

Meets Industry Standards[6] **for Indoor Environmental Conditions:**

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

Certifying Professional
N/A

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

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

The Mount Pleasant Schools building was originally built in 1956 with several additions built in 1958, 1964 and 2002. It houses a single story elementary school on one side and a two story middle school on the other. Currently the school consists of a total 135,507 square feet of conditioned space. Besides various types of classrooms and administrative offices for both schools, the building has multipurpose rooms, gymnasiums, kindergarten, activity rooms, cafeteria, media centers, boiler and utility rooms. In the near future, a small addition is planned to house additional classrooms for the elementary school.

2.2. Building occupancy profiles

Occupancy for the Mount Pleasant Schools building is approximately 871 students and 113 teachers and staff personnel. The school is in session from 8:00 am to 3:30 pm, while the YMCA afterschool program utilizes the building from 2:30 pm through 6:00 pm. There are some weekly evening programs and gym activities 7:00 pm-10:00 pm. A Chinese teaching school with approximately 400 attendees meets Saturdays 9:00 am-1:00 pm from September through April. The YMCA operates a summer program from June 29 through August 15, 8:30 am-1:00 pm with a staff of approximately 20 counselors and attended by approximately 250 students. During summer recess, approximately 30 part-time workers clean and perform annual maintenance on the building.

2.3. Building envelope

2.3.1.Exterior Walls

The exterior wall envelope consists of a brick veneer façade with split block banding and accents in some areas. Interior finishes are mostly painted CMU (Concrete Masonry Units) or gypsum wall board. The veneer wall is acceptable condition, except for some minor cracks in brick and mortar, isolated areas of cracked or missing caulk and algae growth on the veneer due to uncontrolled roof water runoff and leaking cap flashing. Otherwise the exterior walls seem to be in age appropriate condition overall.

Cracked caulk, bricks and mortar together with signs of uncontrolled roof water were found

SWA recommends caulking and re-pointing the veneer with appropriate materials to prevent further cracking due to moisture and water infiltration, especially around window sills and all other wall

penetrations. Fascia and cap flashing failures need to be inspected and fixed to prevent further water damage potentially leading to structural and energy compromising issues.

Exterior wall insulation levels could not be visually verified but available construction plans of additions show some insulation between the brick veneer and CMU walls. IR (Infrared) images taken in the field do not show any major water or moisture issues within the wall cavities, except for low levels or no insulation in the original parts of the building. During the next major construction, SWA recommends insulating the exterior walls of at least the original structure by adhering 2" polyiso boards (Polyisocyanurate) together with furring strips and gypsum wall boards to the inside of the painted CMU walls. Additions completed in 2002 were inspected and found to have acceptable levels of wall insulation.

2.3.2.Roof

The flat roof finish is mostly dark colored EPDM from 1992 with some area of built up type roofing installed 2002. Cracked seams, signs of pooling, leaking and little or uneven insulation were found throughout the older parts of the building. Cold spots were identified by IR technology. SWA recommends adding 10" of fiberglass insulation at the interior or 3"exterior XPS during future reroofing. SWA also recommends the EPDM areas of the roof to be replaced within the next 5 years due to age and condition.

Signs of pooling, cracked EPDM seams and dry cold spots

Besides the roof surface and insulation conditions, SWA noticed uncontrolled roof water runoff besides the already mentioned cap flashing under 2.3.1. Exterior Walls. Some downspouts were found to be ineffective. SWA recommends all downspouts, scuppers and roof drains inspected and cleaned or repaired as necessary. Additionally, sharp rocks were noticed to be laying on the roof in all areas, a possible cause of leakage by foot traffic or impact. Vegetation should be trimmed back not to overhang or touch roof perimeter, which has a negative impact on the roof's warranties and life span.

Ineffective or leaking downspouts, rocks and vegetation issues found

2.3.3.Base

The building's base is a 4" concrete slab-on grade with a perimeter footing and concrete block or poured concrete stem walls. No water seepage through the slab or other issues related to thermal performance was detected.

2.3.4.Windows

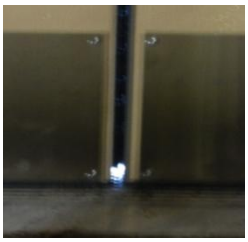
Most of the building's windows were found to be recently updated double glazed aluminum framed windows in good condition. About 48 units are original, aluminum, single glazed type windows. Skylights were also found to be original.

SWA recommends replacing all original windows / skylights with double glazed, low-e type units. All caulking at windows need to be inspected and replaced if necessary and openings around window air conditioning units need airtight gaskets / sealing for optimal all year performance. Insulated hoods should be installed during winter months if removing the units is not an option.


Skylight and window caulking showing signs of age

2.3.5.Exterior doors

The aluminum and vinyl exterior doors were inspected and observed to be in good condition except for some weather-stripping that started to show wear and tear at the time of the inspection. SWA recommends that the exterior doors of the building be weather-stripped in order to decrease the amount of conditioned air that is lost around each door. SWA also recommends checking the weather-stripping of each door on a regular basis and replacing any broken seals. Tight seals around doors will help ensure the building to be is kept continuously insulated.




Signs of worn or missing weather stripping

2.3.6.Building air tightness

In addition to the above mentioned recommendations SWA suggests air sealing, caulking and / or insulating around all plumbing, electrical, HVAC and structural envelope penetrations. This should

include bottom and top plates, recessed light fixtures, electrical boxes, chimney walls and window, or sleeve air conditioner units.

The air tightness of buildings helps to maximize other implemented energy measures and investments and minimizes long term maintenance and repair cost.

2.4. HVAC Systems

Mount Pleasant Elementary and Middle Schools are heated by a hybrid heating system, with the older portions of the building still utilizing a steam heating system, and the newer elementary school classroom addition heated by a hot water system. With the exception of the Media Centers and Main Office / Computer Lab / Social Studies additions and modifications, all of the heating is provided by two (2) steam boilers in the Boiler Room of the original building, and a heat exchanger is utilized to produce hot water for the heating equipment in the latest elementary school classroom addition. The two Media Centers and the Main Office / Computer Lab / Social Studies renovations included gas-fired heating / electric DX cooling packaged rooftop units for heating and cooling.

2.4.1.Heating

The original portion of the building and the earlier additions contain steam heating terminal units in the form of unit ventilators in the classrooms, enclosed wall mounted and ceiling mounted finned tube radiation in the corridors, vestibules, toilet rooms and in some of the classrooms. The original building has steam heating-only unit ventilators in most of the classrooms on the first floor and second floor. There is a small section of 5 classrooms on the second floor that were reconstructed in 2002 and contain newer steam heating / split system DX cooling AAF unit ventilators.

The Middle School Cafeteria is heated by floor mounted steam unit ventilators and enclosed finned-tube radiation surface mounted on the exterior walls. The Elementary School Gym / Cafeteria is heated by four (4) steam H&V units mounted high in the space, one in each corner, along with enclosed finned-tube radiation. The Middle School Gym is heated by four (4) steam H&V units mounted high in the space, all along the outside wall. This gym also contains four (4) steam unit heaters mounted high in the space along the interior wall that is parallel to the adjacent corridor. The two (2) locker rooms adjacent to the Middle School Gym contain older steam cabinet unit heaters mounted high in the space.

The Middle School Auditorium is served by steam H&V units that are original to this portion of the building, circa 1956. There is also a steam unit heater above each of the two stage doors. The rooms surrounding this Auditorium, including Tech Education, Social Studies, Art and Home Economics are heated by steam unit ventilators. The Tech Education rooms and Social Studies also contain steam unit heaters for supplemental heat. The Music Room and offices in this area are served by a small rooftop unit, and the adjacent Band Room is served by a newer ceiling-mounted steam heating unit ventilator, with DX split cooling.

The Media Center and Main Office / Computer Lab / Social Studies additions and modifications are heated by gas-fired packaged rooftop HVAC units. These units were installed circa 2002 and are in good condition. This equipment is about halfway through its expected service life of 15 years.

The 2002 elementary school addition houses mostly classrooms heated by floor mounted hot water unit ventilators installed at that time. The Computer Lab and Media Center located in that wing are heated by a gas-fired packaged rooftop HVAC unit. This unit was installed circa 2002 and is in good condition. This equipment is about halfway through its expected service life of 15 years.

In total, the older portions of the school contain approximately forty-five (45) AAF / Herman Nelson or Nesbitt steam unit ventilators that are in fair to poor condition and SWA recommends that these units be replaced.

There are enclosed wall mounted and ceiling mounted finned tube radiation in the corridors, vestibules, toilet rooms. The heating hot water is produced by passing steam from two of the steam boilers through a heat exchanger located in the Boiler Room. The heating water is then pumped out to the various hot water zones by two sets of two (2) supply circulating pumps and one set of three (3) supply circulating pumps, all located in the Boiler Room. There is one (1) condensate receiver and two (2) duplex condensate return pumps in the Boiler Room feeding water back into the feed water tank, which is then pumped to the boilers. There is also a vacuum condensate return pump in the Storage Room below the stairs near the Middle School cafeteria, and another in a pit at the rear of the main lobby. The purpose for these intermediate vacuum pumps is to elevate the condensate returning from the further reaches of the building since the required pitch of the condensate piping would not allow for this condensate to enter the boiler room.

Each unit ventilator contains a heating coil, fan assembly, damper, filter and controls within a metal cabinet. It is the intent of the equipment that it should introduce outdoor air via a grille and damper located on the outside wall. The units are designed to mix room air with outside air, condition the air as required, and delivered to the occupied space. The older wall mounted AAF / Herman Nelson and Nesbitt unit ventilators deliver the air directly through a grille on the top of the unit.

The heating steam is produced by three (3) Weil-McLain cast iron sectional steam boilers located in the Boiler Room in the basement of the original building. The boilers are of similar capacity. The boilers were installed in the year 2002, approximately. According to their age, the boilers have about 23 years remaining on their expected service life of 30 years, as published in the 2007 ASHRAE HVAC Applications Handbook. The burners were installed in 2002 and are less than halfway through their expected service life of 20 years.

Two of the Three Steam Boilers

The steam portions of the heating system return steam condensate back to intermediate vacuum pumps and eventually receivers located in the Boiler Room. In addition, the steam supply lines are served by various steam traps to remove steam condensate that collects in the supply lines. This practice is typical for a steam heating system, although it should be noted that these traps are often the source of operations and maintenance issues within the system. The steam condensate is piped to two (2) separate condensate receiver tanks in the boiler room, each containing a duplex pump set to return

the condensate back to an elevated feed-water tank, from which it is pumped back to the boilers. It is assumed that the receivers were installed with the boilers in 2001, are in fair condition and are about half way through their expected service life of 15 years. There is one exception to this statement - a receiver and pump set in the Boiler Room that appears to be older than the others. SWA recommends that this equipment is replaced as part of a capital improvement plan in the Livingston Public Schools, since they are nearing the end of their service life.

Duplex Condensate Receiver Pump Set In Boiler Room

It is assumed that the circulating pumps were originally installed when the latest classroom addition was built. SWA recommends that the pump motors are replaced with premium efficiency motors.

The building contains a Johnson Controls Metasys EMS system to monitor the older equipment and control the newer equipment, and that can communicate with the district-wide EMS system.

There weren't any complaints about the ability of the heating system to provide adequate heat to the building occupants. It was reported that the areas of the building heated by the steam system overheat while the system is operating. It was also observed that the air compressor serving the pneumatic controls system runs constantly. The expected service life of a pneumatic controls system is 20 years per 2007 ASHRAE HVAC Applications Handbook. Based on these facts, SWA recommends that the pneumatic controls system is replaced with a Direct Digital Control (DDC) system, including thermostats to control the steam valves at the new unit ventilators and the equipment in the Boiler Room and the remainder of the school. The new controls in the building should be an extension of the existing Johnson Controls Metasys EMS system.

A wholesale conversion of the older portions of the building heated by steam to hot water is feasible but expensive. There is a good chance of reduction of maintenance, the avoidance of other pipe and accessory replacement, and increased occupant comfort if this system conversion were to take place. Plus, due to the ability to more closely control the system and the reduction of standby losses that are common with steam systems, there is a good chance of reduction of energy consumption. Unfortunately this reduction is very difficult to quantify. Further, due to the prohibitive cost for installing new piping and the required central plant changes, the payback period is roughly estimated to be several decades.

2.4.2. Cooling

The majority of the school is not provided with cooling.

The Music Room and offices in this area are cooled by a small rooftop unit, and the adjacent Band Room is served by a newer ceiling-mounted steam heating unit ventilator, with DX split cooling.

The Media Center and Main Office / Computer Lab / Social Studies additions and modifications are cooled by gas-fired packaged rooftop HVAC units with VVT controls. These units were installed circa 2002 and are in good condition. This equipment is about halfway through its expected service life of 15 years.

The Computer Lab and Media Center in the 2002 elementary school addition are cooled by a gas-fired packaged rooftop HVAC unit with VVT controls. This unit was installed circa 2002 and is in good condition. This equipment is about halfway through its expected service life of 15 years.

There is a small section of 5 classrooms on the second floor that were reconstructed in 2002. Two (2) of these unit ventilators contain newer steam heating / split system DX cooling AAF unit ventilators.

There were approximately 5 window air conditioning units in the offices, Faculty Lounge and one of the classrooms in the Elementary School. There are also window air conditioning units noted in the World Language classroom on the second floor of the Middle School and another classroom across the hall from this room. There is a window unit in the second floor classroom adjacent to the Middle School Gym (above the Boy's locker room). Most of the window air conditioning units are 1- 10 years old, and are generally in good condition, however, a few are noted to be in fair to poor condition. The unit in the Faculty Lounge was noted to be Energy Star rated.

2.4.3. Ventilation

As mentioned above, the grilles on the AAF / Herman Nelson and Nesbitt unit ventilators provide fresh air to the occupied space. SWA recommends that the older equipment be replaced as part of a capital improvement project, and that the new equipment is provided with a means of providing a code compliant level of outside air to the spaces. For example, due to a grade elevation issue versus the exterior window of one of the classrooms near the new Middle School office block, there isn't any fresh air provided to the room's unit ventilator.

The Middle School Cafeteria is ventilated by floor mounted steam unit ventilators mounted on the exterior walls. The Elementary School Gym / Cafeteria is ventilated by four (4) steam H&V units mounted high in the space, one in each corner. The Middle School Gym is ventilated by four (4) steam H&V units mounted high in the space, all along the outside wall.

The Middle School Auditorium is ventilated by steam H&V units that are original to this portion of the building, circa 1956.

The Music Room and offices in this area are ventilated by a small rooftop unit, and the adjacent Band Room is ventilated by a newer ceiling-mounted steam heating unit ventilator with a duct leading to a wall louver. It is assumed that this equipment provides code compliant fresh air due to its age.

The Media Center and Main Office / Computer Lab / Social Studies additions and modifications are ventilated by gas-fired packaged rooftop HVAC units. These units were installed circa 2002 and are in good condition. It is assumed that this equipment provides code compliant fresh air due to its age.

The 2002 elementary school addition houses mostly classrooms ventilated by floor mounted hot water unit ventilators installed at that time. The Computer Lab and Media Center located in that wing are ventilated by a gas-fired packaged rooftop HVAC unit. It is assumed that this equipment provides code compliant fresh air due to its age.

There are three (3) science classrooms with hoods in a portion of the school that was reconstructed in 2002 and that are in the wing adjacent to the Middle School Offices. Each hood is exhausted by a rooftop exhaust fan and the associated classroom is provided with makeup air from a rooftop gas-fired makeup air unit.

One of the Tech Education classrooms has a ducted dust collection system whose exhaust fan and collection tank are located outside the classroom. This system is in fair to poor condition and should be replaced as part of a capital improvement project in the Livingston Public Schools.

The building has a number of exhaust fans that do not operate. SWA recommends that this equipment is replaced as part of the End of Life Cycle ECM#8, and that it is designed to provide code minimum ventilation rates.

Dust Collection System at Tech Education Classroom

2.4.4.Domestic Hot Water

The domestic water for the school is provided by two (2) gas-fired, A.O. Smith Cyclone, 100 gallon tank-type water heaters. These units are sealed combustion, direct-vent type, with PVC combustion flue and combustion air intake penetrating the roof of the Boiler Room. This equipment was manufactured in 2008 and is high efficiency, so it is assumed that no energy savings opportunities are available here.

Domestic Water Heaters

2.5. Electrical systems

2.5.1. Lighting

Interior Lighting - The Mount Pleasant Schools building currently consists of mostly T8 fluorescent fixtures with electronic ballasts. Based on measurements of lighting levels for each space, there are not any vastly over-illuminated areas. SWA recommends installing occupancy sensors in bathrooms, closets, offices and areas that are occupied only part of the day and payback on savings are justified. Typically, occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion or sound is detected within a set time period. SWA recommends replacing gymnasium Metal Halide fixtures with T5 fixtures. See attached lighting schedule in Appendix A for a complete inventory of lighting throughout the building and estimated power consumption.

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

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be mostly a mix of Metal Halide and High Pressure Sodium fixtures. The exterior lighting is controlled by photocells. SWA does not recommend replacing these lights at this time since they are designed for building occupant safety and security. Also, SWA does not recommend at this time any upgrades to the exterior photocells.

2.5.2. Appliances and process

Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. For example, Energy Star refrigerators use as little as 315 kWh / yr. When compared to the average electrical consumption of older equipment, Energy Star equipment results in a large savings. Building management should select Energy Star label appliances and equipment when replacing: refrigerators, printers, computers, copy machines, etc. More information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov. Also, energy vending miser devices are now available for conserving energy usage by Drinks and Snacks vending machines. When equipped with the vending miser devices, vending machines use less energy and are comparable in daily energy performance to new ENERGY STAR qualified machines.

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

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

Commercial Kitchen Equipment

There are several pieces of refrigeration equipment located in the kitchen, including an ice machine, solid chest freezer, residential refrigerator, (4) reach-in soft drink refrigerated merchandisers, a chest type ice cream freezer, and a stainless steel 6-door refrigerator. This equipment all seems to be in fair to good condition. There is also a walk-in box that is approximately 10'wide x 10' deep. This unit appears to be at least 15-20 years old

There are also several pieces of commercial-style cooking equipment, including a gas-fired 4-burner range, a fryer, (2) small top-bottom 4-rack ovens, (2) microwave ovens, an electric conveyor pizza oven and a tall heated storage cabinet. There is a large kitchen hood provided for this equipment. There is also a residential 4-burner gas range. There is also a commercial kitchen style dishwasher with hood. It does not appear that any dedicated makeup air is provided for the kitchen hoods. The makeup air is likely provided via transfer from the adjacent Elementary School Gym H&V units or via infiltration from nearby exterior doors and windows.

2.5.3. Elevators

The Mount Pleasant Middle School has an elevator for ADA purposes, manufactured by Dover, which is now part of ThyssenKrupp Elevator Co., capacity of 4500 lbs., 2 landings / 2 openings, with a submersible hydraulic pump motor, 30 HP, Model EP-125-30. The school also has an ADA chair lift for another part of the building.

2.5.4. Others electrical systems

There are not currently any other significant energy impacting electrical systems installed at the Mount Pleasant Schools building.

3. EQUIPMENT LIST

Inventory

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	(2) boilers, steam, with hot water heat exchangers	Boiler Room	Weil-McLain M#2594 5411 MBH output (steam)	Natural Gas	Building	Approx 2002	75%
Heating	(1) boiler, steam	Boiler Room	Weil-McLain M#2494 5186 MBH output (steam)	Natural Gas	Building	Approx 2002	75%
Heating	(3) boiler burners	Boiler Room	Power Flame M# WCR5-G-30 8660 MBH output	Natural Gas	Building	Approx 2002	65%
Domestic hot water	(2) Hot water heaters	Boiler Room	A.O. Smith - Cyclone Xi M# BTH-150-100 100 gallons 150 MBH input	Natural Gas	Building	2008	95%
Heating	(16) hot water unit ventilators	Elem. School class-rooms	AAF/Herman Nelson	Electric	2002 addition classrooms and several previous addition(s) classrooms	Est. 2002	70%
Heating	(13) Steam Unit Ventilators	Elem. School class-rooms	AAF/Herman Nelson	Electric	Elementary school classrooms	Circa 1964	0%, operating past expected useful life
Heating	(4) Steam H&V Units	Elem. Gym	Nameplate Not Accessible	Electric	Elementary School Gym/Cafeteria	Circa 1964	0%, operating past expected useful life
Heating	(4) Steam H&V Units	Middle School Gym	Nameplate Not Accessible	Electric	Middle School Gym	Circa 1964	0%, operating past expected useful life
Heating	(2) Steam H&V Units	MS Auditorium	Nameplate Not Accessible	Electric	Auditorium	Circa 1956	0%, operating past expected useful life
Heating	Radiators	various class-rooms	Unknown	Electric	Various elementary school classrooms and gym/cafeteria	Circa 1964	0%, operating past expected useful life

continued on the next page

continued from the previous page

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	(2) steam ceiling cabinet unit heaters	Elem. Corridors	Unknown	Electric	Elementary school corridors	Circa 1964	0%, operating past expected useful life
Heating	(3) Boiler feed pumps	Boiler Room	Base mounted return pumps: Bell & Gossett M# varies 1/2 HP ea.	Electric	Building	Unknown	est. 50%
Heating	(2) Circulator pumps, from heat exchanger #1	Boiler Room	Pipe mounted supply pumps, Baldor M# VM3157 1-1/2 HP ea.	Electric	Building	Unknown	est. 50%
Heating	(2) Circulator pumps, from heat exchanger #2	Boiler Room	Pipe mounted supply pumps, WEG, 3 HP Marathon Electric, 2 HP	Electric	Building	Unknown	est. 50%
Heating	(2) Condensate Receivers	Boiler Room	A.O. Smith M# C48H2EC15A1 1/3 HP ea.	Electric	Building	Unknown	est. 50%
Heating	Vacuum pump & condensate receiver	Boiler Room	Hoffman Series HV, Model 2CHV2-2C-35, 30 GPM, @ Hp pump	Electric	Building	Unknown	0%, operating past expected useful life
Domestic hot water	(1) Hot water recirculation pump	Boiler Room	Bell & Gossett 1/12 HP	Electric	Building	2008	95%
Heating / Cooling	(1) RTU	Media center roof (Elem. School)	AAON M# RK-16-2-E0-32M 390 MBH input 316 MBH output (2) Cond. 3/5 hp ea. Evap. 5 hp Power Ex. 3 hp	Natural Gas	Elementary school media center	2002	50%
Cooling	(2) Condensing Units	Roof - middle school	York 1 - M# H2RA036S06E 2 - M# H1RA042S06D	Electric	Middle school - 2nd floor roof above computer lab & World Language	2002	60%

continued on the next page

continued from the previous page

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Cooling	Condensing Unit	Roof - middle school	Sanyo M# SAP243C	Electric	Middle school - 2nd floor roof above Classrooms near Elevator	Unknown	20%
Ventilation	(2) Make-up air units	Roof - middle school	Sterling / Kees M# MUA-9 1/2 HP ea.	Natural Gas	Science rooms (hoods) 1st floor, middle school	2002 (?)	65%
Ventilation	Make up air unit	Roof - middle school	Sterling / Kees M# MUA-10 1-1/2 HP	Natural Gas	2nd Floor Science Room (Hood)	2002	65%
Heating / Cooling	RTU	Roof - middle school	Carrier M# 48HJD008Z--541BW 92-125 MBH input 75.44-102.5 MBH output	Natural Gas	Middle school computer labs adjacent to 2002 office addition	2001	45%
Heating / Cooling	RTU	Roof - middle school	Aaon M# RK-15-2-E0-32M 270 MBH input 219 MBH output	Natural Gas	Middle School Media Center	2001	45%
Heating / Cooling	RTU	Roof - middle school	Carrier M# 48HJE004Z--541BW 50-72 MBH input 41-59.05 MBH output	Natural Gas	Middle School music room behind auditorium stage	2001	45%
Heating / Cooling	RTU	Roof - middle school	Carrier M# 48HJE012Z--571BW	Natural Gas	Middle school offices, 2002 addition	2001	45%
Cooling	(8) window AC units throughout the building	various class-rooms	Varies, Approx. 1-2 tons each	Electric	various classrooms throughout building	varies	varies, estimating 50%
Cooling	(2) Condensing Units	Roof - middle school	Unknown (nameplate worn away) M# WAKA-042CAS	Electric	Middle school band rehearsal room and stage	1996	30%
Ventilation	80+/- rooftop exhaust fans; additional exhausts for kitchen and bathrooms	Roof	Varies	Electric	Throughout building	varies	0%-50%

continued on the next page

continued from the previous page

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	(4) Condensate vacuum pumps	Pump pit #1 & #2 below stair-well(s)	US Electric 1-1/2 HP ea.	Electric	building	unknown	est. 50%
Heating	(4) Condensate pumps	Pump pit #1 & #2 below stair-well(s)	(2) Marathon 1 HP ea. (2) Baldor 2 HP ea.	Electric	Building	Unknown	est. 50%
Heating	(10) hot water unit ventilators	Middle school science & 2nd flr class-rooms	AAF/Herman Nelson	Electric	Middle school science classrooms and 2nd floor classrooms	Est. 2002	70%
Heating	(31) Steam Unit Ventilators	Middle school class-rooms	AAF/Herman Nelson	Electric	Middle school classrooms, 1st & 2nd floors, and Cafeteria	Circa 1964	0%, operating past expected useful life
Heating	Radiators	various class-rooms	Unknown	Electric	Various middle school classrooms and gym/cafeteria	Circa 1964	0%, operating past expected useful life

continued on the next page

continued from the previous page

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	(14) steam ceiling cabinet unit heaters	Middle school rooms and corridors	Unknown	Electric	Middle school rooms and corridors	Circa 1964	0%, operating past expected useful life
Ventilation	Dust collection system	Tool education room	Unknown	Electric	Tool education room	unknown	Est. 25%
Heating	Ceiling Unit Ventilator	Band rehearsal	Nesbitt (nameplate not accessible during survey)	Electric	band rehearsal room	Est. 2002	70%
Refriger.	Ice machine	Kitchen	Scotsman (nameplate info not accessible during survey)	Electric	Kitchen	Circa 2002	Est 60%
Refriger.	Chest Freezer	Kitchen	Huer M# HCM050JA 115V 1ph. R-134a	Electric	Kitchen	Circa 2002	Est 60%
Refriger.	Refrigerator	Kitchen	GE Refrigerator M# GTS21KBXAWW S# LS 130943	Electric	Kitchen	Unknown	Good Condition, Est. 80%
Refriger.	Walk-in Box	Kitchen	Unknown	Electric	Kitchen	Est 1990s	Est. 20%
Refriger.	(2) Reach-in coolers	Kitchen	Beverage Air M# MT38 115V 1ph. 10.5A R-134a	Electric	Kitchen	Est. 2002	Est. 60%
Refriger.	Reach-in ice cream chest freezer	Kitchen	AHT M# R10S100	Electric	Kitchen	Unknown	Good Condition, Est. 75%

continued on the next page

continued from the previous page							
Building System	**Description**	**Location**	**Model #**	**Fuel**	**Space Served**	**Year Installed**	**Estimated Remaining Useful Life %**
Refriger.	Aquafina Reach-in Merchandiser	Kitchen	Unknown (nameplate not accessible)	Electric	Kitchen	Unknown	Good Condition, Est. 75%
Refriger.	Glass Door Merchandiser	Kitchen	True Model GDM-37 1/2 Hp, 115v-1 phase 8.9A	Electric	Kitchen	Unknown	Good Condition, Est. 75%
Refriger.	6 Door Stainless Steel Cooler	Kitchen	Koch M# M6 S# 859717005 115V 3A	Electric	Kitchen	Unknown	Est. 50%
Pneumatic Controls	Air Compressor	Boiler Room	Quincy Model QC01008D; duplex 1 hp (lead-lag) on 80 gallon tank	Electric	Building	Unknown	0%, operating past expected useful life
Elevator	ADA Elevator with capacity of 4500 lbs., 2 landings / 2 openings, with a submersible hydraulic pump motor, 30 HP	Middle School	Dover, which is now part of ThyssenKrupp Elevator Co., Model EP-125-30, Serial #EE0343	Electric	Middle School	Circa 2002	Est. 75%
Lighting	See details - Appendix A	building	-	Electric	Building	varies	varies, average 60%

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

4. ENERGY CONSERVATION MEASURES

Based on the assessment of the Livingston Mount Pleasant Schools, SWA has separated the investment opportunities into three recommended categories:

1. Capital Improvements - Upgrades not directly associated with energy savings
2. Operations and Maintenance - Low Cost / No Cost Measures
3. Energy Conservation Measures - Higher cost upgrades with associated energy savings

Category I Recommendations: Capital Improvements

- Replace unit ventilators - There are 45 AAF / Herman Nelson steam unit ventilators originally installed in the original building or its early additions. All of these units are well beyond their expected service life. Considering the increased maintenance repair costs and that replacement parts are difficult to find, SWA recommends replacement of this equipment. There is better control offered by the newer, electronically controlled units, although energy savings are negligible.

  The 45 AAF / Herman Nelson unit ventilators are operating beyond their useful operating lives. SWA evaluated replacement of all 45 units with new. The updated fan coils should be double inlet, forward curved of centrifugal variety; have a maximum speed of 1,000 rpm with permanent split capacitor motors. The fan housing should be constructed of heavy gauge metal to help reduce air noise during operation. Wheel motors are to be premium efficiency, single speed, permanent split capacitor with overload protection. Each fan should be equipped with a three speed switch for air balancing. An ultra-low leak, blade type outside air damper will ensure low leakage of the outside air when the equipment is not operating. The unit shall have a solid-state defrost control system and two separate filters. The provided air-to-air heat exchanger should be designed to support two air streams in a counter-flow direction. The heat exchanger matrix shall permit less than one percent of cross contamination between the air streams. The heat exchanger shall have an effectiveness of approximately 80% with equal airflow. The proposed unit will not be that much more energy efficient than the existing unit. The estimated budget installed cost of 45 new fan coil ventilators is $420,000. The recommended enhancements over the replacement in kind (with pneumatic controlled units) will offer negligible energy savings.

  The Livingston Public Schools may wish to consider adding DX cooling as part of the equipment replacement as seen in the later additions to the school. In this case, it should be recognized that cooling will result in an increase in energy usage versus providing heating and ventilation only.

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

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

- Upgrade Building Management System (BMS) - Currently, the building is controlled by an antiquated, pneumatic temperature control system and only monitored and partly controlled (2002 equipment) by a more modern Direct Digital Control system. The BMS should be expanded and upgraded to control the new unit ventilators and other equipment replaced as part of the capital improvement recommendations. This upgrade will result in energy savings via improved temperature control and by the elimination of the air compressors. This recommendation will ensure that the retro-commissioning estimated savings (per ECM#5) are maintained and reproducible.

- Replace (4) H&V units serving the Elementary School Gym - The steam heating only ventilation system for the Elementary School Gym is beyond its expected service life. SWA recommends that this equipment is replaced as part of a capital improvement project, and that it is designed to provide code minimum ventilation rates. The Livingston Public Schools may wish to consider providing DX cooling as part of this system to make the room more functional in warm weather, but should recognize that this will increase energy usage versus providing a heating and ventilation system only. If cooling is desired, it is strongly recommended that a system is provided that utilizes a heat recovery wheel for pretreatment of the outside air. This is a replacement in kind recommendation which offers negligible energy savings.

- Replace (4) H&V units serving the Middle School Gym - The steam heating only ventilation system for the Middle School Gym is beyond its expected service life. SWA recommends that this equipment is replaced as part of a capital improvement project, and that it is designed to provide code minimum ventilation rates. The Livingston Public Schools may wish to consider providing DX cooling as part of this system to make the room more functional in warm weather, but should recognize that this will increase energy usage versus providing a heating and ventilation system only. If cooling is desired, it is strongly recommended that a system is provided that utilizes a heat recovery wheel for pretreatment of the outside air. This is a replacement in kind recommendation which offers negligible energy savings.

- Replace (2) H&V units serving the Auditorium - The steam heating only ventilation system for the Auditorium is beyond its expected service life. SWA recommends that this equipment is replaced as part of a capital improvement project, and that it is designed to provide code minimum ventilation rates. The Livingston Public Schools may wish to consider providing DX cooling as part of this system to make the room more functional in warm weather, but should recognize that this will increase energy usage versus providing a heating and ventilation system only. If cooling is desired, it is strongly recommended that a system is provided that utilizes a heat recovery wheel for pretreatment of the outside air. This is a replacement in kind recommendation which offers negligible energy savings.

- Replace dust collection system and associated ductwork in Tech Education classroom. This is a replacement in kind recommendation which offers negligible energy savings (since system is operated only a few hours/year) even when upgrading the low Hp blower motor to a NEMA premium motor.

- Replace windows - SWA evaluated, as part of a capital improvement plan, replacing approximately 48 single-pane windows with newer models with thermal breaks, dual glazing and a low-e rating. Proper flashing and caulking should be performed upon installation of the new windows.

  Most of the building contains double glazed windows found to be in good condition. Sections of the building contain approximately 48 single-pane fixed and casement aluminum-framed windows with single-glazing. These windows appear to be original to the building. In context of other energy measures proposed in this report and in an effort to maximize the cost-benefit factor for improvements, SWA recommends that these 48 windows be replaced with the next major capital improvement / renovation project. Windows considered for replacement should have the following

outline specifications besides conforming to local code and regulations: the windows shall be aluminum frame thermally manufactured as double hung commercial type modules. The clear, low-e, argon filled dual glazing should be 2 independent panes. The walls should be extruded aluminum with integral poured-in-place thermal barrier. All horizontal rails should be of tubular shape and joinery should be butted and coped with stainless steel screws. Air infiltration shall not exceed 0.10 cfm/sf of unit. The conductive thermal transmittance (U-Value) shall not be more than 0.51 Btu/hr sq ft °F.

An E-Quest model was performed to estimate energy savings with the new proposed windows. The assumptions made in the E-Quest model were that existing window U-Value is 1.09 Btu/hr sq ft °F vs. the improved thermally insulated window U-Value of 0.51 Btu/hr sq ft °F. The installed cost of approximately 48 replacement school building window units of the type outlined above is estimated to cost $96,000, based on RS Means 2009 (Building Construction Cost Data) and similar projects, which would provide $1,508 annual energy savings and a 64 year simple payback, which could reduce the building's energy requirements by at least 0.5 kBtu/sq ft yr. The Livingston Public Schools are eligible for a 40% state grant, which will decrease the new windows simple payback to 38 years when the December bond referendum passes. Window replacement rebates and tax incentives are available only for residential buildings at this time. This investment cannot be justified by energy savings alone and should be considered as part of a major renovation plan.

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

- Insulate exterior walls and roof - During the next major construction, SWA recommends insulating the exterior walls of at least the original structure by adhering 2" polyiso boards (Polyisocyanurate) together with furring strips and gypsum wall boards to the inside of the painted CMU walls.

  SWA recommends adding 10" of fiberglass insulation at the interior or 3"exterior XPS during future reroofing. SWA also recommends the EPDM areas of the roof to be replaced due to age and condition. Cracked seams were detected and overall it looks that the roof has reached its expectant life span. SWA recommends replacement of the 1992 roof sections with an Energy Star certified membrane and insulation (3" rigid) assembly. Maintenance should be performed at regular intervals with a roofing contractor to prevent future roof leaks. It is also advisable to upgrade any questionable roof integrity areas before photovoltaics are installed, as any repairs after the system is installed will be costly.

  An E-Quest model was performed to estimate energy savings with the new proposed roof. The assumptions made in the E-Quest model were that the existing roof U-Value is 0.475 Btu/hr sq ft °F vs. the new EPDM - 3" XPS insulated roof U-Value of 0.069 Btu/hr sq ft °F. The estimated 77,390 sq ft insulated roof replacement cost is approximately $773,900, based on RS Means 2009 (Building Construction Cost Data) and similar projects, which would provide $32,788 annual energy savings and a 24 year simple payback, which could reduce the building's energy requirements by at least 15.9 kBtu/sq ft yr. The Livingston Public Schools are eligible for a 40% state grant, which will decrease the new roof simple payback to 14 years when the December bond referendum passes.

- Upgrade building per ADA requirements - SWA recommends that the Livingston Board of Education do as much as possible to comply with the latest ADA regulations.

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

Category II Recommendations: Operations and Maintenance

- Replace steam traps - on steam supply piping throughout the portions of the building that are served by the steam heating system. These traps are subject to corrosion and blockages and are often the source of operations and maintenance issues within the system. In addition, these traps should be inspected and maintained on a regular basis.

- Boiler room and building piping insulation - Insulate un-insulated steam and hot water piping to efficiently deliver heat where required and provide personnel protection.

- Inspect and replace gaskets around doors into walk-in refrigeration box in the Kitchen. Ineffective gaskets allow infiltration of warm air into the walk-in box, which increases the run-time of the compressors.

- Asbestos abatement - Abate asbestos insulating old piping and other building systems per local codes and regulations.

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

- Maintain downspouts - Repair / install missing downspouts as needed to prevent water / moisture infiltration and insulation damage.

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

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

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

- Use Energy Star labeled appliances - such as Energy Star refrigerators that should replace older energy inefficient equipment.

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

- Create an energy educational program - that teaches how to minimize their energy use. The US Department of Energy offers free information for hosting energy efficiency educational programs and plans, for more information please visit: http://www1.eere.energy.gov/education/

Category III Recommendations: Energy Conservation Measures

Summary table

ECM#	Description of Highly Recommended 0-5 Year Payback ECMs
1	install Drinks and Snacks vending machine energy misers
2	replace motors with premium efficiency type on refrigerated walk-in box
3.1, 3.2 & 3.3	replace motors with premium efficiency type on heating hot water circulating pumps
4.1 & 4.2	install occupancy sensors and replace gymnasium Metal Halide lamps with T5 fixtures
5	retro-commission mechanical equipment
	Description of Recommended 5-10 Year Payback ECMs
6	install 248 kW PV rooftop system
	Description of Recommended End of Life Cycle ECMs
7	replace old commercial refrigerator and freezer with an Energy Star models
8	replace exhaust fans with premium efficiency units
9	Replace condensate receiver and vacuum pump

ECM#1: *Install Vending Misers*

Description:

The Mount Pleasant Schools building has one Drinks and two Snacks vending machines, besides the four Drinks refrigerated coolers in the Cafeteria. Energy vending miser devices are now available for conserving energy with these vending machines and coolers. There isn't a need to purchase new machines to reduce operating costs and greenhouse gas emissions. When equipped with the vending miser devices, refrigerated beverage vending machines use less energy and are comparable in daily energy performance to new ENERGY STAR qualified machines. Vending miser devices incorporate innovative energy-saving technology into small plug-and-play devices that installs in minutes, either on the wall or on the vending machine. Vending miser devices use a Passive Infrared Sensor (PIR) to: Power down the machine when the surrounding area is vacant; Monitor the room's temperature; Automatically repower the cooling system at one- to three-hour intervals, independent of sales; Ensure the product stays cold.

Snacks vending miser devices can be used on Snacks vending machines to achieve maximum energy savings that result in reduced operating costs and decreased greenhouse gas emissions with existing machines. Snacks vending miser devices also use a Passive Infrared Sensor (PIR) to determine if there is anyone within 25 feet of the machine. It waits for 15 minutes of vacancy, then powers down the machine. If a customer approaches the machine while powered down, the snacks vending miser will sense the presence and immediately power up.

Installation cost:

Estimated installed cost: $1,753
Source of cost estimate: www.usatech.com *and established costs*

Economics (without incentives):

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1	install 1 Drinks, 2 Snacks vending machine and 4 reach-in Drink cooler energy misers - in cafeteria	www.usatech.com and established costs	1,753	none at this time	1,753	8,834	2.4	0	0.2	0	1,405	12	16,855	1.2	862	72	80	12,228	12,103

Assumptions: SWA assumes energy savings based modeling calculator found at www.usatech.com or http://www.usatech.com/energy_management/energy_calculator.php

Rebates/financial incentives:

This measure does not qualify for a rebate or other financial incentive at this time.

Options for funding ECM:

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

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

ECM#2: *Install Premium Efficiency Motors on Refrigerated Walk-In Box*

Description:

There is one walk-in cooler box in the Kitchen of the Mount Pleasant Schools. Typically, the evaporator and condenser fans of walk-in coolers will run 24 hours per day, 7 days per week. The motors on these fans are standard efficiency, shaded pole motors. There are (3) evaporator cooler fans motors and (3) condenser fan motors. Nameplates were not very legible and it is assumed that three (3) of the motors are 1 Hp and three (3) of the motors are fractional horsepower. The Mount Pleasant Schools will realize energy savings by utilizing premium efficiency motors for these fans.

Installation cost:

Estimated installed cost: $1,527
Source of cost estimate: Similar projects and DOE Motor Master International selection & savings analysis

Economics (with incentives):

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
2	replace (3) 1 Hp cond fan and (3) frac Hp motors with Premium Efficiency on walk-in refrigerated box	similar projects, DOE Motor Master + International	1,662	135	1,527	3,350	0.9	0	0.1	0	533	20	10,653	2.9	598	30	35	6,397	4,590

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. The DOE Motor Master International selection and calculator was used with the assumption that all of the fans operate for 8,760 hours per year.

Rebates/financial incentives:

NJ Clean Energy - Premium three-phase motors ($45-$700 per motor)
Maximum incentive amount is $135.

Options for funding ECM:

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

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

ECM#3: *Install Premium Efficiency Motors on Heating / Hot Water Circulators*

Description:

The boiler room houses two sets of two (2) pipe-mounted circulator pumps as part of the hot water heating system to serve the hot water unit ventilators and other hot water terminal units listed in this report. The pumps are in relatively good condition. One pair of pumps is 3 Hp and 2 Hp, and the other two pumps are 1-1/2 Hp each, and each set operates in a lead-lag fashion. The pump motors are standard efficiency. The Mount Pleasant Schools will realize energy savings by utilizing premium efficiency motors for the pumps.

Installation cost:

Estimated installed cost: $1,079
Source of cost estimate: Similar projects and DOE Motor Master International selection & savings analysis

Economics (with incentives):

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
3.1	replace (1) 3 Hp hot water circulator pump motors with Premium Efficiency	similar projects, DOE Motor Master + International	360	54	306	556	0.2	0	0.0	0	88	20	1,768	3.5	478	24	29	1,009	762
3.2	replace (1) 2 Hp hot water circulator pump motors with Premium Efficiency	similar projects, DOE Motor Master + International	325	54	271	330	0.1	0	0.0	0	52	20	1,049	5.2	287	14	19	510	452
3.3	replace (2) 1-1/2 Hp hot water circulator pump motors with Premium Efficiency	similar projects, DOE Motor Master + International	610	108	502	584	0.2	0	0.0	0	93	20	1,857	5.4	270	13	18	879	800

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. The DOE Motor Master International selection and calculator was used with the assumption that one of each set of heating water pumps operates for the heating

season. According to weather bin data for Newark, each set of pumps considered should operate for approximately 5,000 hours per year. For the calculations regarding the pair of motors that is 2 Hp and 3 Hp, we assumed 2,500 annual hours of operation each.

Rebates/financial incentives:

NJ Clean Energy - Premium three-phase motors ($45-$700 per motor)
Maximum incentive amount is $216.

Options for funding ECM:

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

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

ECM#4: *Building Lighting Upgrades*

Description:

On the days of the site visits, SWA completed a lighting inventory of the Mount Pleasant Schools building (see Appendix A). The existing lighting consists of mostly T8 fluorescent fixtures with electronic ballasts. Many of the lights in the Mount Pleasant Schools building appear to have been upgraded to T8 fixtures. SWA has performed an evaluation of installing occupancy sensors in large spaces, offices and bathrooms that may be left unoccupied a considerable amount of time throughout the day and installing T5 fixtures in place of Metal Halide gymnasium lighting. The labor in all these installations was evaluated using prevailing electrical contractor wages. The Livingston Board of Education may decide to perform this work with in-house resources from its Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor, to obtain savings.

Installation cost:

Estimated installed cost: $11,256
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

Economics (Some of the options considered with incentives):

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
4.1	replace gym Metal Halide lamps with (24) T5 fixtures	RS Means, Lit Search, NJ Clean Energy Program	6,240	384	5,856	15,677	4.3	0	1.1	140	2,633	15	37,390	2.2	574	38	45	25,572	21,477
4.2	install (27) occupancy sensors	RS Means, Lit Search, NJ Clean Energy Program	5,940	540	5,400	5,110	1.4	0	0.4	0	812	12	9,750	6.6	81	7	11	2,688	7,001

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

Rebates/financial incentives:

NJ Clean Energy - Wall Mounted occupancy sensors ($20 per control)
Maximum incentive amount is $540.

NJ Clean Energy - T5 and T8 lamps with electronic ballast in existing facilities ($10-30 per fixture, depending on quantity and lamps)
Maximum incentive amount is $384.

Options for funding the Lighting ECM: *This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.*

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

ECM#5: *Retro-Commissioning*

Description:

Retro-commissioning is a process that seeks to improve how building equipment and systems function together. Depending on the age of the building, retro-commissioning can often resolve problems that occurred during design or construction and / or address problems that have developed throughout the building's life. Owners often undertake retro-commissioning to optimize building systems, reduce operating costs, and address comfort complaints from building occupants.

Since the systems at the Mount Pleasant Schools building have undergone some renovations in recent years, and the building continues to have concerns with thermal comfort control, SWA recommends undertaking retro-commissioning to optimize system operation as a follow-up to completion of the upgrades. The retro-commissioning process should include a review of existing operational parameters for both newer and older installed equipment. During retro-commissioning, the individual loop temperatures should also be reviewed to identify opportunities for optimizing system performance.

Installation cost:

Estimated installed cost: $101,630
Source of cost estimate: Similar projects

Economics (without incentives):

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
5	retro commission-ing	similar projects	101,630	none at this time	101,630	27,980	7.7	10,912	8.8	1,820	22,899	12	252,952	4.4	170	14	20	126,310	38,333

Assumptions: Since the utility bills have some accounting fluctuations, it is difficult to determine the amount of energy used for heating and cooling the Mount Pleasant Schools building. Based on experience with similar buildings, SWA estimated the heating and cooling energy consumption. Typical savings for retro-commissioning range from 5-20%, as a percentage of the total space conditioning consumption. SWA assumed 10% savings. Estimated costs for retro-commissioning range from $0.50-$2.00 per square foot. SWA assumed $0.75 per square foot of a

total square footage of 135,507. SWA also assumed on the average 1 hr/wk operational savings when systems are operating per design vs. the need to make more frequent adjustments.

Rebates / financial incentives:

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

Options for funding ECM:

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

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

ECM#6: *Install 248kW PV system*

Description:

Currently, the Mount Pleasant Schools building does not use any renewable energy systems. Renewable energy systems such as photovoltaic panels, can be mounted on the building roofs, and can offset a portion of the purchased electricity for the building. Power stations generally have two separate electrical charges: usage and demand. Usage is the amount of electricity in kilowatt-hours that a building uses from month to month. Demand is the amount of electrical power that a building uses at any given instance in a month period. During the summer periods, when electric demand at a power station is high due to the amount of air conditioners, lights, equipment, etc… being used within the region, demand charges go up to offset the utility's cost to provide enough electricity at that given time. Photovoltaic systems not only offset the amount of electricity use by a building, but also reduce the building's electrical demand, resulting in a higher cost savings as well. SWA presents below the economics, and recommends at this time that Livingston Board of Education further review installing a 248 kW PV system to offset electrical demand and reduce the annual net electric consumption for the building, and review guaranteed incentives from NJ rebates to justify the investment. The Mount Pleasant Schools building is not eligible for a 30% federal tax credit. Instead, the Livingston Board of Education may consider applying for a grant and / or engage a PV generator / leaser who would install the PV system and then sell the power at a reduced rate. PSE&G provides the ability to buy SRECs at $600 / MWh or best market offer.

There are many possible locations for a 248 kW PV installation on the building roofs and away from shade. A commercial multi-crystalline 230 Watts panel (37.0 volts, 8.24 amps) has 17.5 square feet of surface area (13. 1 Watts per square foot). A 248 kW system needs approximately 1,080 panels, which would take up 18,944 square feet. The installation of a renewable Solar Photovoltaic power generating system could also serve as a good educational tool and exhibit for the community.

Installation cost:

Estimated installed cost: $1,925,000
Source of cost estimate: Similar projects

Economics (<u>without</u> NJ 40% debt service aid - pending December referendum approval):

school	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Burnet Hill Elementary	install 120 kW PV rooftop system with incentives	similar projects	932,250	0	932,250	136,459	120	N/A	9.0	0	106,572	25	794,302	8.7	98.3	3.9	8.5	476,728	186,949
Collins Elementary	install 128 kW PV rooftop system with incentives	similar projects	995,000	0	995,000	145,591	128	N/A	10.2	0	110,003	25	575,086	9.0	89.0	3.6	7.9	444,163	199,460
Harrison Elementary	install 45 kW PV rooftop system with incentives	similar projects	349,350	51,000	298,350	51,140	45	N/A	2.7	0	38,885	25	207,116	7.7	123.3	4.9	10.5	211,212	70,061
Hillside Elementary	install 98 kW PV rooftop system with incentives	similar projects	7113,560	0	7113,560	110,890	98	N/A	8.4	0	83,742	25	443,558	9.0	89.2	3.6	7.9	339,294	151,919
Mount Pleasant Schools	install 248 kW PV rooftop system with incentives	similar projects	1,925,000	0	1,925,000	281,1130	248	N/A	7.1	0	211,714	25	1,077,846	9.1	87.4	3.5	7.8	838,484	386,052
Riker Hill Elementary	install 170 kW PV rooftop system with incentives	similar projects	1,319,000	0	1,319,000	193,078	170	N/A	13.6	0	147,465	25	791,791	8.9	91.7	3.7	8.1	614,1137	264,517
Heritage Middle School	install 116 kW PV rooftop system with incentives	similar projects	900,000	0	900,000	131,763	116	N/A	3.0	0	100,868	25	556,698	8.9	92.9	3.7	8.2	426,076	180,515
Livingston High School	install 195 kW PV rooftop system with incentives	similar projects	1,509,745	0	1,509,745	220,996	195	N/A	2.4	0	165,370	25	834,261	9.1	86.4	3.5	7.8	647,147	302,765
Totals			8,687,905	51,000	8,636,905	1,271,708	1,121		56.5	0	964,790		5,110,489					3,997,901	1,742,239

Economics (<u>with</u> NJ 40% debt service aid - pending December referendum approval):

school	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Burnet Hill Elementary	install 120 kW PV rooftop system with incentives	similar projects	932,250	372,900	559,350	136,459	120	N/A	9.0	0	106,572	25	794,302	5.2	230.4	9.2	17.7	849,1138	186,949
Collins Elementary	install 128 kW PV rooftop system with incentives	similar projects	995,000	398,000	597,000	145,591	128	N/A	10.2	0	110,003	25	575,086	5.4	214.9	8.6	17.0	842,163	199,460
Harrison Elementary	install 45 kW PV rooftop system with incentives	similar projects	349,350	190,740	158,610	51,140	45	N/A	2.7	0	38,885	25	207,116	4.1	320.0	12.8	23.7	350,952	70,061
Hillside Elementary	install 98 kW PV rooftop system with incentives	similar projects	7113,560	303,024	454,1136	110,890	98	N/A	8.4	0	83,742	25	443,558	5.4	215.4	8.6	17.0	642,318	151,919
Mount Pleasant Schools	install 248 kW PV rooftop system with incentives	similar projects	1,925,000	770,000	1,155,000	281,1130	248	N/A	7.1	0	211,714	25	1,077,846	5.5	212.3	8.5	16.8	1,608,484	386,052
Riker Hill Elementary	install 170 kW PV rooftop system with incentives	similar projects	1,319,000	527,600	1131,400	193,078	170	N/A	13.6	0	147,465	25	791,791	5.4	219.5	8.8	17.2	1,142,397	264,517
Heritage Middle School	install 116 kW PV rooftop system with incentives	similar projects	900,000	360,000	540,000	131,763	116	N/A	3.0	0	100,868	25	556,698	5.4	221.4	8.9	17.3	786,076	180,515
Livingston High School	install 195 kW PV rooftop system with incentives	similar projects	1,509,745	603,898	905,847	220,996	195	N/A	2.4	0	165,370	25	834,261	5.5	210.7	8.4	16.8	1,251,045	302,765
Totals			8,687,905	3,526,1113	5,161,743	1,271,708	1,121		56.5	0	964,790		5,110,489					7,473,063	1,742,239

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

Rebates/financial incentives:

NJ Clean Energy - Renewable Energy Incentive Program, Incentive based on $1.00 / watt Solar PV application for systems 50kW or less. Incentive amount for this application is $45,000 only for the Mount Pleasant Schoolss.

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

NJ Clean Energy - Solar Renewable Energy Certificate Program. Each time a solar electric system generates 1000kWh (1MWh) of electricity, a SREC is issued which can then be sold or traded separately from the power. The buildings must also become net-metered in order to earn SRECs as well as sell power back to the electric grid. A total Livingston Public Schools $760,200 has been incorporated in the above costs, however it requires proof of performance, application approval and negotiations with the utility.

Options for funding ECM:

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

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

ECM#7: *Replace Old Refrigerators and Freezer with Energy Star Models*

Description:

On the days of the site visits, SWA observed that there are three (3) existing solid door refrigerators and one (1) solid ice cream chest freezer in the kitchen area which are not Energy Star rated (using approximately 773 kWh/yr per refrigerator and 4,300 kWh/yr per freezer). Appliances, such as refrigerators, that are over 10-12 years of age should be replaced with newer efficient models with the Energy Star label. SWA recommends the replacement of the existing refrigerators, freezers and ice cream chest freezers, which are operating at the end of their useful lives with more modern, ENERGY STAR®, energy efficient systems. Besides saving energy, the replacement will also keep the kitchen and other areas cooler. In addition, the existing systems utilize R-12 refrigerant, which is not an ozone-friendly refrigerant. Newer systems should be specified with R-134A or R-404A refrigerant. When compared to the average electrical consumption of older equipment, Energy Star equipment results in large savings. Look for the Energy Star label when replacing appliances and equipment, including: window air conditioners, refrigerators, printers, computers, copy machines, etc. More information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov.

Installation cost:

Estimated installed cost: $4,950
Source of cost estimate: *Energy Star purchasing and procurement site, similar projects, Manufacturer and Store established costs*

Economics:

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
7.1a	replace 3 old refrigerator with Energy Star models	Energy Star purchasing and procurement site, similar projects	2,250	0	2,250	1,050	0.3	0	0.0	0	167	12	2,003	13.5	-11	-1	-2	-588	1,439
7.1b	incremental cost to replace 3 old refrigerator with Energy Star models	Energy Star purchasing and procurement site, similar projects	150	0	150	1,050	0.3	0	0.0	0	167	12	2,003	0.9	1236	103	111	1,512	1,439
7.2a	replace reach-in ice cream freezer with a 24 cu ft Energy Star freezer	Energy Star purchasing and procurement site, similar projects	2,700	0	2,700	311	0.1	0	0.0	150	199	12	593	13.5	-11	-1	-2	-715	426
7.2b	incremental cost to replace reach-in ice cream freezer with a 24 cu ft Energy Star freezer	Energy Star purchasing and procurement site, similar projects	300	0	300	311	0.1	0	0.0	150	199	12	593	1.5	698	58	66	1,685	426

Assumptions: SWA calculated the savings for this measure using measurements taken the day of the field visit and using the billing analysis. SWA assumed one annual call to a refrigeration contractor to perform minor repairs on old freezer.

Rebates/financial incentives:

NJ Clean Energy - There aren't any incentives at this time offered by the state of NJ for this energy conservation measure.

Options for funding the Lighting ECM:

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

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

ECM#8: Replace Exhaust Fans with High Efficiency Units

Description:

Several of the building rooftop exhaust fans are in fair condition and should be considered for replacement. Some of the fans are not operating at all. SWA recommends replacement of approximately fifty (50) of the building exhaust fans that are operating beyond their useful lives. The motors are small, in the 2 horsepower range, and replacement units will have small energy savings over the existing.

Installation cost:

Estimated installed cost: $139,800
Source of cost estimate: Similar projects

Economics (with incentives):

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
8a	replace 50 exhaust fans with premium efficiency units	similar projects, DOE Motor Master + International	142,500	2,700	139,800	12,750	3.5	0	0.3	1,820	3,847	10	20,273	36.3	-72	-7	<0	-106,982	17,468
8b	incremental cost to replace 50 exhaust fans with premium efficiency units	similar projects, DOE Motor Master + International	21,350	2,700	18,650	12,750	3.5	0	0.8	1,820	3,847	10	20,273	4.8	106	11	16	14,168	17,468

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA also assumed an aggregated 1 hr/wk to troubleshoot exhaust fan malfunctions vs. newly installed.

Rebates/financial incentives:

NJ Clean Energy - Premium three-phase motors ($45-$700 per motor)
Maximum incentive amount is $2,700.

State of NJ School Grant - The Livingston Public Schools are eligible for a 40% state grant, which will decrease investment and simple payback when the December bond referendum passes. Since approval is pending, this has not been included in the above calculations.

Options for funding the Lighting ECM: *This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.*

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

ECM#9: *Replace Condensate Receiver / Pumps / Motors*

Description:

Replace one (1) condensate receiver vacuum pump set in the original boiler room. This equipment is beyond its expected service life, and the Livingston Public Schools should consider replacement as part of the capital improvement plan. This is a replacement in kind that offers low energy savings. The remainder of the vacuum pumps and condensate receiver pumps are in relatively good condition. Pump motor should be replaced with NEMA premium motors.

Installation cost:

Estimated installed cost: $4,946
Source of cost estimate: Similar projects and DOE Motor Master International selection & savings analysis

Economics (with incentives):

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
9a	replace 1 condensate receiver including a 2 Hp vacuum pump motor	similar projects, DOE Motor Master + International	5,000	54	4,946	94	0.0	0	0.0	105	120	20	299	41.2	-51	-3	<0	-3,162	129
9b	incremental cost to replace 1 condensate receiver including a 2 Hp vacuum pump Premium eff motor	similar projects, DOE Motor Master + International	427	54	373	94	0.0	0	0.0	105	120	20	299	3.1	543	27	32	1,411	129

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. The DOE Motor Master International selection and calculator was used with the assumption that one of each set of heating water pumps operates for the heating season. According to weather bin data for Newark and considering that the pumps operate periodically to empty a holding tank, we estimate that the set of pumps considered should operate for approximately 1,500 hours per year. SWA also assumed a 3 hrs/yr to troubleshoot condensate receiver malfunctions vs. newly installed. At the time of SWA's visit the school experienced a condensate receiver malfunction.

Rebates/financial incentives:

NJ Clean Energy - Premium three-phase motors ($45-$700 per motor)
Maximum incentive amount is $54.

State of NJ School Grant - The Livingston Public Schools are eligible for a 40% state grant, which will decrease investment and simple payback when the December bond referendum passes. Since approval is pending, this has not been included in the above calculations.

Options for funding the Lighting ECM: *This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.*

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

5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES

5.1. Existing systems

There aren't currently any existing renewable energy systems.

5.2. Wind

Description:

A Wind system is not applicable for this building because the area does not have winds of sufficient velocity to justify installing a wind turbine system.

5.3. Solar Photovoltaic

Pleases see the above recommended ECM#6.

5.4. Solar Thermal Collectors

Description:

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

5.5. Combined Heat and Power

Description:

CHP is not applicable for this building because of several existing split system cooling, insufficient domestic hot water use and plans to install a large PV system that would generate a large portion of the building electricity needs.

5.6. Geothermal

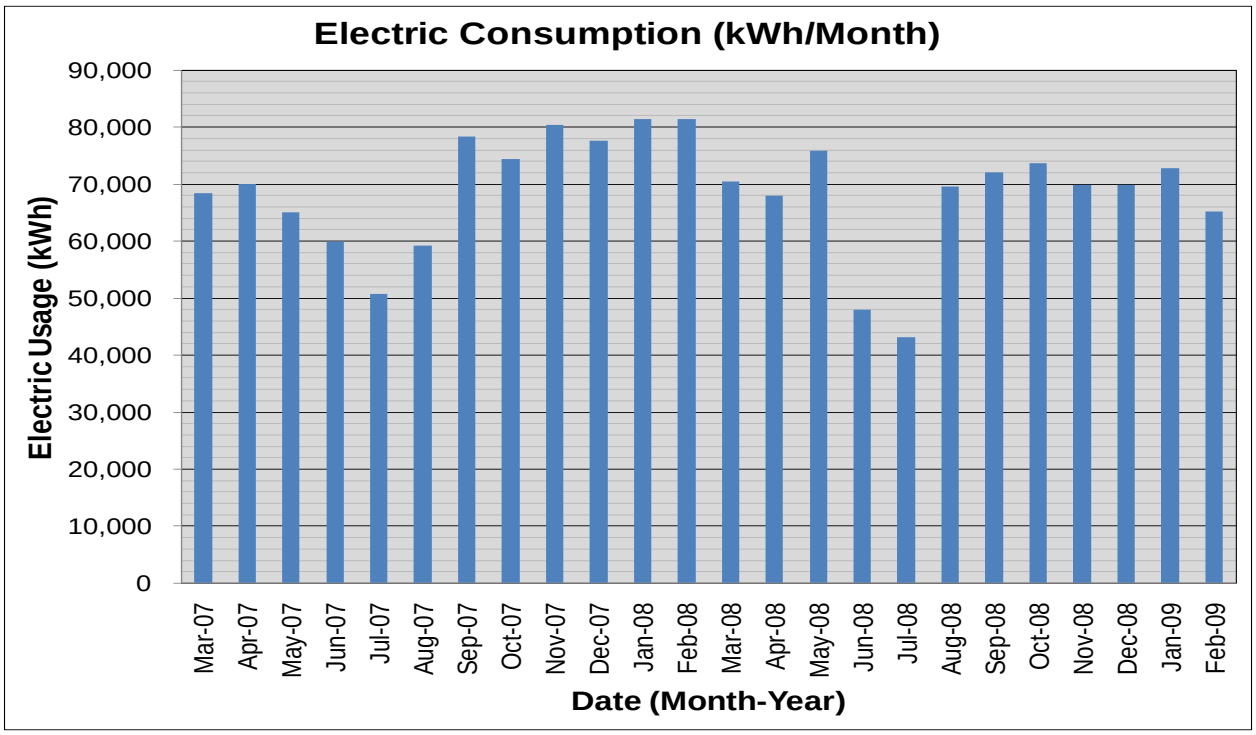
Description:

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

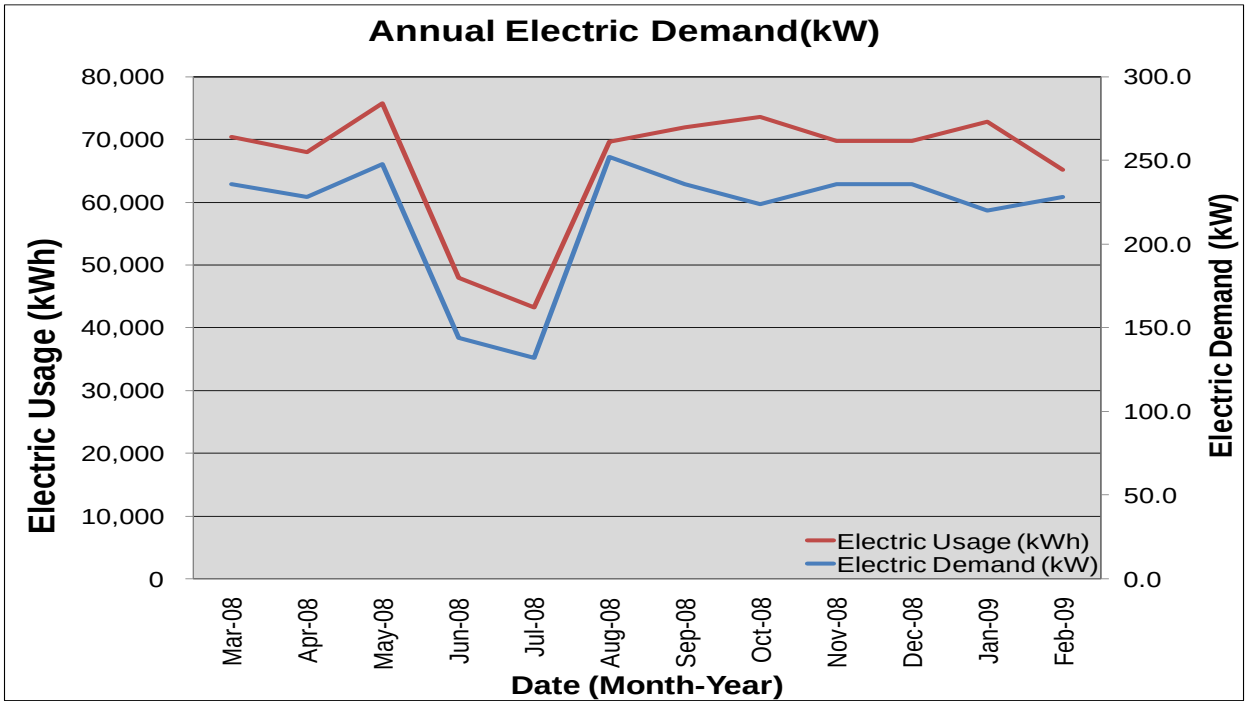
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Load profiles

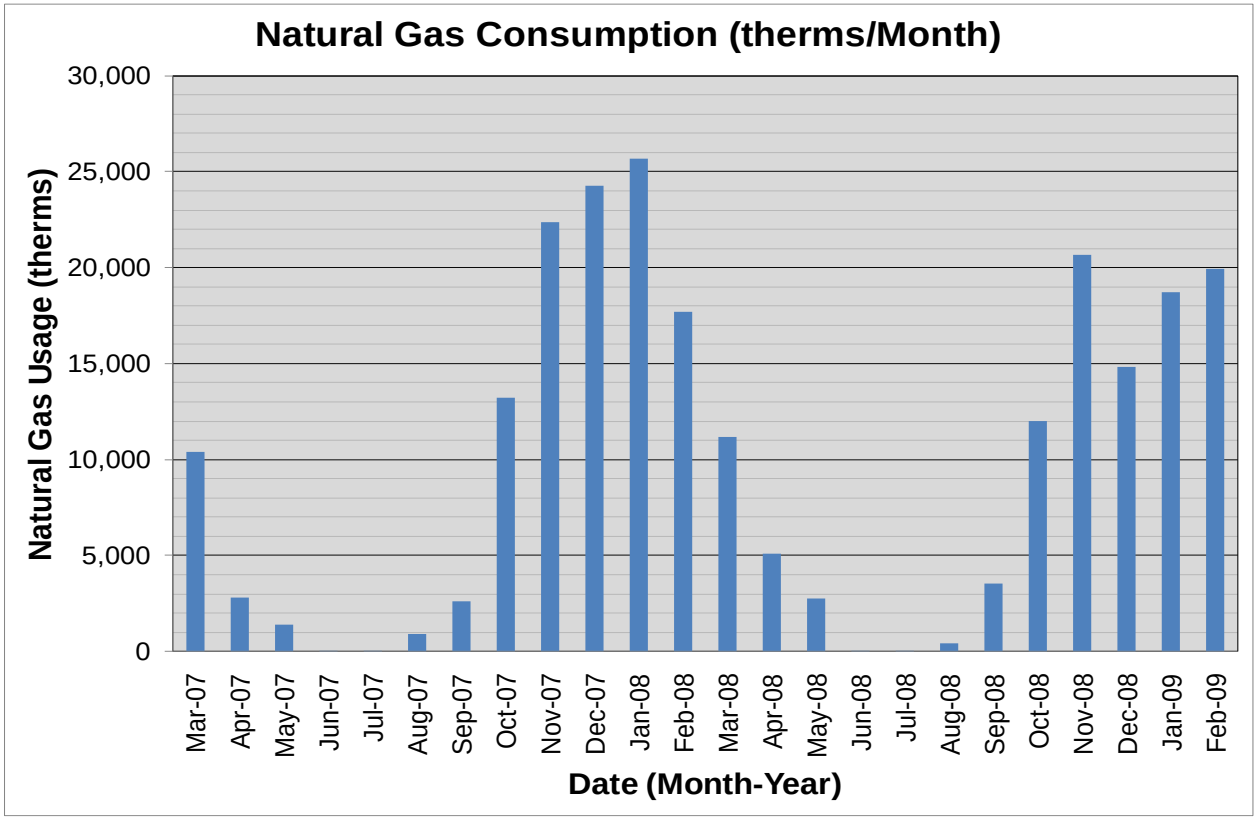
The following are charts that show the annual electric and natural gas load profiles for the Livingston Mount Pleasant Schools building.

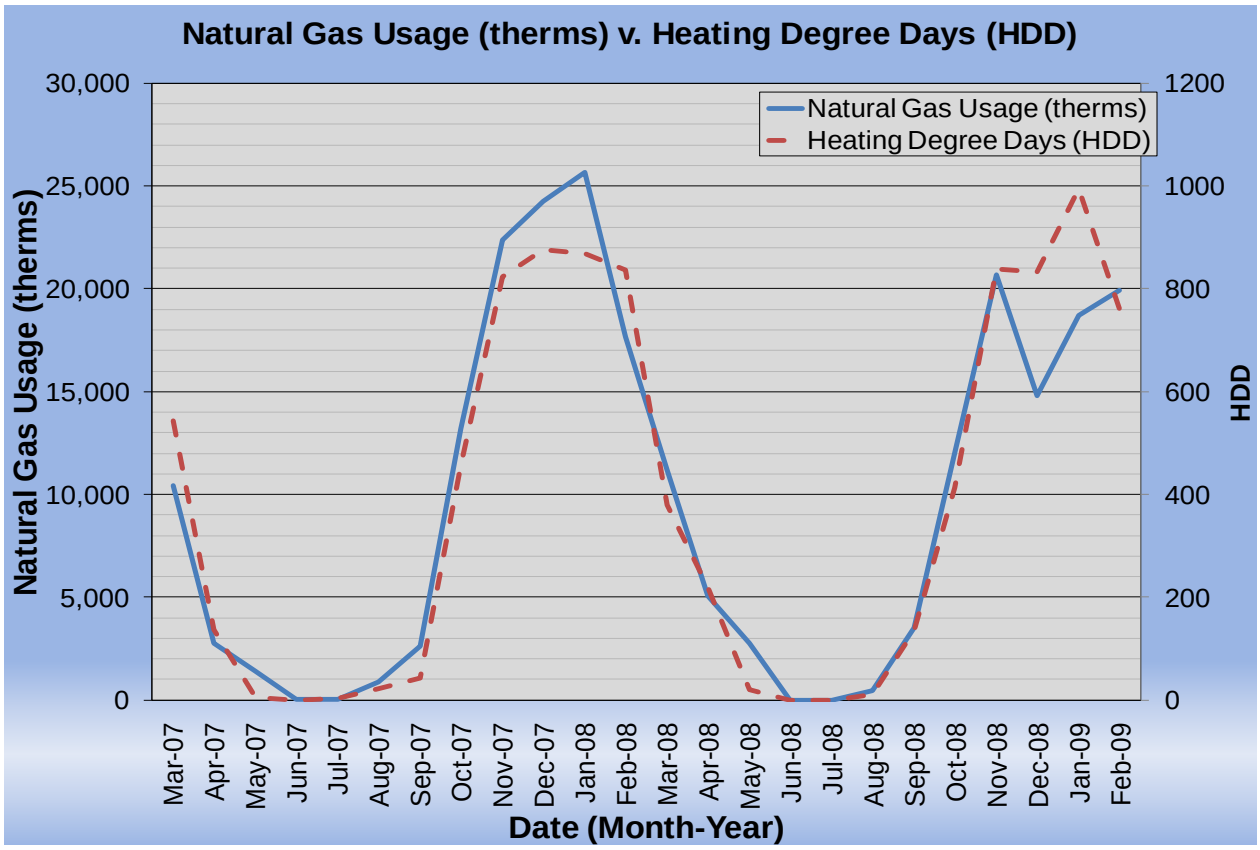


Some minor unusual electric fluctuations shown may be due to adjustments between estimated and actual meter readings. Also, note on the following chart how the electrical Demand peaks (except for a few unusual fluctuation anomalies) follow the electrical consumption peaks.



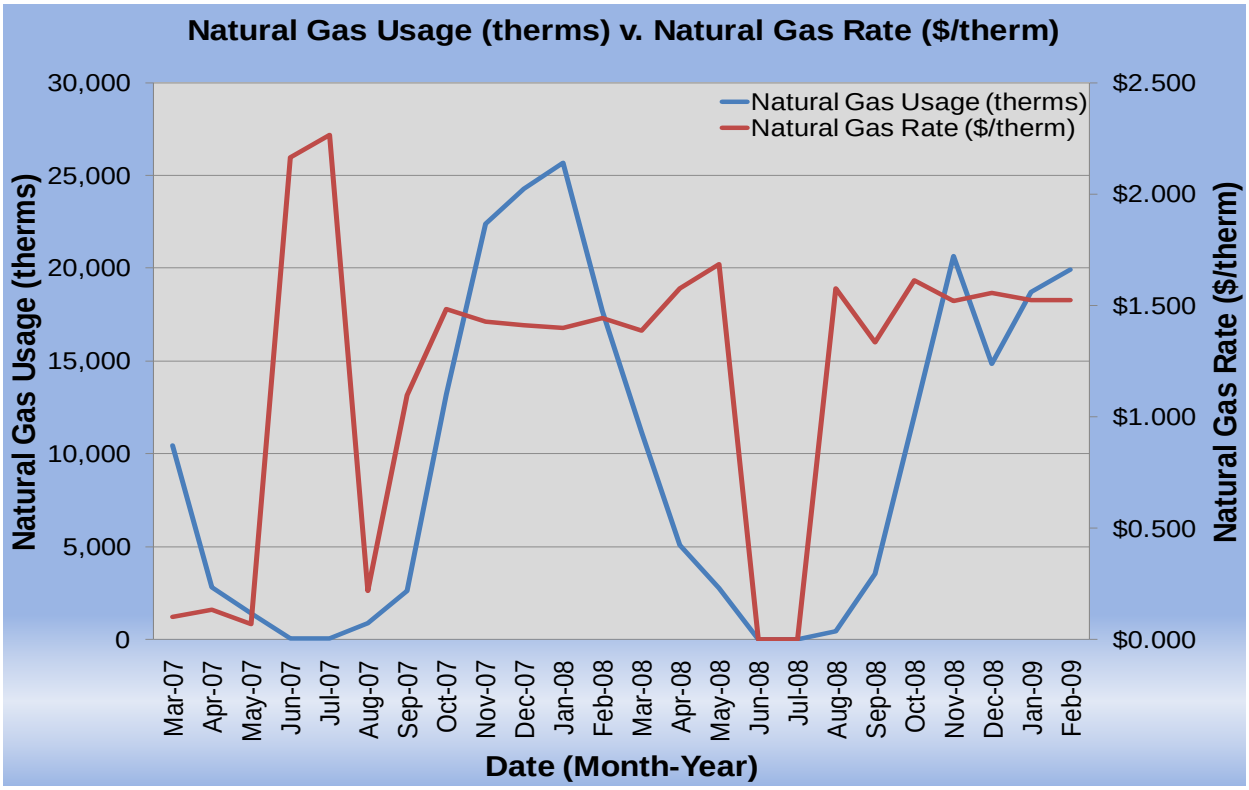
The following is a chart of the natural gas annual load profile for the building, peaking in the coldest months of the year and a chart showing natural gas consumption following the "heating degree days" curve.


Natural Gas Consumption (therms/Month)
Natural Gas Usage (therms)
30,000
25,000
20,000
15,000
10,000
5,000
0
Mar-07
Apr-07
May-07
Jun-07
Jul-07
Aug-07
Sep-07
Oct-07
Nov-07
Dec-07
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Date (Month-Year)


Natural Gas Usage (therms) v. Heating Degree Days (HDD)
Natural Gas Usage (therms)
Heating Degree Days (HDD)
Natural Gas Usage (therms)
30,000
25,000
20,000
15,000
10,000
5,000
0
HDD
1200
1000
800
600
400
200
0
Mar-07
Apr-07
May-07
Jun-07
Jul-07
Aug-07
Sep-07
Oct-07
Nov-07
Dec-07
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Date (Month-Year)

6.2. Tariff analysis

Currently, natural gas is provided to the Mount Pleasant Schools building via one gas meter with the Hess Corporation acting as the supply and PSE&G acting as the transport company. Gas is provided by the Hess Corporation at a general service rate. The suppliers' general service rate for natural gas charges a market-rate price based on use and the Mount Pleasant Schools billing does not breakdown demand costs for all periods. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Typically, the natural gas prices increase during the heating months when natural gas is used by the hot water boiler units. The high gas price per therm fluctuations in the summer may be due to high energy costs that occurred in 2008 and low use caps for the non-heating months. Thus the building pays for fixed costs such as meter reading charges during the summer months. So June, July and August cap payment are excluded from the following chart.

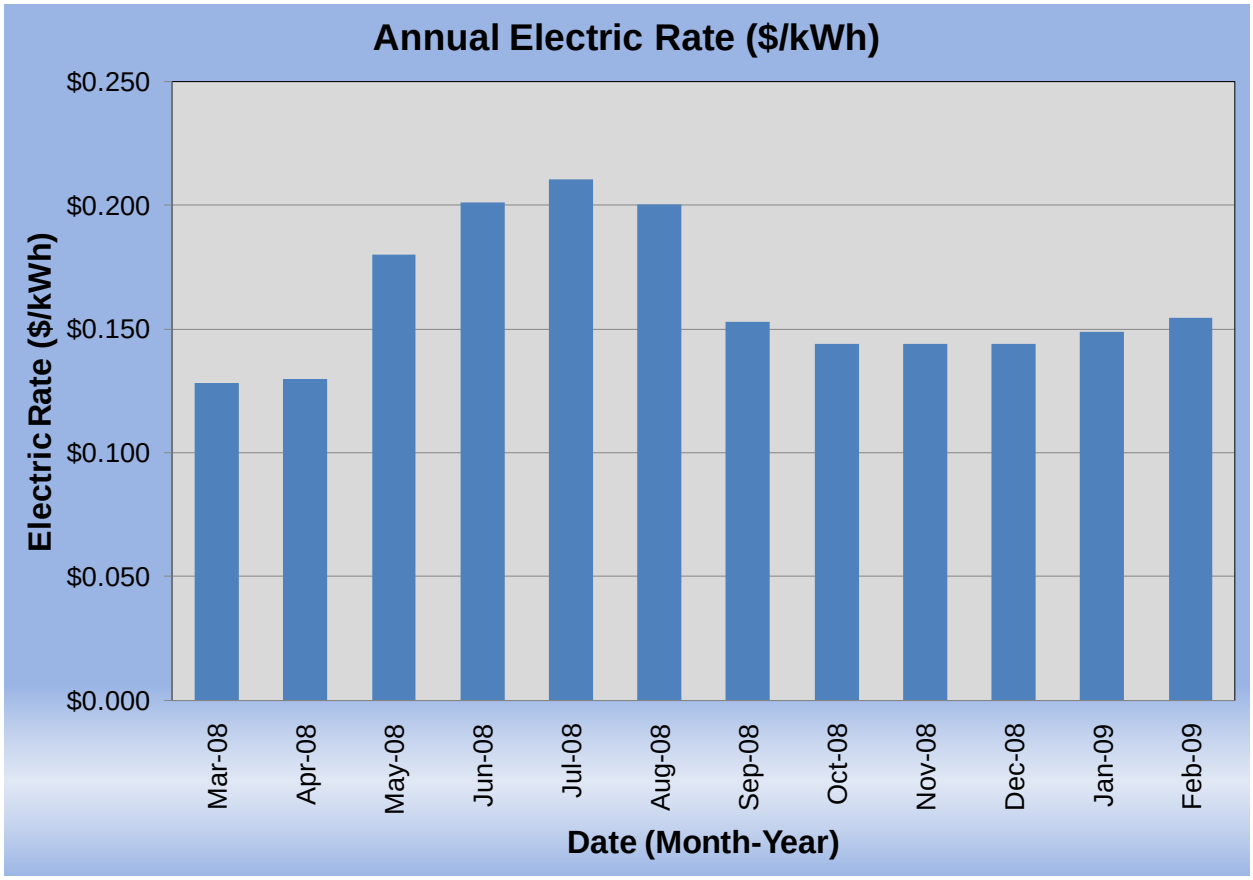


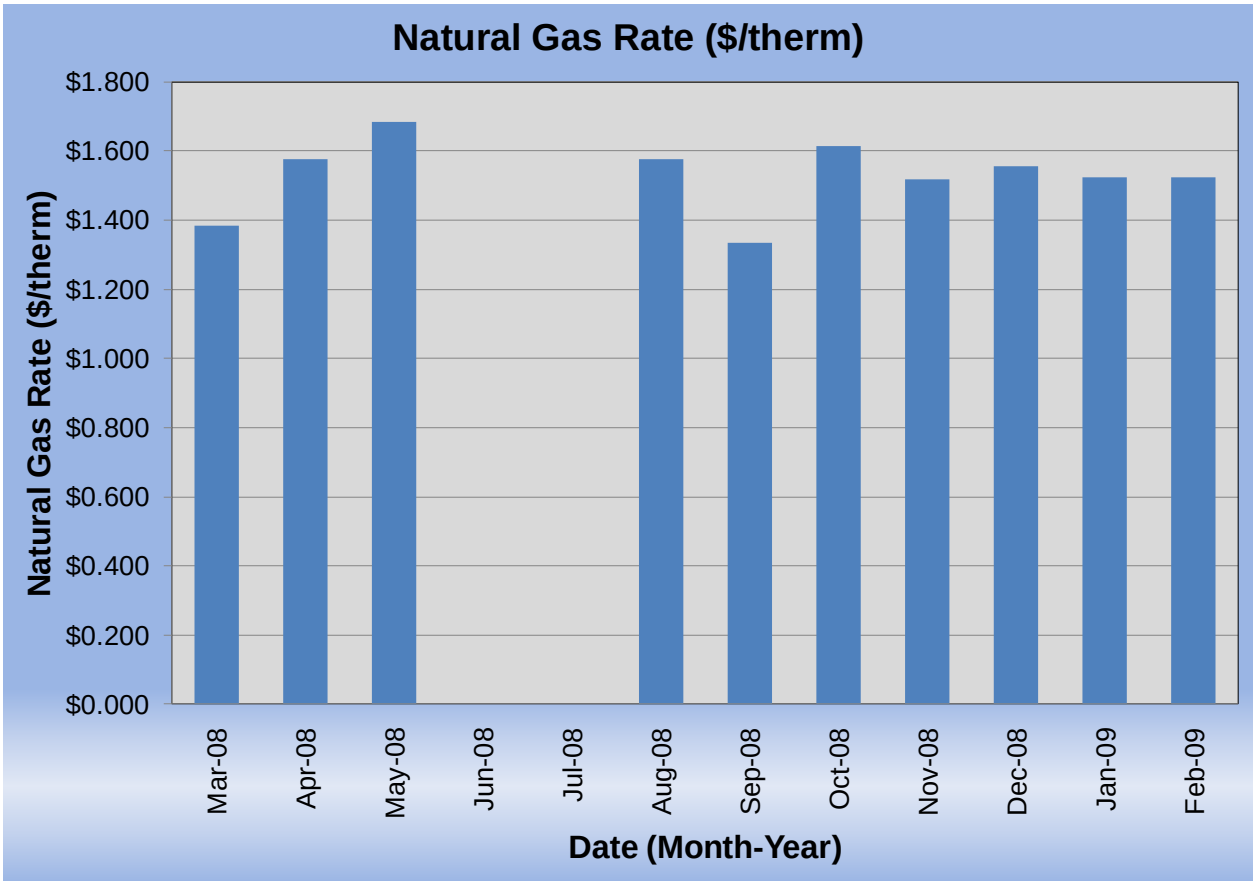
The Mount Pleasant Schools building is direct-metered (via one main meter) and currently purchases electricity from PSE&G at a general service rate. The general service rate for electric charges are market-rate based on use and the Mount Pleasant Schools building billing does show a breakdown of demand costs. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Typically, the electricity prices increase during the cooling months when electricity is used by the HVAC condensing units and air handlers.

6.3. Energy Procurement strategies

The Mount Pleasant Schools building receives natural gas via one incoming meter. The Hess Corporation supplies the gas and PSE&G transports it. There is not an ESCO engaged in the process. An Energy Services Company (ESCO) is a consultancy group that engages in a performance based contract with a client firm to implement measures which reduce energy consumption and costs in a technically and financially viable manner. Electricity is also purchased via one incoming meter directly for the Mount

Pleasant Schools building from PSE&G without an ESCO. SWA analyzed the utility rate for natural gas and electricity supply over an extended period. Electric bill analysis shows fluctuations up to 40% over the most recent 12 month period. Natural gas bill analysis shows fluctuations up to 41% over the most recent 12 month period. Some of these fluctuations may have been caused by adjustments between estimated and actual meter readings, others may be due to unusual high and escalating energy costs in 2008. The average estimated NJ commercial utility rates for electric and gas are $0.150/kWh and $1.550/therm respectively. The Mount Pleasant Schools building annual utility costs are $7,184 higher for electric and $2,837 lower for natural gas for a total of $4,347 higher, when compared to the average estimated NJ commercial utility rates. SWA recommends that the Livingston Board of Education further explore opportunities of purchasing both natural gas and electricity from ESCOs in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the Mount Pleasant Schools building. Appendix B contains a complete list of third party energy suppliers for the Livingston Township service area. The Livingston Board of Education may want to consider partnering with other school districts, municipalities, townships and communities to aggregate a substantial electric and natural gas use for better leveraging in negotiations with ESCOs and of improving the pricing structures. This sort of activity is happening in many parts of the country and in New Jersey. Also, the Mount Pleasant Schools building would not be eligible for enrollment in a Demand Response Program, because there isn't the capability at this time (without a large capital investment) to shed a minimum of 150 kW electric demand when requested by the utility during peak demand periods, which is the typical threshold for considering this option. Demand Response could be an option in the future when the Livingston Board of Education may install a large enough back-up emergency generator. The following charts show the Mount Pleasant Schools building monthly spending per unit of energy in 2008.




Natural Gas Rate ($/therm)
$1.800
$1.600
$1.400
$1.200
$1.000
$0.800
$0.600
$0.400
$0.200
$0.000
Natural Gas Rate ($/therm)
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Date (Month-Year)

7. METHOD OF ANALYSIS

7.1. Assumptions and tools

Energy modeling tool:	established / standard industry assumptions, E-Quest
Cost estimates:	RS Means 2009 (Facilities Maintenance & Repair Cost Data) RS Means 2009 (Building Construction Cost Data) RS Means 2009 (Mechanical Cost Data) Published and established specialized equipment material and labor costs Cost estimates also based on utility bill analysis and prior experience with similar projects

7.2. Disclaimer

This engineering audit was prepared using the most current and accurate fuel consumption data available for the site. The estimates that it projects are intended to help guide the owner toward best energy choices. The costs and savings are subject to fluctuations in weather, variations in quality of maintenance, changes in prices of fuel, materials, and labor, and other factors. Although we cannot guarantee savings or costs, we suggest that you use this report for economic analysis of the building and as a means to estimate future cash flow.

THE RECOMMENDATIONS PRESENTED IN THIS REPORT ARE BASED ON THE RESULTS OF ANALYSIS, INSPECTION, AND PERFORMANCE TESTING OF A SAMPLE OF COMPONENTS OF THE BUILDING SITE. ALTHOUGH CODE-RELATED ISSUES MAY BE NOTED, SWA STAFF HAVE NOT COMPLETED A COMPREHENSIVE EVALUATION FOR CODE-COMPLIANCE OR HEALTH AND SAFETY ISSUES. THE OWNER(S) AND MANAGER(S) OF THE BUILDING(S) CONTAINED IN THIS REPORT ARE REMINDED THAT ANY IMPROVEMENTS SUGGESTED IN THIS SCOPE OF WORK MUST BE PERFORMED IN ACCORDANCE WITH ALL LOCAL, STATE, AND FEDERAL LAWS AND REGULATIONS THAT APPLY TO SAID WORK. PARTICULAR ATTENTION MUST BE PAID TO ANY WORK WHICH INVOLVES HEATING AND AIR MOVEMENT SYSTEMS, AND ANY WORK WHICH WILL INVOLVE THE DISTURBANCE OF PRODUCTS CONTAINING MOLD, ASBESTOS, OR LEAD.

Appendix A: Lighting Study

Location			Existing Fixture Information												Retrofit Information												Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
1	1	Classroom	Parabolic	E	4'T8	20	2	32	S	9	190	6	1,400	2,394	N/A	Parabolic	4'T8	E	S	20	2	32	9	190	6	1400	2394	0	0	0
2	1	Bathroom	Screw-in	N	Inc	1	1	40	S	9	190	0	40	68	N/A	Screw-in	Inc	N	S	1	1	40	9	190	0	40	68	0	0	0
3	1	Classroom (2B)	Parabolic	E	4'T8	8	2	32	S	9	190	6	560	958	N/A	Parabolic	4'T8	E	S	8	2	32	9	190	6	560	958	0	0	0
4	1	Bathroom (2B)	Screw-in	N	CFL	1	1	13	S	9	190	0	13	22	N/A	Screw-in	CFL	N	S	1	1	13	9	190	0	13	22	0	0	0
5	1	Classroom (1)	Parabolic	E	4'T8	27	2	32	S	9	190	6	1,890	3,232	N/A	Parabolic	4'T8	E	S	27	2	32	9	190	6	1890	3232	0	0	0
6	1	Classroom (1)	Screw-in	N	CFL	4	2	13	S	9	190	0	104	178	N/A	Screw-in	CFL	N	S	4	2	13	9	190	0	104	178	0	0	0
7	1	Bathroom (1)	Recessed	E	4'T8	1	2	32	S	9	190	6	70	120	N/A	Recessed	4'T8	E	S	1	2	32	9	190	6	70	120	0	0	0
8	1	Vestibule	Recessed	E	4'T8	1	2	32	S	16	190	6	70	213	N/A	Recessed	4'T8	E	S	1	2	32	16	190	6	70	213	0	0	0
9	1	Vestibule	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
10	1	Faculty Room	Parabolic	E	4'T8	18	2	32	S	8	190	6	1,260	1,915	C	Parabolic	4'T8	E	OS	18	2	32	6	190	6	1260	1436	0	479	479
11	1	Faculty Room	Recessed	N	CFL	4	2	13	S	8	190	0	104	158	N/A	Recessed	CFL	N	S	4	2	13	8	190	0	104	158	0	0	0
12	1	Storage Room	Recessed	E	4'T8	6	3	32	S	2	190	10	636	242	N/A	Recessed	4'T8	E	S	6	3	32	2	190	10	636	242	0	0	0
13	1	Hallway	Recessed	E	4'T8	8	2	32	S	16	190	6	560	1,702	N/A	Recessed	4'T8	E	S	8	2	32	16	190	6	560	1702	0	0	0
14	1	Hallway	Recessed	E	4'T8	4	2	32	S	16	190	6	280	851	N/A	Recessed	4'T8	E	S	4	2	32	16	190	6	280	851	0	0	0
15	1	Hallway	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
16	1	Classroom (5)	Parabolic	E	4'T8	27	2	32	S	9	190	6	1,890	3,232	N/A	Parabolic	4'T8	E	S	27	2	32	9	190	6	1890	3232	0	0	0
17	1	Bathroom (5)	Recessed	E	4'T8	1	2	32	S	9	190	6	70	120	N/A	Recessed	4'T8	E	S	1	2	32	9	190	6	70	120	0	0	0
18	1	Nurse's Station	Recessed	E	4'T8	4	4	32	S	9	190	13	564	964	C	Recessed	4'T8	E	OS	4	4	32	7	190	13	564	723	0	241	241
19	1	Nurse's Station - Bathroom	Screw-in	N	Inc	1	1	60	S	9	190	0	60	103	N/A	Screw-in	Inc	N	S	1	1	60	9	190	0	60	103	0	0	0
20	1	Nurse's Station - Storage Room	Parabolic	E	1'T8	1	2	6	S	9	190	3	15	26	N/A	Parabolic	1'T8	E	S	1	2	6	9	190	3	15	26	0	0	0
21	1	Office	Recessed	E	4'T8	5	4	32	S	9	190	13	705	1,206	N/A	Recessed	4'T8	E	S	5	4	32	9	190	13	705	1206	0	0	0
22	1	Office - Principal	Recessed	E	4'T8	2	4	32	S	9	190	13	282	482	N/A	Recessed	4'T8	E	S	2	4	32	9	190	13	282	482	0	0	0
23	1	Office - Storage Room	Parabolic	E	4'T8	1	2	32	S	9	190	6	70	120	N/A	Parabolic	4'T8	E	S	1	2	32	9	190	6	70	120	0	0	0
24	1	Vestibule	Recessed	E	4'T8	1	2	32	S	16	190	6	70	213	N/A	Recessed	4'T8	E	S	1	2	32	16	190	6	70	213	0	0	0
25	1	Hallway	Recessed	E	4'T8	2	2	32	S	16	190	6	140	426	N/A	Recessed	4'T8	E	S	2	2	32	16	190	6	140	426	0	0	0
26	1	Hallway	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
27	1	Hallway	Recessed	E	4'T8	5	4	32	S	16	190	13	705	2,143	N/A	Recessed	4'T8	E	S	5	4	32	16	190	13	705	2143	0	0	0
28	1	Bathroom	Recessed	E	4'T8	1	2	32	S	9	190	6	70	120	N/A	Recessed	4'T8	E	S	1	2	32	9	190	6	70	120	0	0	0
29	1	Server Room Unoccupied	Recessed	E	4'T8	3	3	32	S	2	190	10	318	121	N/A	Recessed	4'T8	E	S	3	3	32	2	190	10	318	121	0	0	0
30	1	Bathroom Men	Recessed	E	4'T8	3	4	32	S	9	190	13	423	723	N/A	Recessed	4'T8	E	S	3	4	32	9	190	13	423	723	0	0	0
31	1	Bathroom Women	Recessed	E	4'T8	3	4	32	S	9	190	13	423	723	N/A	Recessed	4'T8	E	S	3	4	32	9	190	13	423	723	0	0	0
32	1	Hallway	Recessed	E	4'T8	7	4	32	S	16	190	13	987	3,000	N/A	Recessed	4'T8	E	S	7	4	32	16	190	13	987	3000	0	0	0
33	1	Hallway	Exit Sign	N	LED	2	1	5	N	24	365	1	12	105	N/A	Exit Sign	LED	N	N	2	1	5	24	365	1	12	105	0	0	0
34	1	Hallway	2'U-shape	E	4'T8	4	2	32	S	16	190	6	280	851	N/A	2'U-Shape	4'T8	E	S	4	2	32	16	190	6	280	851	0	0	0
35	1	Classroom (101)	Recessed	E	4'T8	12	3	32	S	9	190	10	1,272	2,175	N/A	Recessed	4'T8	E	S	12	3	32	9	190	10	1272	2175	0	0	0
36	1	Classroom (102)	Recessed	E	4'T8	12	3	32	S	9	190	10	1,272	2,175	N/A	Recessed	4'T8	E	S	12	3	32	9	190	10	1272	2175	0	0	0
37	1	Hallway	Recessed	E	4'T8	1	2	32	S	16	190	6	70	213	N/A	Recessed	4'T8	E	S	1	2	32	16	190	6	70	213	0	0	0
38	1	Janitor's Closet	Recessed	E	4'T8	1	4	32	S	2	190	13	141	54	N/A	Recessed	4'T8	E	S	1	4	32	2	190	13	141	54	0	0	0
39	1	Storage Room	Recessed	E	4'T8	3	2	32	S	2	190	6	210	80	N/A	Recessed	4'T8	E	S	3	2	32	2	190	6	210	80	0	0	0
40	1	Library	Parabolic	E	4'T8	36	3	32	S	9	190	10	3,816	6,525	N/A	Parabolic	4'T8	E	S	36	3	32	9	190	10	3816	6525	0	0	0
41	1	Library	Recessed	N	CFL	39	2	13	D	9	190	0	1,014	1,734	N/A	Recessed	CFL	N	D	39	2	13	9	190	0	1014	1734	0	0	0
42	1	Library	2'U-shape	E	4'T8	3	2	32	S	9	190	6	210	359	N/A	2'U-Shape	4'T8	E	S	3	2	32	9	190	6	210	359	0	0	0
43	1	Hallway	Recessed	E	4'T8	10	4	32	S	16	190	13	1,410	4,286	N/A	Recessed	4'T8	E	S	10	4	32	16	190	13	1410	4286	0	0	0
44	1	Hallway	Recessed	N	CFL	2	2	13	S	16	190	0	52	158	N/A	Recessed	CFL	N	S	2	2	13	16	190	0	52	158	0	0	0
45	1	Classroom (103)	Recessed	E	4'T8	12	3	32	S	9	190	10	1,272	2,175	N/A	Recessed	4'T8	E	S	12	3	32	9	190	10	1272	2175	0	0	0
46	1	Classroom (104)	Recessed	E	4'T8	12	3	32	S	9	190	10	1,272	2,175	N/A	Recessed	4'T8	E	S	12	3	32	9	190	10	1272	2175	0	0	0
47	1	Computer Lab (107)	2'U-shape	E	4'T8	5	1	32	S	9	190	3	175	299	N/A	2'U-Shape	4'T8	E	S	5	1	32	9	190	3	175	299	0	0	0
48	1	Computer Lab (107)	Parabolic	E	4'T8	15	2	32	S	9	190	6	1,050	1,796	N/A	Parabolic	4'T8	E	S	15	2	32	9	190	6	1050	1796	0	0	0
49	1	Computer Lab (107)	Parabolic	E	4'T8	6	3	32	S	8	190	10	636	967	N/A	Parabolic	4'T8	E	S	6	3	32	8	190	10	636	967	0	0	0
50	1	Hallway	Recessed	E	4'T8	7	4	32	S	16	190	13	987	3,000	N/A	Recessed	4'T8	E	S	7	4	32	16	190	13	987	3000	0	0	0
51	1	Hallway	Exit Sign	N	LED	3	1	5	N	24	365	1	18	158	N/A	Exit Sign	LED	N	N	3	1	5	24	365	1	18	158	0	0	0
52	1	Classroom (105)	Recessed	E	4'T8	15	3	32	S	9	190	10	1,590	2,719	N/A	Recessed	4'T8	E	S	15	3	32	9	190	10	1590	2719	0	0	0
53	1	Storage Room	2'U-shape	E	4'T8	2	2	32	S	2	190	6	140	53	N/A	2'U-Shape	4'T8	E	S	2	2	32	2	190	6	140	53	0	0	0
54	1	Classroom (106)	Recessed	E	4'T8	15	3	32	S	9	190	10	1,590	2,719	N/A	Recessed	4'T8	E	S	15	3	32	9	190	10	1590	2719	0	0	0
55	1	Classroom Storage Room (106)	Recessed	E	4'T8	2	3	32	S	9	190	10	212	363	N/A	Recessed	4'T8	E	S	2	3	32	9	190	10	212	363	0	0	0
56	1	Hallway	Recessed	E	4'T8	6	3	32	S	16	190	10	636	1,933	N/A	Recessed	4'T8	E	S	6	3	32	16	190	10	636	1933	0	0	0
57	1	Hallway	Recessed	E	4'T8	2	4	32	S	16	190	13	282	857	N/A	Recessed	4'T8	E	S	2	4	32	16	190	13	282	857	0	0	0
58	1	Hallway	Recessed	E	4'T8	2	2	32	S	16	190	6	140	426	N/A	Recessed	4'T8	E	S	2	2	32	16	190	6	140	426	0	0	0
59	1	Bathroom Men	Parabolic	E	4'T8	1	1	32	S	9	190	3	35	60	N/A	Parabolic	4'T8	E	S	1	1	32	9	190	3	35	60	0	0	0
60	1	Bathroom Women	Parabolic	E	4'T8	1	1	32	S	9	190	3	35	60	N/A	Parabolic	4'T8	E	S	1	1	32	9	190	3	35	60	0	0	0
61	1	Storage Room	Recessed	E	4'T8	6	4	32	S	2	190	13	846	321	N/A	Recessed	4'T8	E	S	6	4	32	2	190	13	846	321	0	0	0
62	1	Classroom (6A)	Parabolic	E	4'T8	6	2	32	S	9	190	6	420	718	N/A	Parabolic	4'T8	E	S	6	2	32	9	190	6	420	718	0	0	0
63	1	Classroom (7)	Parabolic	E	4'T8	12	2	32	S	9	190	6	840	1,436	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	6	840	1436	0	0	0
64	1	Vestibule	Parabolic	E	4'T8	4	1	32	S	16	190	3	140	426	N/A	Parabolic	4'T8	E	S	4	1	32	16	190	3	140	426	0	0	0
65	1	Storage Room	Parabolic	E	4'T8	1	2	32	S	2	190	6	70	27	N/A	Parabolic	4'T8	E	S	1	2	32	2	190	6	70	27	0	0	0

Location			Existing Fixture Information												Retrofit Information												Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
66	1	Bathroom	Screw-in	N	Inc	2	1	60	S	9	190	0	120	205	N/A	Screw-in	Inc	N	S	2	1	60	9	190	0	120	205	0	0	0
67	1	Storage Room	Parabolic	E	4'T8	2	2	32	S	2	190	6	140	53	N/A	Parabolic	4'T8	E	S	2	2	32	2	190	6	140	53	0	0	0
68	1	Meeting Room	Parabolic	E	4'T8	2	2	32	S	8	190	6	140	213	N/A	Parabolic	4'T8	E	S	2	2	32	8	190	6	140	213	0	0	0
69	1	Meeting Room	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
70	1	Storage Room	Parabolic	E	4'T8	1	2	32	S	2	190	6	70	27	N/A	Parabolic	4'T8	E	S	1	2	32	2	190	6	70	27	0	0	0
71	1	Kitchen	Parabolic	E	2'T8	8	4	17	S	9	190	5	584	999	C	Parabolic	2'T8	E	OS	8	4	17	7	190	5	584	749	0	250	250
72	1	Office	Parabolic	E	4'T8	1	2	32	S	9	190	6	70	120	N/A	Parabolic	4'T8	E	S	1	2	32	9	190	6	70	120	0	0	0
73	1	Office	Parabolic	E	4'T8	2	2	32	S	9	190	6	140	239	N/A	Parabolic	4'T8	E	S	2	2	32	9	190	6	140	239	0	0	0
74	1	Classroom (8)	Parabolic	E	4'T8	12	2	32	S	9	190	6	840	1,436	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	6	840	1436	0	0	0
75	1	Gymnasium	Recessed	E	4'T8	30	4	32	S	9	190	13	4,230	7,233	N/A	Recessed	4'T8	E	S	30	4	32	9	190	13	4230	7233	0	0	0
76	1	Gymnasium	Exit Sign	N	LED	4	1	5	N	24	365	1	24	210	N/A	Exit Sign	LED	N	N	4	1	5	24	365	1	24	210	0	0	0
77	1	Hallway	Recessed	E	4'T8	14	2	32	S	16	190	6	980	2,979	N/A	Recessed	4'T8	E	S	14	2	32	16	190	6	980	2979	0	0	0
78	1	Classroom (9)	Parabolic	E	4'T8	12	2	32	S	9	190	6	840	1,436	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	6	840	1436	0	0	0
79	1	Classroom (10)	Parabolic	E	4'T8	12	2	32	S	9	190	6	840	1,436	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	6	840	1436	0	0	0
80	1	Hallway	Recessed	E	4'T8	11	2	32	S	16	190	6	770	2,341	N/A	Recessed	4'T8	E	S	11	2	32	16	190	6	770	2341	0	0	0
81	1	Hallway	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
82	1	Janitor's Closet	Parabolic	E	2'T8	1	2	17	S	2	190	3	37	14	N/A	Parabolic	2'T8	E	S	1	2	17	2	190	3	37	14	0	0	0
83	1	Bathroom	2'U-shape	E	4'T8	3	2	32	S	9	190	6	210	359	N/A	2'U-Shape	4'T8	E	S	3	2	32	9	190	6	210	359	0	0	0
84	1	Classroom (11)	Parabolic	E	4'T8	12	2	32	S	9	190	6	840	1,436	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	6	840	1436	0	0	0
85	1	Classroom (12A)	Parabolic	E	4'T8	9	3	32	S	9	190	10	954	1,631	N/A	Parabolic	4'T8	E	S	9	3	32	9	190	10	954	1631	0	0	0
86	1	Classroom (12B)	Parabolic	E	4'T8	9	3	32	S	9	190	10	954	1,631	N/A	Parabolic	4'T8	E	S	9	3	32	9	190	10	954	1631	0	0	0
87	1	Hallway	Recessed	E	4'T8	8	2	32	S	16	190	6	560	1,702	N/A	Recessed	4'T8	E	S	8	2	32	16	190	6	560	1702	0	0	0
88	1	Hallway	Recessed	E	4'T8	8	2	32	S	16	190	6	560	1,702	N/A	Recessed	4'T8	E	S	8	2	32	16	190	6	560	1702	0	0	0
89	1	Hallway	Exit Sign	N	LED	2	1	5	N	16	365	1	12	70	N/A	Exit Sign	LED	N	N	2	1	5	16	365	1	12	70	0	0	0
90	1	Classroom (13)	Parabolic	E	4'T8	15	2	32	S	9	190	6	1,050	1,796	N/A	Parabolic	4'T8	E	S	15	2	32	9	190	6	1050	1796	0	0	0
91	1	Classroom (14)	Parabolic	E	4'T8	18	2	32	S	9	190	6	1,260	2,155	N/A	Parabolic	4'T8	E	S	18	2	32	9	190	6	1260	2155	0	0	0
92	1	Classroom (15)	Parabolic	E	4'T8	15	2	32	S	9	190	6	1,050	1,796	N/A	Parabolic	4'T8	E	S	15	2	32	9	190	6	1050	1796	0	0	0
93	1	Classroom (16)	Parabolic	E	4'T8	18	2	32	S	9	190	6	1,260	2,155	N/A	Parabolic	4'T8	E	S	18	2	32	9	190	6	1260	2155	0	0	0
94	1	Storage Room	Parabolic	E	4'T8	2	2	32	S	2	190	6	140	53	N/A	Parabolic	4'T8	E	S	2	2	32	2	190	6	140	53	0	0	0
95	1	Gymnasium	Parabolic	E	4'T8	27	1	32	S	9	190	3	945	1,616	N/A	Parabolic	4'T8	E	S	27	1	32	9	190	3	945	1616	0	0	0
96	1	Gymnasium	Exit Sign	N	LED	3	1	5	N	24	365	1	18	158	N/A	Exit Sign	LED	N	N	3	1	5	24	365	1	18	158	0	0	0
97	1	Classroom (17A)	Recessed	E	4'T8	8	3	32	S	9	190	10	848	1,450	N/A	Recessed	4'T8	E	S	8	3	32	9	190	10	848	1450	0	0	0
98	1	Classroom (17B)	Recessed	E	4'T8	8	3	32	S	9	190	10	848	1,450	N/A	Recessed	4'T8	E	S	8	3	32	9	190	10	848	1450	0	0	0
99	1	Classroom (18)	Parabolic	E	4'T8	15	2	32	S	9	190	6	1,050	1,796	N/A	Parabolic	4'T8	E	S	15	2	32	9	190	6	1050	1796	0	0	0
100	1	Hallway	Parabolic	E	4'T8	8	2	32	S	16	190	6	560	1,702	N/A	Parabolic	4'T8	E	S	8	2	32	16	190	6	560	1702	0	0	0
101	1	Hallway	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
102	1	Classroom (19)	Parabolic	E	4'T8	15	2	32	S	9	190	6	1,050	1,796	N/A	Parabolic	4'T8	E	S	15	2	32	9	190	6	1050	1796	0	0	0
103	1	Vestibule	Recessed	E	4'T8	2	2	32	S	16	190	6	140	426	N/A	Recessed	4'T8	E	S	2	2	32	16	190	6	140	426	0	0	0
104	1	Elevator Vestibule	2'U-shape	E	4'T8	1	2	32	S	2	190	6	70	27	N/A	2'U-Shape	4'T8	E	S	1	2	32	2	190	6	70	27	0	0	0
105	1	Hallway	Recessed	E	4'T8	1	2	32	S	16	190	6	70	213	N/A	Recessed	4'T8	E	S	1	2	32	16	190	6	70	213	0	0	0
106	1	Classroom (20)	Parabolic	E	4'T8	12	2	32	S	9	190	6	840	1,436	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	6	840	1436	0	0	0
107	1	Classroom (106)	Parabolic	E	4'T8	12	2	32	S	9	190	6	840	1,436	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	6	840	1436	0	0	0
108	1	Electrical Room	Parabolic	E	4'T8	3	1	32	S	2	190	3	105	40	N/A	Parabolic	4'T8	E	S	3	1	32	2	190	3	105	40	0	0	0
109	1	Vestibule	Parabolic	E	4'T8	1	2	32	S	16	190	6	70	213	N/A	Parabolic	4'T8	E	S	1	2	32	16	190	6	70	213	0	0	0
110	1	Staircase	Parabolic	E	4'T8	3	2	32	S	16	190	6	210	638	N/A	Parabolic	4'T8	E	S	3	2	32	16	190	6	210	638	0	0	0
111	1	Bathroom Women	Parabolic	E	4'T8	3	2	32	S	9	190	6	210	359	N/A	Parabolic	4'T8	E	S	3	2	32	9	190	6	210	359	0	0	0
112	1	Mens Locker Room Storage	Parabolic	E	2'T8	2	2	17	S	8	190	3	74	112	C	Parabolic	2'T8	E	OS	2	2	17	6	190	3	74	84	0	28	28
113	1	Mens Locker Room Storage	Parabolic	E	4'T8	2	2	32	S	8	190	6	140	213	C	Parabolic	4'T8	E	OS	2	2	32	6	190	6	140	160	0	53	53
114	1	Mens Locker Room Office	Parabolic	E	4'T8	2	1	32	S	8	190	3	70	106	C	Parabolic	4'T8	E	OS	2	1	32	6	190	3	70	80	0	27	27
115	1	Mens Locker Room Bath	Screw-in	N	Inc	2	1	60	S	8	190	0	120	182	N/A	Screw-in	Inc	N	OS	2	1	60	6	190	0	120	137	0	46	46
116	1	Men's Locker Room	Parabolic	E	4'T8	23	1	32	S	8	190	3	805	1,224	C	Parabolic	4'T8	E	OS	23	1	32	6	190	3	805	918	0	306	306
117	1	Mens Locker Room Storage	Parabolic	E	4'T8	4	4	32	S	8	190	13	564	857	C	Parabolic	4'T8	E	OS	4	4	32	6	190	13	564	643	0	214	214
118	1	Mens Locker Room	Exit Sign	N	LED	3	1	5	N	24	365	1	18	158	N/A	Exit Sign	LED	N	N	3	1	5	24	365	1	18	158	0	0	0
119	1	Gymnasium	HID	N	MH	24	1	400	S	9	190	100	12,000	20,520	T5	Parabolic	4'T5	E	S	24	4	28	9	190	6	2832	4843	15,677	0	15,677
120	1	Gymnasium	Exit Sign	N	LED	3	1	5	N	9	190	1	18	31	N/A	Exit Sign	LED	N	N	3	1	5	9	190	1	18	31	0	0	0
121	1	Gymnasium - Storage	Parabolic	E	4'T8	1	2	32	S	9	190	6	70	120	N/A	Parabolic	4'T8	E	S	1	2	32	9	190	6	70	120	0	0	0
122	1	Gymnasium - Vestibule	Parabolic	E	4'T8	1	2	32	S	9	190	6	70	120	N/A	Parabolic	4'T8	E	S	1	2	32	9	190	6	70	120	0	0	0
123	1	Gymnasium - Vestibule	Exit Sign	N	LED	1	1	5	N	9	190	1	6	10	N/A	Exit Sign	LED	N	N	1	1	5	9	190	1	6	10	0	0	0
124	1	Gymnasium - Storage	Parabolic	E	4'T8	1	2	32	S	9	190	6	70	120	N/A	Parabolic	4'T8	E	S	1	2	32	9	190	6	70	120	0	0	0
125	1	Gymnasium - Vestibule	Parabolic	E	4'T8	1	2	32	S	9	190	6	70	120	N/A	Parabolic	4'T8	E	S	1	2	32	9	190	6	70	120	0	0	0
126	1	Gymnasium - Vestibule	Exit Sign	N	LED	1	1	5	N	9	190	1	6	10	N/A	Exit Sign	LED	N	N	1	1	5	9	190	1	6	10	0	0	0
127	1	Gymnasium - Storage	Parabolic	E	4'T8	6	2	32	S	9	190	6	420	718	N/A	Parabolic	4'T8	E	S	6	2	32	9	190	6	420	718	0	0	0
128	1	Womens Locker Room Storage	Parabolic	E	2'T8	2	2	17	S	8	190	3	74	112	C	Parabolic	2'T8	E	OS	2	2	17	6	190	3	74	84	0	28	28
129	1	Womens Locker Room Storage	Parabolic	E	4'T8	2	2	32	S	8	190	6	140	213	C	Parabolic	4'T8	E	OS	2	2	32	6	190	6	140	160	0	53	53
130	1	Womens Locker Room Office	Parabolic	E	4'T8	2	1	32	S	8	190	3	70	106	C	Parabolic	4'T8	E	OS	2	1	32	6	190	3	70	80	0	27	27

Location			Existing Fixture Information												Retrofit Information												Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
131	1	Womens Locker Room Bath	Screw-in	N	Inc	2	1	60	S	8	190	0	120	182	N/A	Screw-in	Inc	N	OS	2	1	60	6	190	0	120	137	0	46	46
132	1	Men's Locker Room	Parabolic	E	4'T8	23	1	32	S	8	190	3	805	1,224	C	Parabolic	4'T8	E	OS	23	1	32	6	190	3	805	918	0	306	306
133	1	Womens Locker Room Storage	Parabolic	E	4'T8	4	4	32	S	8	190	13	564	857	C	Parabolic	4'T8	E	OS	4	4	32	6	190	13	564	643	0	214	214
134	1	Womens Locker Room	Exit Sign	N	LED	3	1	5	N	24	365	1	18	158	N/A	Exit Sign	LED	N	N	3	1	5	24	365	1	18	158	0	0	0
135	1	Hallway	Recessed	E	4'T8	55	1	32	S	16	190	3	1,925	5,852	N/A	Recessed	4'T8	E	S	55	1	32	16	190	3	1925	5852	0	0	0
136	1	Hallway	2'U-shape	E	4'T8	4	2	32	S	16	190	6	280	851	N/A	2'U-Shape	4'T8	E	S	4	2	32	16	190	6	280	851	0	0	0
137	1	Hallway	Exit Sign	N	LED	2	1	5	N	24	365	1	12	105	N/A	Exit Sign	LED	N	N	2	1	5	24	365	1	12	105	0	0	0
138	1	Science Room / Laboratory (112)	Recessed	E	4'T8	16	4	32	S	9	190	13	2,256	3,858	N/A	Recessed	4'T8	E	S	16	4	32	9	190	13	2256	3858	0	0	0
139	1	Office (112)	Recessed	E	4'T8	2	4	32	S	9	190	13	282	482	N/A	Recessed	4'T8	E	S	2	4	32	9	190	13	282	482	0	0	0
140	1	Storage Rm (112)	Recessed	E	4'T8	2	4	32	S	2	190	13	282	107	N/A	Recessed	4'T8	E	S	2	4	32	2	190	13	282	107	0	0	0
141	1	Science Room / Laboratory (113)	Recessed	E	4'T8	16	4	32	S	9	190	13	2,256	3,858	N/A	Recessed	4'T8	E	S	16	4	32	9	190	13	2256	3858	0	0	0
142	1	Office (113)	Recessed	E	4'T8	2	4	32	S	9	190	13	282	482	N/A	Recessed	4'T8	E	S	2	4	32	9	190	13	282	482	0	0	0
143	1	Classroom (114)	Recessed	E	4'T8	16	4	32	S	9	190	13	2,256	3,858	N/A	Recessed	4'T8	E	S	16	4	32	9	190	13	2256	3858	0	0	0
144	1	Classroom (115)	Recessed	E	4'T8	16	4	32	S	9	190	13	2,256	3,858	N/A	Recessed	4'T8	E	S	16	4	32	9	190	13	2256	3858	0	0	0
145	1	Classroom (125)	Recessed	E	4'T8	6	3	32	S	9	190	10	636	1,088	N/A	Recessed	4'T8	E	S	6	3	32	9	190	10	636	1088	0	0	0
146	1	Computer Lab (116)	Parabolic	E	4'T8	18	2	32	S	9	190	6	1,260	2,155	N/A	Parabolic	4'T8	E	S	18	2	32	9	190	6	1260	2155	0	0	0
147	1	Computer Lab (116)	2'U-shape	E	4'T8	5	1	32	S	9	190	3	175	299	N/A	2'U-Shape	4'T8	E	S	5	1	32	9	190	3	175	299	0	0	0
148	1	Server Room Unoccupied	Parabolic	E	4'T8	2	2	32	S	2	190	6	140	53	N/A	Parabolic	4'T8	E	S	2	2	32	2	190	6	140	53	0	0	0
149	1	Boiler Rm	Parabolic	E	4'T8	1	2	32	S	2	190	6	70	27	N/A	Parabolic	4'T8	E	S	1	2	32	2	190	6	70	27	0	0	0
150	1	Classroom (107)	Parabolic	E	4'T8	12	2	32	S	9	190	6	840	1,436	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	6	840	1436	0	0	0
151	1	Janitor's Closet	Parabolic	E	4'T8	1	2	32	S	2	190	6	70	27	N/A	Parabolic	4'T8	E	S	1	2	32	2	190	6	70	27	0	0	0
152	1	Bathroom Men	Parabolic	E	4'T8	3	2	32	S	9	190	6	210	359	N/A	Parabolic	4'T8	E	S	3	2	32	9	190	6	210	359	0	0	0
153	1	Classroom (118)	Parabolic	E	4'T8	12	2	32	S	9	190	6	840	1,436	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	6	840	1436	0	0	0
154	1	Faculty Room (109)	Recessed	E	4'T8	6	4	32	S	9	190	13	846	1,447	C	Recessed	4'T8	E	OS	6	4	32	7	190	13	846	1085	0	362	362
155	1	Office (109)	2'U-shape	E	4'T8	1	2	32	S	4	190	6	70	53	N/A	2'U-Shape	4'T8	E	S	1	2	32	4	190	6	70	53	0	0	0
156	1	Classroom (111)	Parabolic	E	4'T8	12	2	32	S	9	190	6	840	1,436	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	6	840	1436	0	0	0
157	1	Staircase	Parabolic	E	4'T8	3	2	32	S	16	190	6	210	638	N/A	Parabolic	4'T8	E	S	3	2	32	16	190	6	210	638	0	0	0
158	1	Vestibule	Parabolic	E	4'T8	1	2	32	S	16	190	6	70	213	N/A	Parabolic	4'T8	E	S	1	2	32	16	190	6	70	213	0	0	0
159	1	Classroom (110)	Parabolic	E	4'T8	14	2	32	S	9	190	6	980	1,676	N/A	Parabolic	4'T8	E	S	14	2	32	9	190	6	980	1676	0	0	0
160	1	Cafeteria	Parabolic	E	4'T8	55	2	32	S	8	190	6	3,850	5,852	N/A	Parabolic	4'T8	E	S	55	2	32	8	190	6	3850	5852	0	0	0
161	1	Cafeteria	Exit Sign	N	LED	2	1	5	N	24	365	1	12	105	N/A	Exit Sign	LED	N	N	2	1	5	24	365	1	12	105	0	0	0
162	1	Faculty Dining Room	Recessed	E	4'T8	4	4	32	S	4	190	13	564	429	N/A	Recessed	4'T8	E	S	4	4	32	4	190	13	564	429	0	0	0
163	1	Kitchen	Recessed	E	4'T8	21	4	32	S	16	190	13	2,961	9,001	C	Recessed	4'T8	E	OS	21	4	32	12	190	13	2961	6751	0	2,250	2,250
164	1	Office	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
165	1	Office	Parabolic	E	4'T8	1	2	32	S	9	190	6	70	120	N/A	Parabolic	4'T8	E	S	1	2	32	9	190	6	70	120	0	0	0
166	1	Kitchen Locker Room	Screw-in	N	Inc	1	1	75	S	9	190	0	75	128	N/A	Screw-in	Inc	N	S	1	1	75	9	190	0	75	128	0	0	0
167	1	Kitchen Bathroom	Screw-in	N	Inc	1	1	75	S	9	190	0	75	128	N/A	Screw-in	Inc	N	S	1	1	75	9	190	0	75	128	0	0	0
168	1	Bathroom Men	Parabolic	E	4'T8	2	2	32	S	9	190	6	140	239	N/A	Parabolic	4'T8	E	S	2	2	32	9	190	6	140	239	0	0	0
169	1	Janitor's Closet	Parabolic	E	4'T8	2	2	32	S	2	190	6	140	53	N/A	Parabolic	4'T8	E	S	2	2	32	2	190	6	140	53	0	0	0
170	1	Staircase	Recessed	E	4'T8	1	2	32	S	16	190	6	70	213	N/A	Recessed	4'T8	E	S	1	2	32	16	190	6	70	213	0	0	0
171	1	Staircase	Screw-in	N	Inc	2	1	75	S	16	190	0	150	456	N/A	Screw-in	Inc	N	S	2	1	75	16	190	0	150	456	0	0	0
172	1	Lobby	2'U-shape	E	4'T8	12	2	32	S	8	190	6	840	1,277	N/A	2'U-Shape	4'T8	E	S	12	2	32	8	190	6	840	1277	0	0	0
173	1	Lobby	Recessed	N	CFL	12	2	15	S	8	190	0	360	547	N/A	Recessed	CFL	N	S	12	2	15	8	190	0	360	547	0	0	0
174	1	Lobby	Exit Sign	N	LED	4	1	5	N	24	365	1	24	210	N/A	Exit Sign	LED	N	N	4	1	5	24	365	1	24	210	0	0	0
175	1	Lobby	Parabolic	E	4'T8	7	2	32	S	16	190	6	490	1,490	N/A	Parabolic	4'T8	E	S	7	2	32	16	190	6	490	1490	0	0	0
176	1	Vestibule	Exit Sign	N	LED	3	1	5	N	24	365	1	18	158	N/A	Exit Sign	LED	N	N	3	1	5	24	365	1	18	158	0	0	0
177	1	Vestibule	Screw-in	N	CFL	5	1	23	S	16	190	0	115	350	N/A	Screw-in	CFL	N	S	5	1	23	16	190	0	115	350	0	0	0
178	1	Hallway	Recessed	E	4'T8	6	4	32	S	16	190	13	846	2,572	N/A	Recessed	4'T8	E	S	6	4	32	16	190	13	846	2572	0	0	0
179	1	Hallway	Recessed	E	4'T8	1	3	32	S	16	190	10	106	322	N/A	Recessed	4'T8	E	S	1	3	32	16	190	10	106	322	0	0	0
180	1	Hallway	Exit Sign	N	LED	2	1	5	N	24	365	1	12	105	N/A	Exit Sign	LED	N	N	2	1	5	24	365	1	12	105	0	0	0
181	1	Nurse's Station	Recessed	E	4'T8	4	3	32	S	9	190	10	424	725	C	Recessed	4'T8	E	OS	4	3	32	7	190	10	424	544	0	181	181
182	1	Nurse's Station	2'U-shape	E	4'T8	4	2	32	S	9	190	6	280	479	N/A	2'U-Shape	4'T8	E	S	4	2	32	9	190	6	280	479	0	0	0
183	1	Nurse's Bathroom	Recessed	E	4'T8	1	3	32	S	9	190	10	106	181	N/A	Recessed	4'T8	E	S	1	3	32	9	190	10	106	181	0	0	0
184	1	Nurse's Exam Room	Recessed	E	4'T8	2	3	32	S	9	190	10	212	363	N/A	Recessed	4'T8	E	S	2	3	32	9	190	10	212	363	0	0	0
185	1	Guidance Office 1	Recessed	E	4'T8	2	3	32	S	9	190	10	212	363	N/A	Recessed	4'T8	E	S	2	3	32	9	190	10	212	363	0	0	0
186	1	Guidance Office 2	Recessed	E	4'T8	2	3	32	S	9	190	10	212	363	N/A	Recessed	4'T8	E	S	2	3	32	9	190	10	212	363	0	0	0
187	1	Vice Principals Office	Recessed	E	4'T8	4	3	32	S	9	190	10	424	725	N/A	Recessed	4'T8	E	S	4	3	32	9	190	10	424	725	0	0	0
188	1	Principals Office	Recessed	E	4'T8	6	3	32	S	9	190	10	636	1,088	N/A	Recessed	4'T8	E	S	6	3	32	9	190	10	636	1088	0	0	0
188	1	Bathroom Women	Recessed	E	4'T8	1	3	32	S	9	190	10	106	181	N/A	Recessed	4'T8	E	S	1	3	32	9	190	10	106	181	0	0	0
189	1	Bathroom Men	Recessed	E	4'T8	1	3	32	S	9	190	10	106	181	N/A	Recessed	4'T8	E	S	1	3	32	9	190	10	106	181	0	0	0
190	1	Meeting Rm	Recessed	E	4'T8	3	3	32	S	4	190	10	318	242	N/A	Recessed	4'T8	E	S	3	3	32	4	190	10	318	242	0	0	0
191	1	Copy Room	Recessed	N	4'T8	2	3	32	S	9	190	10	212	363	N/A	Recessed	4'T8	N	S	2	3	32	9	190	10	212	363	0	0	0
192	1	Main Office	Exit Sign	N	LED	3	1	5	N	24	365	1	18	158	N/A	Exit Sign	LED	N	N	3	1	5	24	365	1	18	158	0	0	0
193	1	Main Office	Recessed	E	4'T8	18	3	32	S	9	190	10	1,908	3,263	N/A	Recessed	4'T8	E	S	18	3	32	9	190	10	1908	3263	0	0	0
194	1	Display Cases	Screw-in	N	CFL	12	1	23	S	24	190	0	276	1,259	N/A	Screw-in	CFL	N	S	12	1	23	24	190	0	276	1259	0	0	0

Location			Existing Fixture Information												Retrofit Information												Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
195	1	Hallway	Recessed	E	4'T8	13	2	32	S	16	190	6	910	2,766	N/A	Recessed	4'T8	E	S	13	2	32	16	190	6	910	2766	0	0	0
196	1	Hallway	Exit Sign	N	LED	3	1	5	N	24	365	1	18	158	N/A	Exit Sign	LED	N	N	3	1	5	24	365	1	18	158	0	0	0
197	1	Auditorium	Parabolic	E	4'T8	19	6	32	S	4	190	20	4,028	3,061	N/A	Parabolic	4'T8	E	S	19	6	32	4	190	20	4028	3061	0	0	0
198	1	Auditorium	Exit Sign	N	LED	4	1	5	N	24	365	1	24	210	N/A	Exit Sign	LED	N	N	4	1	5	24	365	1	24	210	0	0	0
199	1	Stage	Parabolic	E	4'T8	10	4	32	S	4	190	13	1,410	1,072	N/A	Parabolic	4'T8	E	S	10	4	32	4	190	13	1410	1072	0	0	0
200	1	Stage	Exit Sign	N	LED	2	1	5	N	24	365	1	12	105	N/A	Exit Sign	LED	N	N	2	1	5	24	365	1	12	105	0	0	0
201	1	Staircase	Screw-in	N	CFL	2	1	23	S	16	190	0	46	140	N/A	Screw-in	CFL	N	S	2	1	23	16	190	0	46	140	0	0	0
202	1	Hallway	Recessed	E	4'T8	6	4	32	S	16	190	13	846	2,572	N/A	Recessed	4'T8	E	S	6	4	32	16	190	13	846	2572	0	0	0
203	1	Hallway	Exit Sign	N	LED	3	1	5	N	24	365	1	18	158	N/A	Exit Sign	LED	N	N	3	1	5	24	365	1	18	158	0	0	0
204	1	Bathroom Men	Parabolic	E	4'T8	3	2	32	S	9	190	6	210	359	N/A	Parabolic	4'T8	E	S	3	2	32	9	190	6	210	359	0	0	0
205	1	Bathroom Women	Parabolic	E	4'T8	3	2	32	S	9	190	6	210	359	N/A	Parabolic	4'T8	E	S	3	2	32	9	190	6	210	359	0	0	0
206	1	Janitor's Closet	Parabolic	E	4'T8	1	2	32	S	2	190	6	70	27	N/A	Parabolic	4'T8	E	S	1	2	32	2	190	6	70	27	0	0	0
207	1	Storage Rm	Parabolic	E	4'T8	2	2	32	S	2	190	6	140	53	N/A	Parabolic	4'T8	E	S	2	2	32	2	190	6	140	53	0	0	0
208	1	Hallway	Recessed	E	4'T8	26	1	32	S	16	190	3	910	2,766	N/A	Recessed	4'T8	E	S	26	1	32	16	190	3	910	2766	0	0	0
209	1	Hallway	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
210	1	Shop Classroom (102)	Parabolic	E	4'T8	36	2	32	S	9	190	6	2,520	4,309	N/A	Parabolic	4'T8	E	S	36	2	32	9	190	6	2520	4309	0	0	0
211	1	Classroom (103B)	Recessed	E	4'T8	5	3	32	S	9	190	10	530	906	N/A	Recessed	4'T8	E	S	5	3	32	9	190	10	530	906	0	0	0
212	1	Classroom (103A)	Recessed	E	4'T8	4	3	32	S	9	190	10	424	725	N/A	Recessed	4'T8	E	S	4	3	32	9	190	10	424	725	0	0	0
213	1	Hallway	2'U-shape	E	4'T8	3	2	32	S	16	190	6	210	638	N/A	2'U-Shape	4'T8	E	S	3	2	32	16	190	6	210	638	0	0	0
214	1	Classroom (100)	Parabolic	E	4'T8	14	4	32	S	9	190	13	1,974	3,376	N/A	Parabolic	4'T8	E	S	14	4	32	9	190	13	1974	3376	0	0	0
215	1	Vestibule	Screw-in	N	Inc	1	1	75	S	16	190	0	75	228	N/A	Screw-in	Inc	N	S	1	1	75	16	190	0	75	228	0	0	0
216	1	Classroom (101)	Recessed	E	4'T8	15	2	32	S	9	190	6	1,050	1,796	N/A	Recessed	4'T8	E	S	15	2	32	9	190	6	1050	1796	0	0	0
217	1	Classroom (101)	Parabolic	E	4'T8	4	2	32	S	9	190	6	280	479	N/A	Parabolic	4'T8	E	S	4	2	32	9	190	6	280	479	0	0	0
218	1	Classroom (101)	Parabolic	E	4'T8	2	2	32	S	9	190	6	140	239	N/A	Parabolic	4'T8	E	S	2	2	32	9	190	6	140	239	0	0	0
219	1	Hallway (101)	Recessed	E	4'T8	26	1	32	S	16	190	3	910	2,766	N/A	Recessed	4'T8	E	S	26	1	32	16	190	3	910	2766	0	0	0
220	1	Hallway	2'U-shape	E	4'T8	1	2	32	S	16	190	6	70	213	N/A	2'U-Shape	4'T8	E	S	1	2	32	16	190	6	70	213	0	0	0
221	1	Hallway	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
222	1	Vestibule	Screw-in	N	Inc	1	1	75	S	16	190	0	75	228	N/A	Screw-in	Inc	N	S	1	1	75	16	190	0	75	228	0	0	0
223	1	Classroom (117)	Parabolic	E	4'T8	27	2	32	S	9	190	6	1,890	3,232	N/A	Parabolic	4'T8	E	S	27	2	32	9	190	6	1890	3232	0	0	0
224	1	Classroom (118)	Parabolic	E	4'T8	24	2	32	S	9	190	6	1,680	2,873	N/A	Parabolic	4'T8	E	S	24	2	32	9	190	6	1680	2873	0	0	0
225	1	Classroom - Shared Room (118)	Parabolic	E	4'T8	3	2	32	S	9	190	6	210	359	N/A	Parabolic	4'T8	E	S	3	2	32	9	190	6	210	359	0	0	0
226	1	Classroom (119)	Parabolic	E	4'T8	21	2	32	S	9	190	6	1,470	2,514	N/A	Parabolic	4'T8	E	S	21	2	32	9	190	6	1470	2514	0	0	0
227	1	Classroom (120)	Parabolic	E	4'T8	21	2	32	S	9	190	6	1,470	2,514	N/A	Parabolic	4'T8	E	S	21	2	32	9	190	6	1470	2514	0	0	0
228	1	Classroom (121)	Recessed	E	4'T8	25	3	32	S	9	190	10	2,650	4,532	N/A	Recessed	4'T8	E	S	25	3	32	9	190	10	2650	4532	0	0	0
229	1	Classroom (121)	2'U-shape	E	4'T8	12	2	32	S	9	190	6	840	1,436	N/A	2'U-Shape	4'T8	E	S	12	2	32	9	190	6	840	1436	0	0	0
230	1	Library	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
231	1	Library	2'U-shape	E	4'T8	6	2	32	S	9	190	6	420	718	N/A	2'U-Shape	4'T8	E	S	6	2	32	9	190	6	420	718	0	0	0
232	1	Library - Workroom	Recessed	E	4'T8	6	3	32	S	9	190	10	636	1,088	N/A	Recessed	4'T8	E	S	6	3	32	9	190	10	636	1088	0	0	0
233	1	Library - Office	Recessed	E	4'T8	3	3	32	S	9	190	10	318	544	N/A	Recessed	4'T8	E	S	3	3	32	9	190	10	318	544	0	0	0
234	1	Library	Recessed	N	CFL	8	2	13	S	9	190	0	208	356	N/A	Recessed	CFL	N	S	8	2	13	9	190	0	208	356	0	0	0
235	1	Library	Parabolic	E	4'T8	16	2	32	S	9	190	6	1,120	1,915	N/A	Parabolic	4'T8	E	S	16	2	32	9	190	6	1120	1915	0	0	0
236	1	Library	Parabolic	E	4'T8	34	3	32	S	9	190	10	3,604	6,163	N/A	Parabolic	4'T8	E	S	34	3	32	9	190	10	3604	6163	0	0	0
237	1	Library	Recessed	N	CFL	39	2	13	D	9	190	0	1,014	1,734	N/A	Recessed	CFL	N	D	39	2	13	9	190	0	1014	1734	0	0	0
238	1	Library	Exit Sign	N	LED	2	1	5	N	24	365	1	12	105	N/A	Exit Sign	LED	N	N	2	1	5	24	365	1	12	105	0	0	0
239	2	Staircase	2'U-shape	E	4'T8	3	2	32	S	16	190	6	210	638	N/A	2'U-Shape	4'T8	E	S	3	2	32	16	190	6	210	638	0	0	0
240	2	AV Room	Parabolic	E	4'T8	2	2	32	S	9	190	6	140	239	N/A	Parabolic	4'T8	E	S	2	2	32	9	190	6	140	239	0	0	0
241	2	AV Room	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
242	2	Auditorium Screening Room	Parabolic	E	4'T8	4	2	32	S	9	190	6	280	479	N/A	Parabolic	4'T8	E	S	4	2	32	9	190	6	280	479	0	0	0
243	2	Auditorium Screening Room	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
244	2	Mechanical Rm	Screw-in	N	CFL	1	2	23	S	2	190	0	46	17	N/A	Screw-in	CFL	N	S	1	2	23	2	190	0	46	17	0	0	0
245	2	Mechanical Rm	Screw-in	N	Inc	1	1	75	S	2	190	0	75	29	N/A	Screw-in	Inc	N	S	1	1	75	2	190	0	75	29	0	0	0
246	2	Mechanical Rm	Screw-in	N	CFL	2	2	23	S	2	190	0	92	35	N/A	Screw-in	CFL	N	S	2	2	23	2	190	0	92	35	0	0	0
247	1	Hallway	Exit Sign	N	LED	4	1	5	N	24	365	1	24	210	N/A	Exit Sign	LED	N	N	4	1	5	24	365	1	24	210	0	0	0
248	1	Hallway	Recessed	E	4'T8	44	1	32	S	16	190	3	1,540	4,682	N/A	Recessed	4'T8	E	S	44	1	32	16	190	3	1540	4682	0	0	0
249	1	Hallway	2'U-shape	E	4'T8	7	2	32	S	16	190	6	490	1,490	N/A	2'U-Shape	4'T8	E	S	7	2	32	16	190	6	490	1490	0	0	0
250	2	Classroom (200)	Recessed	E	4'T8	12	4	32	S	9	190	13	1,692	2,893	N/A	Recessed	4'T8	E	S	12	4	32	9	190	13	1692	2893	0	0	0
251	2	Storage Rm (200)	Recessed	E	4'T8	3	2	32	S	2	190	6	210	80	N/A	Recessed	4'T8	E	S	3	2	32	2	190	6	210	80	0	0	0
252	2	Science Room / Laboratory (201)	Parabolic	E	4'T8	16	2	32	S	9	190	6	1,120	1,915	N/A	Parabolic	4'T8	E	S	16	2	32	9	190	6	1120	1915	0	0	0
253	2	Classroom (202)	Parabolic	E	4'T8	12	2	32	S	9	190	6	840	1,436	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	6	840	1436	0	0	0
254	2	Classroom (203)	Parabolic	E	4'T8	12	2	32	S	9	190	6	840	1,436	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	6	840	1436	0	0	0
255	2	Classroom (204)	Parabolic	E	4'T8	12	2	32	S	9	190	6	840	1,436	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	6	840	1436	0	0	0
256	2	Classroom (205)	Parabolic	E	4'T8	4	2	32	S	9	190	6	280	479	N/A	Parabolic	4'T8	E	S	4	2	32	9	190	6	280	479	0	0	0
257	2	Elevator Lobby	2'U-shape	E	4'T8	4	2	32	S	2	190	6	280	106	N/A	2'U-Shape	4'T8	E	S	4	2	32	2	190	6	280	106	0	0	0
258	2	Elevator Lobby	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
259	2	Classroom (206)	Parabolic	E	4'T8	10	3	32	S	9	190	10	1,060	1,813	N/A	Parabolic	4'T8	E	S	10	3	32	9	190	10	1060	1813	0	0	0

Location			Existing Fixture Information												Retrofit Information													Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
260	2	Classroom (207A)	Recessed	E	4'T8	4	3	32	S	9	190	10	424	725	N/A	Recessed	4'T8	E	S	4	3	32	9	190	10	424	725	0	0	0
261	2	Classroom (207B)	2'U-shape	E	4'T8	4	2	32	S	9	190	6	280	479	N/A	2'U-Shape	4'T8	E	S	4	2	32	9	190	6	280	479	0	0	0
262	2	Classroom (207B)	Recessed	E	4'T8	3	3	32	S	9	190	10	318	544	N/A	Recessed	4'T8	E	S	3	3	32	9	190	10	318	544	0	0	0
263	2	Classroom (208)	Recessed	E	4'T8	8	3	32	S	9	190	10	848	1,450	N/A	Recessed	4'T8	E	S	8	3	32	9	190	10	848	1450	0	0	0
264	2	Classroom (209)	Recessed	E	4'T8	14	3	32	S	9	190	10	1,484	2,538	N/A	Recessed	4'T8	E	S	14	3	32	9	190	10	1484	2538	0	0	0
265	2	Classroom (210)	Parabolic	E	4'T8	26	2	32	S	9	190	6	1,820	3,112	N/A	Parabolic	4'T8	E	S	26	2	32	9	190	6	1820	3112	0	0	0
266	2	Classroom (211)	Parabolic	E	4'T8	12	2	32	S	9	190	6	840	1,436	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	6	840	1436	0	0	0
267	2	Bathroom Men	Parabolic	E	4'T8	3	2	32	S	9	190	6	210	359	N/A	Parabolic	4'T8	E	S	3	2	32	9	190	6	210	359	0	0	0
268	2	Janitor's Closet	Parabolic	E	4'T8	1	2	32	S	2	190	6	70	27	N/A	Parabolic	4'T8	E	S	1	2	32	2	190	6	70	27	0	0	0
269	2	Book Storage Room	Parabolic	E	4'T8	2	2	32	S	2	190	6	140	53	N/A	Parabolic	4'T8	E	S	2	2	32	2	190	6	140	53	0	0	0
270	2	Bathroom Women	Parabolic	E	4'T8	3	2	32	S	9	190	6	210	359	N/A	Parabolic	4'T8	E	S	3	2	32	9	190	6	210	359	0	0	0
271	2	Classroom (212)	Parabolic	E	4'T8	12	2	32	S	9	190	6	840	1,436	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	6	840	1436	0	0	0
272	2	Classroom (213)	Parabolic	E	4'T8	12	2	32	S	9	190	6	840	1,436	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	6	840	1436	0	0	0
273	2	Classroom (214)	Parabolic	E	4'T8	12	2	32	S	9	190	6	840	1,436	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	6	840	1436	0	0	0
274	2	Classroom (215)	Parabolic	E	4'T8	12	2	32	S	9	190	6	840	1,436	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	6	840	1436	0	0	0
275	2	Classroom (216)	Parabolic	E	4'T8	12	2	32	S	9	190	6	840	1,436	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	6	840	1436	0	0	0
276	2	Classroom (217)	Parabolic	E	4'T8	12	2	32	S	9	190	6	840	1,436	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	6	840	1436	0	0	0
277	2	Classroom (218)	Parabolic	E	4'T8	6	2	32	S	9	190	6	420	718	N/A	Parabolic	4'T8	E	S	6	2	32	9	190	6	420	718	0	0	0
278	2	Science Room / Laboratory (219)	Parabolic	E	4'T8	20	2	32	S	8	190	6	1,400	2,128	N/A	Parabolic	4'T8	E	S	20	2	32	8	190	6	1400	2128	0	0	0
279	2	Staircase (219)	Parabolic	E	4'T8	1	2	32	S	16	190	6	70	213	N/A	Parabolic	4'T8	E	S	1	2	32	16	190	6	70	213	0	0	0
280	2	Staircase (219)	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
281	2	Storage Rm (219)	Screw-in	N	Inc	1	1	75	S	2	190	0	75	29	N/A	Screw-in	Inc	N	S	1	1	75	2	190	0	75	29	0	0	0
282	2	Lab Storage Room 1 (219)	Parabolic	E	4'T8	2	2	32	S	9	190	6	140	239	N/A	Parabolic	4'T8	E	S	2	2	32	9	190	6	140	239	0	0	0
283	2	Lab Storage Room 2 (219)	Parabolic	E	4'T8	1	2	32	S	9	190	6	70	120	N/A	Parabolic	4'T8	E	S	1	2	32	9	190	6	70	120	0	0	0
284	Ext	Exterior	Exterior	N	Hal	7	1	65	PC	12	365	16	567	2,483	N/A	Exterior	Hal	N	PC	7	1	65	12	365	16	567	2483	0	0	0
285	Ext	Exterior	Exterior	N	MH	4	1	75	PC	12	365	19	376	1,647	N/A	Exterior	MH	N	PC	4	1	75	12	365	19	376	1647	0	0	0
286	Ext	Exterior	Exterior	N	MH	4	1	150	PC	12	365	38	752	3,294	N/A	Exterior	MH	N	PC	4	1	150	12	365	38	752	3294	0	0	0
287	P	Exterior	Exterior	N	HPS	7	1	200	PC	12	365	50	1,750	7,665	N/A	Exterior	MH	N	PC	7	1	200	12	365	50	1750	7665	0	0	0
Totals:						**2,165**	**611**	**9,114**				**1,921**	**176,596**	**332,352**						**2,165**	**614**	**8,742**			**1,827**	**167,428**	**311,564**	**15,677**	**5,110**	**20,788**

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

TO USERS: ONCE ALL ROOMS ARE ADDED, DELETE ROWS NOT USED. MAKE SURE TO DELETE ENTIRE ROW, DO NOT SHIFT CELLS!

Proposed Lighting Summary Table			
Total Surface Area (SF)	146,935		
Average Power Cost ($/kWh)	0.1590		
Exterior Lighting	**Existing**	**Proposed**	**Savings**
Exterior Annual Consumption (kWh)	7,424	7,424	**0**
Exterior Power (watts)	1,695	1,695	**0**
Total Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	324,928	304,140	**20,788**
Lighting Power (watts)	174,901	165,733	**9,168**
Lighting Power Density (watts/SF)	1.19	1.13	**0.06**
Estimated Cost of Fixture Replacement ($)	5,856		
Estimated Cost of Controls Improvements ($)	5,400		
Total Consumption Cost Savings ($)	**3,305**		

Legend:

Fixture Type	Lamp Type	Control Type	Ballast Type	Retrofit Category
Exit Sign	LED	N (None)	N/A (None)	N/A (None)
Screw-in	Inc (Incandescent)	S (Switch)	E (Electronic)	T8 (Installl new T8)
Pin	1'T5	OS (Occupancy Sensor)	M (Magnetic)	T5 (Install new T5)
Parabolic	2'T5	T (Timer)		CFL (Install new CFL)
Recessed	3'T5	PC (Photocell)		LEDex (Install new LED Exit)
2'U-shape	4'T5	D (Dimming)		LED (Install new LED)
Circiline	2'T8	DL (Daylight Sensor)		D (Delamping)
Exterior	3'T8	M (Microphonic Sensor)		C (Controls Only)
HID (High Intensity Discharge)	4'T8			
	6'T8			
	8'T8			
	2'T12			
	3'T12			
	4'T12			
	6'T12			
	8'T12			
	CFL (Compact Fluorescent Lightbulb)			
	MR16			
	Halogen			
	MV (Mercury Vapor)			
	MH (Metal Halide)			
	HPS (High Pressure Sodium			
	LPS (Low Pressure Sodium)			

Appendix B: Third Party Energy Suppliers (ESCOs)
http://www.state.nj.us/bpu/commercial/shopping.html

PSE&G ELECTRICAL SERVICE TERRITORY Last Updated: 06/15/09		
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095 (800) 437-7872 www.hess.com	**BOC Energy Services, Inc.** 1135 Mountain Avenue Murray Hill, NJ 011374 (800) 247-2644 www.boc.com	**Commerce Energy, Inc.** 4400 Route 9 South, Suite 100 Freehold, NJ 07728 (800) 556-84113 www.commerceenergy.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446 (888) 635-0827 www.newenergy.com	**Direct Energy Services, LLC** 120 Wood Avenue Suite 611 Iselin, NJ 08830 (866) 547-2722 www.directenergy.com	**FirstEnergy Solutions Corp.** 300 Madison Avenue Morristown, NJ 0113113 (800) 977-0500 www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640 (877) 569-2841 www.glacialenergy.com	**Integrys Energy Services, Inc.** 99 Wood Ave, South, Suite 802 Iselin, NJ 08830 (877) 763-9977 www.integrysenergy.com	**Strategic Energy, LLC** 55 Madison Avenue, Suite 400 Morristown, NJ 011360 (888) 925-9115, www.sel.com
Liberty Power Holdings, LLC Park 80 West, Plaza II, Suite 200 Saddle Brook, NJ 07663 (866) 769-31139 www.libertypowercorp.com	**Pepco Energy Services, Inc.** 112 Main St. Lebanon, NJ 08833 (800) ENERGY-9 (363-7499) www.pepco-services.com	**PPL EnergyPlus, LLC** 811 Church Road Cherry Hill, NJ 08002 (800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions The Mac-Cali Building 581 Main Street, 8th Floor Woodbridge, NJ 07095 (877) 273-6772 www.semprasolutions.com	**South Jersey Energy Company** One South Jersey Plaza Route 54 Folsom, NJ 08037 (800) 800-756-3749 www.south jerseyenergy.com	**Suez Energy Resources NA, Inc.** 333 Thornall Street 6th Floor Edison, NJ 08837 (888) 644-1014 www.suezenergyresources.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 080113 (856) 273-9995 www.ugienergyservices.com	**American Powernet Management, LP** 437 North Grove St. Berlin, NJ 08009 (800) 437-7872 www.hess.com	**ConEdison Solutions** Cherry Tree, Corporate Center 1135 State Highway 38 Cherry Hill, NJ 08002 (888) 665-0955 www.conedsolutions.com
Credit Suisse, (USA) Inc. 700 College Road East Princeton, NJ 08450 212-1138-3124 www.creditsuisse.com	**Sprague Energy Corp.** 12 Ridge Road Chatham Township NJ 011328 (800) 225-1560 www.spragueenergy.com	

PSE&G NATURAL GAS SERVICE TERRITORY Last Updated: 06/15/09		
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109 800-6BUYGAS (6-289427) www.cooperativenet.com	**Direct Energy Services, LLP** 120 Wood Avenue, Suite 611 Iselin, NJ 08830 866-547-2722 www.directenergy.com	**Dominion Retail, Inc.** 395 Highway 170 - Suite 125 Lakewood, NJ 08701 866-275-4240 http://retail.dom.com
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701 800-805-8586 www.gesc.com	**UGI Energy Services, Inc. d/b/a GASMARK** 704 East Main Street, Suite 1 Moorestown, NJ 080113 856-273-9995 www.ugienergyservices.com	**Great Eastern Energy** 116 Village Riva, Suite 200 Princeton, NJ 08540 888-651-4121 www.greateastern.com
Hess Energy, Inc. One Hess Plaza Woodbridge, NJ 07095 800-437-7872 www.hess.com	**Hudson Energy Services, LLC** 871 Route 17 South Ridgewood, NJ 07450 877- Hudson 9 www.hudsonenergyservices.com	**Intelligent Energy** 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024 800-724-1880 www.intelligentenergy.org
Keil & Sons 1 Bergen Blvd. Fairview, NJ 07002 1-877-Systrum www.systrumenergy@aol.com	**Metromedia Energy, Inc.** 6 Industrial Way Eatontown, NJ 07724 877-750-7046 www.metromediaenergy.com	**Metro Energy Group, LLC** 14 Washington Place Hackensack, NJ 07601 888-113-Metro www.metroenergy.com
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 088327 800-375-1277 www.mxenergy.com	**NATGASCO (Mitchell Supreme)** 1132 Freeman Street Orange, NJ 07050 800-840-4GAS www.natgasco.com	**Pepco Energy Services, Inc.** 112 Main Street Lebanon, NJ 08833 800-363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road - Office 105 Cherry Hill, NJ 08002 800-281-2000 www.pplenergyplus.com	**Sempra Energy Solutions** The Mac-Cali Building 581 Main Street, 8th fl. Woodbridge, NJ 07095 877-273-6772 800-2 SEMPRA www.semprasolutions.com	**South Jersey Energy Company** One South Jersey Plaza, Route 54 Folsom, NJ 08037 800-756-3749 www.sjindustries.com/sje.htm
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 011328 800-225-1560 www.spragueenergy.com	**Stuyvesant Energy LLC** 10 West Ivy Lane, Suite 4 Englewood, NJ 07631 800-646-64113 www.stuyfuel.com	**Woodruff Energy** 73 Water Street Bridgeton, NJ 08302 800-5113-1121 www.woodruffenergy.com