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February 7, 2010

Local Government Energy Program
Energy Audit Final Report

For

Livingston High School
Livingston, NJ 07039

Project Number: LGEA37

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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
- Mont 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 High School building located at 30 Robert Harp 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 two-story High School building was built in 1948 with renovations and additions in 1955, 1958, 1966, 1988, 1995 and 2008. Besides various types of classrooms and administrative offices, the building has multipurpose rooms, two gymnasiums, activity rooms, cafeteria, expanded café, auditorium, media centers, auto shop, crafts rooms, two boiler rooms, and utility rooms. In early 2009 a new Science Wing (38,610 sq ft) and a new Fitness & Wellness Center (44,911 sq ft) were opened up. The Livingston Board of Education plans to LEED (Leadership in Energy and Environmental Design) certify these new spaces. The original building consists of 213,716 square feet of conditioned space. The High School building is occupied on weekdays by 213 teachers / staff employees and 1,684 students from 7:45 am to 3:30 pm with periodic evening meetings and recreational programs (7:00 am to 10:00 pm).

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 High School 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 High School building located at 30 Robert Harp Drive, Livingston, NJ 07039. The High School building is a two-story building with a floor area of 213,716 square feet. The original structure was built in 1948 with renovations and additions in 1955, 1958, 1966, 1988, 1995 and 2008.

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 High School building (excluding the new Science Wing and the new Fitness & Wellness Center because the additions are too new and there is insufficient billing data) consumed 1,473,600 kWh or $229,147 worth of electricity at an approximate rate of $0.156/kWh and 146,522 therms or $186,552 worth of natural gas at an approximate rate of $1.273/therm . The joint energy consumption for the building, including both electricity and natural gas, was 19,681 MMBtu of energy that cost a total of $415,699.

SWA has entered energy information about the High School main and original 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 49 when compared to other buildings of its kind. This indicates that there are opportunities for the High School 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 93 kBtu/ft^{2}yr compared to the national average of a school building consuming 93 kBtu/ft^{2}yr. Implementing this report's recommendations will reduce use by approximately 15.2 kBtu/ft^{2}yr, which when implemented would make the building energy consumption even better than the national average. There may be energy procurement opportunities for the High School to reduce annual utility costs; however they were $32,450 lower in 2008, when compared to the average estimated NJ commercial utility rates.

Based on the assessment of the High School main 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 the boiler burners
- Replace domestic water heater
- Replace sump pumps
- Replace Trane RTUs and Condensing Units
- Replace common area heating emitters
- Replace two condensate receiver vacuum pump sets
- Replace window air conditioners and seal spaces thoroughly around them
- Upgrade Building Management System (BMS), including pneumatic controls conversion to DDC
- Replace steam H&V unit serving the Kitchen

- Replace sections of the roof and re-point exterior brick walls
- Replace 150 kVA transformer
- Install premium motors and high efficiency transformers when replacements are required

Category II Recommendations: Operations and Maintenance

- Replace / repair steam traps
- Insulate boiler room and building piping insulation
- Inspect and replace gaskets around doors into walk-in refrigeration boxes in the Kitchen
- Maintain roofs to verify water is draining correctly and maintain downspouts
- Replace / repair sections of the main center cupola, the chimney veneer and cap and some of the dormers
- Provide weather stripping / air sealing, especially around window air conditioning units
- Repair / seal wall cracks and penetrations and insulate attic with blown cellulose
- 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 **6** Energy Conservation Measures (ECMs) for the High School building that are summarized in the following Table 1. The total investment cost for these ECMs with incentives is **$11,797**. SWA estimates a first year savings of **$6,158** with a simple payback of **1.9 years**. SWA estimates that implementing the highly recommended ECMs will reduce the carbon footprint of the High School building by **53,466 lbs of CO_2**, which is equivalent to removing approximately 4 cars from the roads each year or avoiding the need of 130 trees to absorb the annual CO_2 generated. SWA also recommends **5** ECMs with a total first year savings of **$194,114** that is summarized in Table 2 and **3** End of Life Cycle ECMs with a total first year savings of **$7,579** 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 Clean Energy Pay for Performance program. Institutional buildings with an average annual peak demand over 200 kW (Livingston High School is 400 kW) are eligible to participate in this 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. Another option would be to enroll in the NJ SmartStart program through the New Jersey Office of Clean Energy. This incentive program 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, to be rolled out soon, could also assist to cover 80% of the capital investment.

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 4 Drinks, 3 Snacks vending machine and 6 reach-in Drink cooler energy misers - in cafeteria	www.usatech.com and established costs	3,327	none at this time	3,327	17,281	4.8	0	0.3	0	2,696	12	32,350	1.2	872	73	81	23,507	23,675
2.1	replace (108) incandescent lamps with CFLs	RS Means, Lit Search, NJ Clean Energy Program	2,160	none at this time	2,160	10,130	2.8	0	0.7	70	1,650	7	11,062	1.3	435	62	75	8,122	13,878
3.1	replace (2) 15 HP hot water circulator pump motors with Premium Efficiency	similar projects, DOE Motor Master + International	1,750	208	1,542	3,564	1.0	0	0.1	0	556	20	11,120	2.8	621	31	36	6,730	4,883
4.1	replace Cooler (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	523	20	10,452	2.9	584	29	34	6,248	4,590
5	replace (3) 1 HP flue updraft fan motors with Premium Efficiency	similar projects, DOE Motor Master + International	831	135	696	1,341	0.4	0	0.0	0	209	20	4,184	3.3	501	25	30	2,416	1,837
4.2	replace Freezer (5) 1 HP cond fan and (5) frac Hp motors with Premium Efficiency on walk-in refrigerated box	similar projects, DOE Motor Master + International	2,770	225	2,545	3,360	1.0	0	0.1	0	524	20	10,483	4.9	312	16	20	5,253	4,603
	TOTALS		**12,500**	**703**	**11,797**	**39,026**	**10.8**	**0**	**1.2**	**70**	**6,158**	**-**	**79,651**	**1.9**	**-**	**-**	**-**	**52,276**	**53,466**

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 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
renewable PV system below, with additional 40% state aid for debt service																			
6b	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
2.2	install (20) occupancy sensors	RS Means, Lit Search, NJ Clean Energy Program	4,400	400	4,000	4,759	1.3	0	0.3	0	742	12	8,909	5.4	123	10	15	3,390	6,520
7	retro commission-ing	similar projects	160,287	none at this time	160,287	37,920	10.4	14,652	7.5	1,820	26,388	12	294,813	6.1	98	8	12	102,377	51,950
3.2	replace (2) 1 HP hot water circulator pump motors with Premium Efficiency	similar projects, DOE Motor Master + International	554	90	464	447	0.1	0	0.0	0	70	20	1,395	6.7	201	10	14	573	612
2.3	replace gym Metal Halide lamps with (48) T5 fixtures	RS Means, Lit Search, NJ Clean Energy Program	15,360	768	14,592	9,448	2.6	0	0.7	70	1,544	15	22,108	9.5	59	4	6	3,839	12,944
	TOTALS		**1,690,346**	**605,156**	**1,085,190**	**273,570**	**209.3**	**14,652**	**10.9**	**1,890**	**194,114**	**-**	**1,161,486**	**5.6**	**-**	**-**	**-**	**1,361,224**	**374,791**

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
8	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	582	13.6	-12	-1	-2	-724	426
9	replace (2) packaged 15-ton electric cooling rooftop HVAC unit with high efficiency units	similar projects	50,000	2,370	47,630	12,500	3.4	0	0.2	910	2,860	10	19,500	16.7	-40	-4	-8	-23,234	17,125
10	replace 45 exhaust fans with premium efficiency units	similar projects, DOE Motor Master + International	144,000	2,430	141,570	11,475	3.2	0	0.2	2,730	4,520	10	17,901	31.3	-68	-7	<0	-103,013	15,721
	TOTALS		**196,700**	**4,800**	**191,900**	**24,286**	**6.7**	**0**	**0.4**	**3,790**	**7,579**	**-**	**37,983**	**25.3**	**-**	**-**	**-**	**-126,970**	**33,272**

1. HISTORIC ENERGY CONSUMPTION

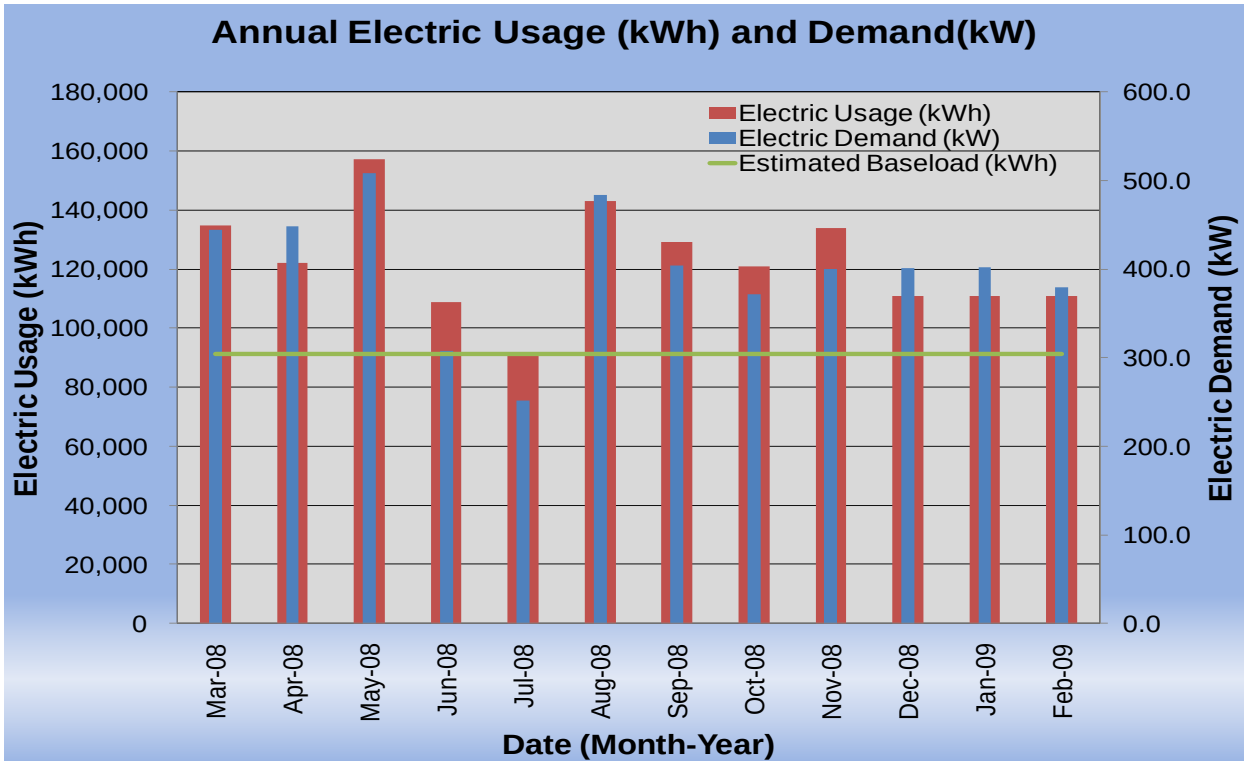
1.1. Energy usage and cost analysis

SWA analyzed utility bills from March 2007 through March 2009 that were received from the utility companies supplying the Livingston High School building with electric and natural gas.

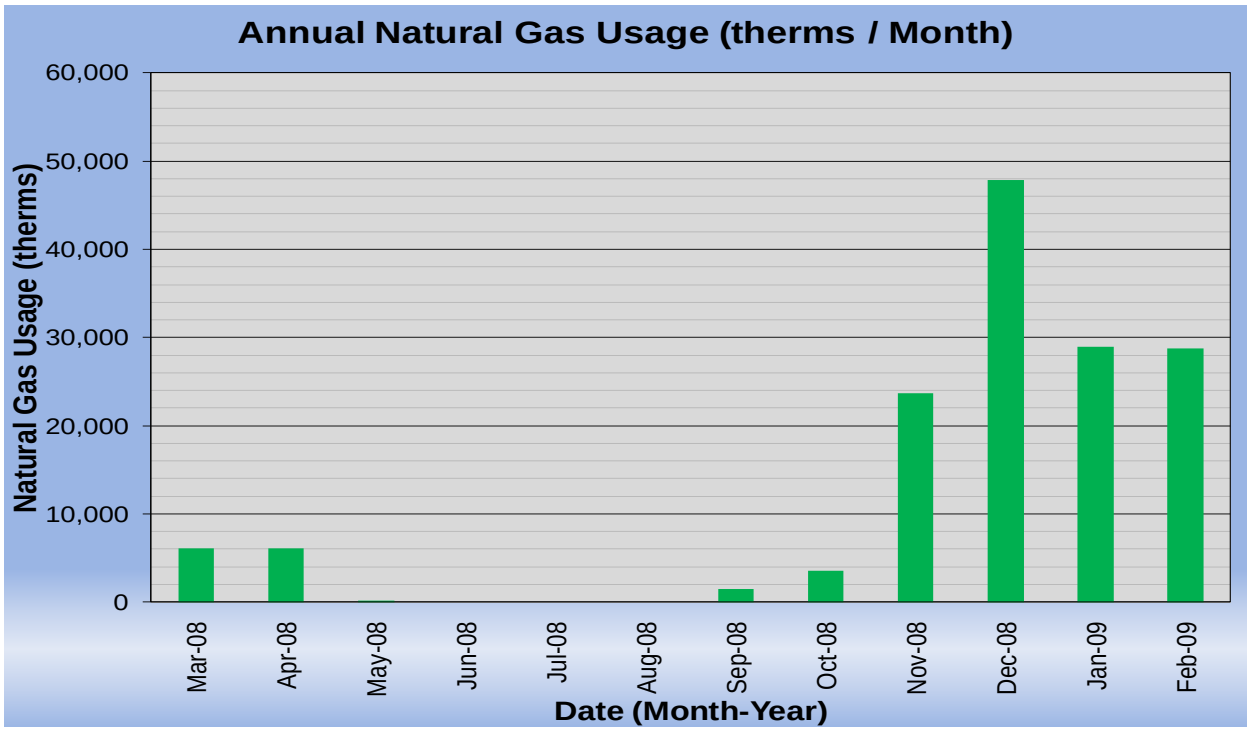
Electricity - The Livingston High School building (aside from the new Science Wing, the new Fitness & Wellness Center and the Athletic Field which have their independent meters) is currently served by one electric meter. The High School building currently buys electricity from PSE&G at **an average rate of $0.156/kWh** based on 12 months of utility bills from March 2008 to February 2009. The High School building purchased **approximately 1,473,600 kWh or $229,147 worth of electricity** in the previous year. The average monthly demand was 400 kW.

Natural gas - The Livingston High School building (aside from the new Science Wing and the new Fitness & Wellness Center which have their independent meters) is currently served by one meter for natural gas. The Livingston High School building currently buys natural gas from PSE&G (supplied by the Hess Corporation) at **an average aggregated rate of $1.273/therm** based on 12 months of utility bills for March 2008 to February 2009. The Livingston High School building purchased **approximately 146,522 therms or $186,552 worth of natural gas** in the previous year.

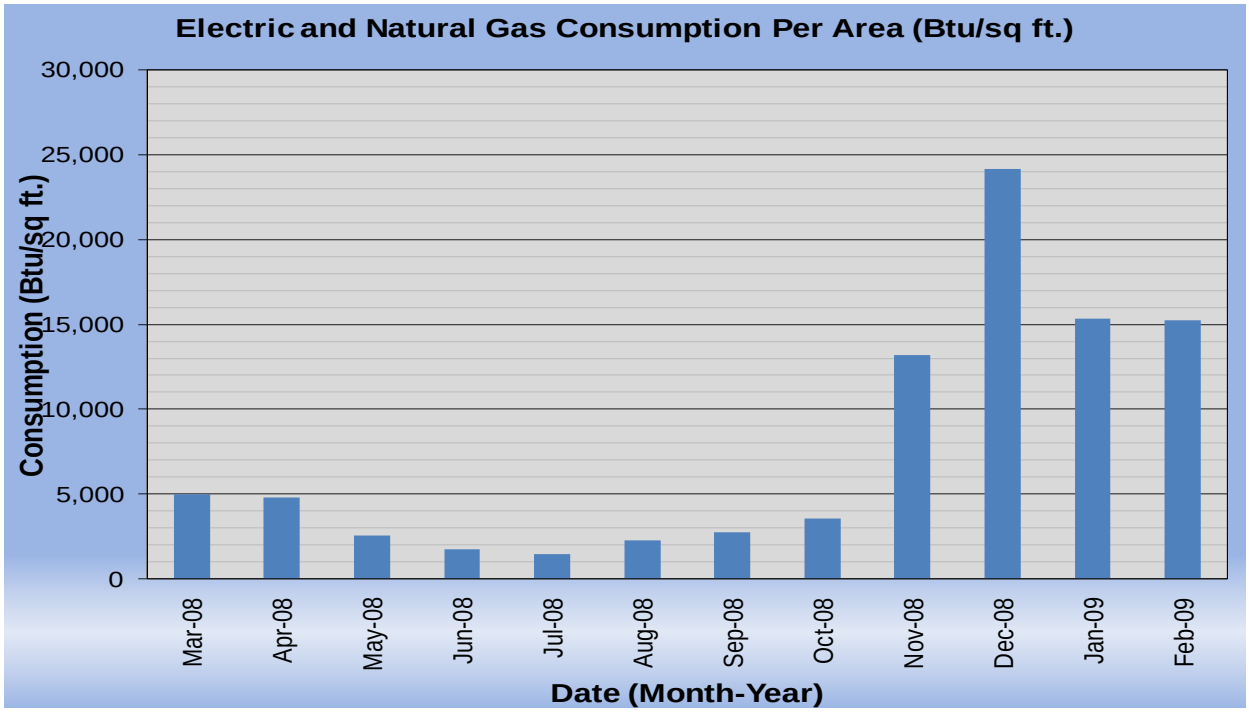
The following chart shows electricity use for the High School building based on utility bills for the 12 month period of March 2008 to February 2009. The chart shows low electric usage in June and July when the school is mostly closed.



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

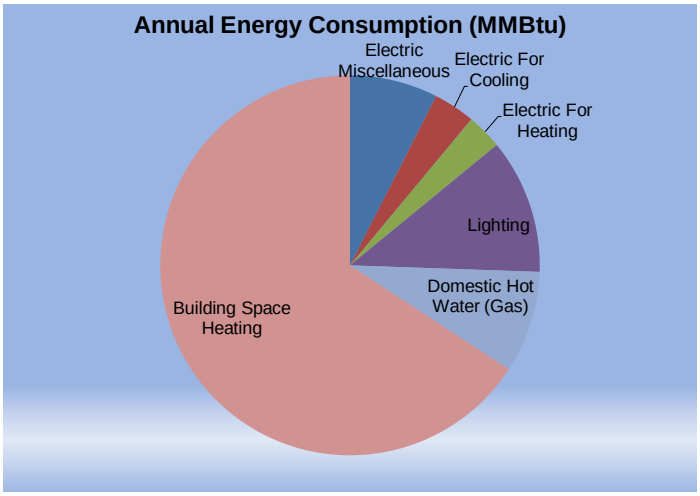


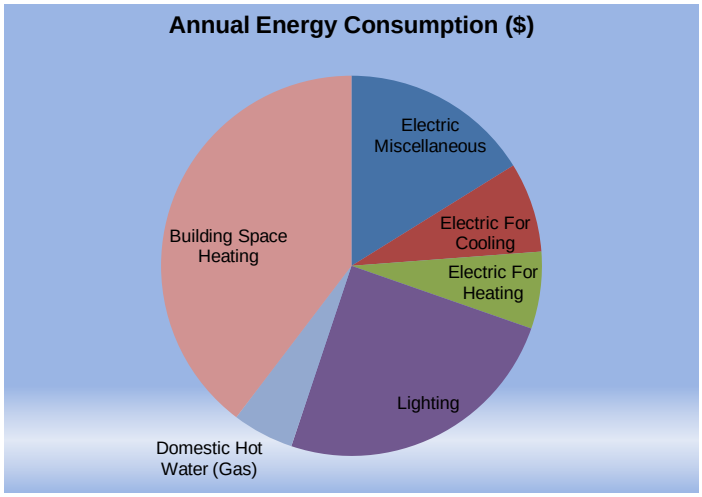
The following chart shows combined natural gas and electric consumption in Btu/sq ft for the High School building based on utility bills for the 12 month period of March 2008 to February 2009.



The following table and chart pies show energy use for the High School building based on utility bills for the 12 month period of March 2008 to February 2009. Note electrical cost at $46/MMBtu of energy is 3.5 times as expensive to use as natural gas at $13/MMBtu.

2008 Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	1,474	7%	$67,175	16%	46
Electric For Cooling	697	4%	$31,784	8%	46
Electric For Heating	596	3%	$27,182	7%	46
Lighting	2,260	11%	$103,005	25%	46
Domestic Hot Water (Gas)	1,706	9%	$21,715	5%	13
Building Space Heating	12,947	66%	$164,837	40%	13
Totals	19,681	100%	$415,699	100%	21
Total Electric Usage	5,028	26%	$229,147	55%	46
Total Gas Usage	14,652	74%	$186,552	45%	13
Totals	19,681	100%	$415,699	100%	21





1.2. Utility rate

The High School main building currently purchases electricity from PSE&G at a general service market rate for electricity use (kWh) with a separate (kW) demand charge. The High School main building currently pays an average rate of approximately $0.156/kWh based on the 12 months of utility bills of March 2008 to February 2009.

The High School main building currently purchases natural gas supply from the Hess Corporation at a general service market rate for natural gas (therms). The rate for the High School is MPLV or Meter Product Large Volume. PSE&G acts as the transport company. There is one gas meter that provides natural gas service to the main High School building currently (aside from the new Science Wing and the new Fitness & Wellness Center which have their independent meters). The average aggregated rate (supply and transport) for the meter is approximately $1.273/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 High School 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 49 when compared to other school buildings of its kind. This indicates that there are good opportunities for the High School 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 93 kBtu/sq ft yr compared to the national average of a School building consuming 93 kBtu/sq ft yr. Implementing this report's highly recommended Energy Conservations Measures (ECMs) will reduce use by approximately 1.2 kBtu/sqft yr, with an additional 10.9 kBtu/sq ft yr from the recommended ECMs, 0.4 kBtu/sq ft yr from the recommended End of Life Cycle ECMs, and 2.7 kBtu/sq ft yr from improved roof insulation upgrades. These recommendations could account for at least 15.2 kBtu/sq ft yr reduction, which when implemented would make the building energy consumption even 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 Livingston High 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 - Livingston High School

Building ID: 1929252
For 12-month Period Ending: January 31, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: November 12, 2009

Facility
Livingston BOE - Livingston High School
30 Robert Harp Drive
Livingston, NJ 07039

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1964
Gross Floor Area (ft^2): 213,716

Energy Performance Rating[2] (1-100) 49

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	5,345,542
Natural Gas (kBtu)[4]	14,504,835
Total Energy (kBtu)	19,850,377

Energy Intensity[5]

Site ($kBtu/ft^2/yr$)	93
Source ($kBtu/ft^2/yr$)	155

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	1,586

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

National Average Comparison

National Average Site EUI	93
National Average Source EUI	154
% Difference from National Average Source EUI	0%
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 Livingston High School main building was originally built in 1948 with several additions and renovations in 1955, 1958, 1966, 1988, 1995 and 2008. Currently the school consists of a total 213,716 square feet of conditioned space. Additionally, in early 2009 a new Science Wing (38,610 sq ft) and a new Fitness & Wellness Center (44,911 sq ft) were opened up. The Livingston Board of Education plans to LEED (Leadership in Energy and Environmental Design) certify these new spaces. Besides various types of classrooms and administrative offices, the building has multipurpose rooms, two gymnasiums, activity rooms, cafeteria, expanded café, auditorium, media centers, auto shop, crafts rooms, two boiler rooms, utility rooms and more.

2.2. Building occupancy profiles

Occupancy for the entire High School building area is approximately 1,684 students and 213 teachers and staff personnel. The school is in session from 7:45 am to 3:30 pm with periodic evening meetings and recreational programs (7:00 am to 10:00 pm). 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 envelopes of the main building and its various additions over time consist of brick veneer with split block / lime stone or clapboard accents in some areas. Interior finishes are mostly painted CMU (Concrete Masonry Units) or gypsum wall board. In most areas the veneer wall is acceptable condition except in older sections of the building some 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 and loose parapet metal wall panels were found

Besides a standard inspection and maintenance program, 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 compromising and energy loss issues.

Exterior wall insulation levels could not be visually verified but available construction plans of additions show acceptable insulation between the brick veneer and CMU walls of the walls inspected.

Wellness Center Complex and Science Wing

The exterior brick veneer walls of these new additions constructed with either or a combination of rigid and fiberglass insulation and either painted CMU or gypsum wall board interior finish were found to be in good / new condition without visual defects, except for some loose inside parapet wall metal panels, as mentioned above.

2.3.2.Roof

The roof finishes vary in material, condition and time of installation. The dark colored, light gravel covered built up roof sections were installed 1993 / 1996 and need to be replaced due to age and condition. Light colored EPDM roofs were installed in 2008 and appear to be in good condition, except some signs of pooling and the clogged roof drains found. In 1990 there were also dark colored EPDM roof sections installed, according to personnel, which also need to be replaced due to age. Access to those parts of the roof was not possible at the time of inspection. Sloped roofs, installed in 1996 were inspected and found to be finished with asphalt shingles and in good condition.

Signs of pooling, drain issues and cracked built-up roofing seams found

Besides the roof surface and insulation conditions, SWA noticed uncontrolled roof water runoff at the already mentioned cap flashing under 2.2.1. Exterior Walls. Some downspouts were found to be ineffective, not leading water away from the perimeter. SWA recommends having all downspouts, scuppers and roof drains inspected and cleaned or repaired as necessary.

Ineffective downspout / discharge directions in various locations

Roof / ceiling insulation was found to be insufficient in the original parts of the clustered building. Blown-in cellulose levels were less than 2" and unevenly distributed. Only gable-end vents were found. SWA recommends adding 8-10" of cellulose insulation to ceilings and the installation of soffit and ridge vents in an effort to maximize winter heat loss and minimize summer cooling loads.

Insufficient ceiling insulation and no-existent attic ventilation in the original building sections

Additionally, the auditors found the main center cupola, the chimney veneer and cap and some of the dormers to be in need of repair. Water infiltration at those locations could potentially cause major energy losses.

Center cupola, chimney and some dormers in need of repair

Wellness Center Complex and Science Wing

The flat EPDM covered roofs were inspected and found to be in good condition. Insulation was inspected as much as possible and confirmed levels reflected on available drawings, either fiberglass bats and / or rigid type. All was found to be in good condition.

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.

Wellness Center Complex and Science Wing

The buildings' bases are 4" concrete slabs-on grade with perimeter footings and some poured concrete stem walls. No water seepage through the slab or other issues related to thermal performance was detected or reported.

2.3.4. Windows

Windows were found to be recently installed or updated double glazed aluminum framed windows in good condition.

All caulking at windows need to be inspected and replaced if necessary and openings around window air conditioning / ducts that are louver sash mounted on the building 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.

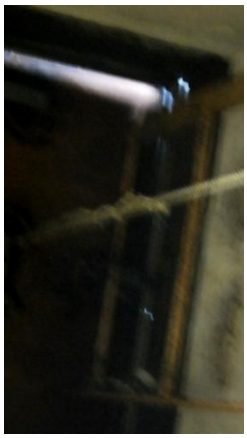
Wellness Center Complex and Science Wing

The double glazed, low–e type windows for the newly constructed parts of the High School were inspected and found to be in good / new condition.

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 at doors and roof hatch

Wellness Center Complex and Science Wing

Metal and glass exterior doors were inspected and found to be in good / new condition without signs of wear on 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.

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

The main school building of the Livingston High School is heated by multiple independent heating systems. A major portion of the building nearest the North Boiler Room utilizes a steam heating system, while the section nearest the South Boiler Room is heated by a hot water system. In addition, there are large portions of the building that now utilize gas-fired heating / electric DX cooling packaged rooftop units for heating and cooling, such as the Cafeteria, the Music Rooms and offices behind the Auditorium, the areas between the North Boiler Room and the Gym, and the new Science Wing.

The separate Field House Wellness Center Complex building is heated and cooled by gas-fired heating / electric DX cooling packaged rooftop units and by split DX heat pumps. The Field House Wellness Center Complex and Science Wing of the main school building were completed in 2008, occupied in early 2009 and the systems are in very good to excellent condition.

2.4.1.Heating

The portions of the building nearest the North Boiler Room still utilize a steam heating system, including the Kitchen, Auditorium, Art Classrooms, several classrooms above the Kitchen and around the Media Center and the Main Offices. These portions of the building 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. There is a mixture of new and original unit ventilators in this area, with most of this equipment having been replaced within the past 5-10 years. In general, it appears that the unit ventilators incorporate split system DX cooling with condensing units located on grade, on an adjacent roof, or on the roof above.

The Kitchen is heated and ventilated by an original steam heating Herman Nelson H&V unit mounted from the ceiling of a food storage room, directly adjacent to the main cooking line. There are also steam unit heaters in this room and near the exterior doors.

Original Steam H&V Unit Serving the Kitchen

The Cafeteria and adjacent Expanded Café are heated by three (3) Aaon gas-fired heating / electric DX cooling packaged rooftop units located on the roof above. Two of the units serve approximately one half of the Cafeteria each, and the third serves the Expanded Café. These units were manufactured in 2008 and are in very good condition. Similarly, the first floor Band, Orchestra and Chorus Rooms and second floor offices located behind the Auditorium stage are heated by 2008 Aaon gas-fired heating / electric DX cooling packaged rooftop units that is in very good condition.

The Media Center and surrounding classrooms appear to be served by a new Aaon gas heating / DX cooling rooftop unit, and an older Trane packaged rooftop unit. In addition, the TV Stations, Digital Imaging, Control Rooms, Broadcast Rooms and other ancillary spaces to these areas are heated by 2008 Aaon gas-fired heating / electric DX cooling packaged rooftop units that are in very good condition.

The Auditorium is served by one (1) large McQuay DX split system with steam heating that was installed in 2008. The air handling unit and return fan are located on a mezzanine mechanical space above the front entry that is accessible via one of the second floor Art Rooms. The ductwork passes directly over the classroom before entering the Auditorium and causes a noisy condition in that Art Classroom when it is operating. SWA recommends additional duct insulation to dampen the noise. There is also recessed steam radiation installed along the side walls of the Auditorium. The main entry vestibule is heated by recessed steam radiation located below the stairwell.

The guidance offices are heated by an air handling unit with steam heating located on a second mezzanine mechanical room above a pair of second floor Art Classrooms. The main offices appear to be conditioned by air handlers located in the ceiling and with exhaust fans located on this same mezzanine. In addition, the perimeter offices are heated by steam baseboard radiation below the windows.

The Faculty Cafeteria, Faculty Workroom and the two classrooms directly adjacent to the Faculty Workroom are heated by steam unit ventilators with DX cooling coils.

The steam heating is produced by three (3) HB Smith cast iron sectional boilers located in the North Boiler Room. Each boiler has 18 sections and is rated for 3,525 MBH output. The boilers were installed in 1989 and are approximately 70-75% through their useful life. 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.

One of the Three Steam Boilers in the North Boiler Room

There are two (2) vacuum pump condensate receiver pump sets in the North Boiler Room. There is also one (1) operating air compressor that was built in 1988 and that services the pneumatic controls system present in the half of the building served by the steam system.

There is also a vacuum condensate return pump in the Storage Room below the stairs near the rear of the Auditorium. 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. The condensate receivers were all seen to leak steam at some point during the surveys, and have at least some rust on the tank bodies. SWA recommends that this equipment is replaced in kind as part of a capital improvement plan in the Livingston Public Schools since they are nearing the end of their service life.

Condensate Receiver Pump Set with Rusted Body, Leaking Steam

There is a courtyard south of the Media Center that contains greenhouses and is surrounded by classrooms. It appears that the corridor running between the Media Center and these classrooms is the approximate dividing line between the portion of the building that is served by the steam heating system and the portion that is served by the hot water heating system that is located in the South Boiler Room. The classrooms surrounding the courtyard mentioned above and the classrooms in the

wing that contains the South Boiler Room are heated by hot water unit ventilators. This equipment appears to have been replaced in 2008 when the heating plant in the South Boiler Room was replaced.

The Wood Shop, Drafting and Applied Tech Labs are heated by gas-fired / DX packaged rooftop units, and the Auto Shop is heated by a ceiling-mounted hot water unit ventilator and ceiling-mounted cabinet unit heaters. This equipment all appears to be relatively new and in very good condition. The classrooms in the corridors above this area are heated by hot water unit ventilators with DX cooling coils. The Wood Tech and Machine Area appear to be served by a Trane packaged rooftop unit that was manufactured in 1996.

The Football Team Rooms and Showers adjacent to the Gym are heated by a Trane gas-fired / DX packaged rooftop unit. There wasn't any legible serial number information, and the unit is estimated to be approximately 10-15 years old. The Trainer's Room and offices are heated by a newer Aaon gas-fired / DX packaged rooftop unit. The Gym and the Boy's and Girl's Locker Rooms are served by two (2) Munters gas-fired energy recovery units. The Aaon and Munters equipment appears to have been installed as part of the 2008 addition and renovations and are in very good condition.

Energy Recovery Unit Serving the Gym Area

The new 2008 Science Wing is heated by multiple Aaon gas-fired / DX packaged rooftop units. The Field House Wellness Center Complex is heated by a combination of Aaon and Munters equipment, similar to what is described for the Gym, Trainer and Locker Rooms above. In addition, there are several split system heat pumps serving various spaces.

There is enclosed wall mounted and ceiling mounted finned tube radiation in the corridors, vestibules and toilet rooms.

The heating hot water is produced by four (4) Lochinvar non-condensing boilers of equal capacity located in the South Boiler Room. The boilers were installed in the year 2008 approximately. These units and the associated flue piping are in very good condition. The burners are integral to these boilers. The heating water is circulated by (2) 15 Hp pumps and (2) 1 Hp pumps which operate in a lead-lag fashion.

Hot Water Boilers In South Boiler Room

In general, there are very few steam or hot water unit ventilators that require replacement. Most of this equipment has been replaced within the last 5-10 years and is in relatively good condition. In total, approximately five (5) AAF / Herman Nelson or Nesbitt unit ventilators are in fair to poor condition and SWA recommends that these units be replaced.

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 often. 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 an extension of the existing Johnson Controls Metasys EMS system, including thermostats to control the steam valves at the new unit ventilators and the equipment in the North Boiler Room and the remainder of the school.

A wholesale conversion of the portion 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 older 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 High School is provided with cooling.

The Cafeteria and adjacent Expanded Café are cooled by three (3) relatively new Aaon gas-fired heating / electric DX cooling packaged rooftop units located on the roof above. Two units are zoned as described in the "Heating" section above. Similarly, the first floor Band, Orchestra and Chorus Rooms and second floor offices located behind the Auditorium stage are cooled by gas-fired heating / electric DX cooling packaged rooftop units that are in very good condition.

The Media Center and surrounding classrooms appear to be cooled by a new Aaon gas heating / DX cooling rooftop unit, and an older Trane packaged rooftop unit. In addition, the TV Stations, Digital Imaging, Control Rooms, Broadcast Rooms and other ancillary spaces to these areas are cooled by new gas-fired heating / electric DX cooling packaged rooftop units.

The Auditorium is cooled by one (1) large McQuay DX split system that was installed in 2008. The air handling unit and return fan are located on a mezzanine mechanical space above the front entry. The main entry vestibule is cooled by a dedicated split system in this same mezzanine that feeds linear diffusers in the front entry.

The guidance offices and main offices are cooled by split systems. The Faculty Cafeteria, Faculty Workroom and the two classrooms directly adjacent to the Faculty Workroom are cooled by unit ventilators with DX cooling coils and condensing units located on grade.

Many of the classrooms in the building are cooled by unit ventilators with DX cooling coils and condensing units located either on grade or on the roof directly above the classroom, depending if the room is located on the top floor of its respective wing.

Typical Condensing Unit Piped to Classroom Unit Ventilator

The Wood Shop, Drafting and Applied Tech Labs are cooled by gas-fired / DX packaged rooftop units. The classrooms in the corridors above this area are heated by hot water unit ventilators with DX cooling coils. The Wood Tech and Machine Area appear to be served by a Trane packaged rooftop unit that was manufactured in 1996.

The Football Team Rooms and Showers adjacent to the Gym are cooled by a Trane gas-fired / DX packaged rooftop unit. The Trainer's Room and offices are cooled by a newer Aaon gas-fired / DX packaged rooftop unit. The Gym and the Boy's and Girl's Locker Rooms are served by two (2) Munters gas-fired energy recovery units.

The second floor TV Studio above the Boiler Room is cooled by a cooling only rooftop unit located on the roof above the Expanded Café.

The new 2008 Science Wing is cooled by multiple Aaon gas-fired / DX packaged rooftop units. The Field House Wellness Center Complex is cooled by a combination of Aaon and Munters equipment, similar to what is described for the Gym, Trainer and Locker Rooms above. In addition, there are several split system heat pumps serving various spaces.

There were approximately 8-12 window air conditioning units in various rooms throughout the school Most of the window air conditioning units are 1-10 years old, and are generally in good condition, however, a few were noted to be in fair to poor condition.

2.4.3. Ventilation

The various spaces of the building are ventilated either by the rooftop units or unit ventilators that serve the respective spaces as described in the "Heating" and "Cooling" sections above.

It should be noted that one of the Aaon units serving the Cafeteria is installed with its outside air intake directly adjacent to an exhaust fan, This fan should be replaced and relocated as part of the capital improvements to provide code compliance for separation of exhaust air from outdoor air intake air.

Exhaust Fan Located Beneath Aaon Out-side Air Intake Hood

It should also be noted that there wasn't any HVAC observed in room B243.

Each of the science classrooms in the new Science Wing contains a lab hood. Each of these classrooms has been provided with a rooftop utility set fan to exhaust the hoods. The Aaon rooftop units that condition and ventilate the spaces also provide adequate ventilation to serve as makeup air for the hoods.

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#10, and that it is designed to provide code minimum ventilation rates.

2.4.4. Domestic Hot Water

The domestic water for the High School is provided by two (3) gas-fired, A.O. Smith Cyclone, 100 gallon tank-type water heaters. These units are sealed combustion, direct-vent type, with PVC combustion flue penetrating high on the exterior wall of the Boiler Room. Two heaters were manufactured in 2004 or later (2007) and are high efficiency, so it is assumed that there aren't any energy savings opportunities available here. The third heater was manufactured in 1999.

Domestic Water Heaters

2.5. Electrical systems

2.5.1. Lighting

Interior Lighting - The main High School 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. SWA also recommends replacing various incandescent lamps around the building with CFLs. 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 a mix of Metal Halide, High Pressure Sodium and incandescent lamp fixtures. Exterior lighting is controlled by astronomical timers. SWA recommends replacing the incandescent lights with CFL lamps. SWA is not recommending at this time any upgrades to the exterior timers or switching out other lamps designed for the safety and security of the building occupants.

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 High School 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 refrigerated equipment located in the kitchen, including two ice machines, a stainless steel refrigerator / freezer unit, (4) reach-in soft drink refrigerated merchandisers, (2) reach-in soft drink refrigerated merchandisers not in use during the survey, and a chest type ice cream freezer. This equipment all seems to be in fair to good condition. There is also a walk-in refrigerator box and freezer box. Both are approximately 10'wide x 10' deep. The units appear to be at least 15-20 years old.

There are also several pieces of commercial-style cooking equipment, including a gas-fired 6-burner range, a top-bottom gas oven, a top-bottom convection oven, an electric conveyor pizza oven, (2) coffee machines, a heated display shelf unit, a food warmer, and a tall heated storage cabinet. There is a large kitchen hood provided for this equipment. 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 the steam H&V unit in the food storage room or via transfer from adjacent rooftop units serving the Cafeteria.

2.5.3. Elevators

The Livingston High School has two hydraulic elevators, one in the new Science wing and the other near the Science wing and on the south side of the High School. They are ThyssenKrupp hydraulic elevators with a submersible 30 HP hydraulic pump motors.

2.5.4. Others electrical systems

Besides a 150 kVA transformer which is 1958 vintage, operating beyond its estimated useful life and should be replaced, there are not currently any other significant energy impacting electrical systems installed at the High School building.

3. EQUIPMENT LIST

Inventory

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	(3) boilers, steam, 18 sections	North boiler rm	HB Smith M#M450L Mills 3524.8 MBH output	Natural Gas	north half of building	1989	25%
Heating	(3) boiler burners	North boiler rm	Industrial Combustion M# DMG-84S	Natural Gas	north half of building	1988	0%
Heating	(3) burner blowers	North boiler rm	Marathon Electric M# TL 182TTDR8309DB L 5 HP ea.	Electric	north half of building	1988	0%
Pneumatic Controls	Air Compressor, (2) motors	North boiler rm	Ingersoll-Rand M# 253T306TM M#2-253E5	Electric	Building	1988	0%
Heating	(3) Condensate boiler feed pumps	North boiler rm	A.O. Smith M# P48J2EB7 3/4 HP ea.	Electric	Building	1988	0%
Heating	(1) Condensate boiler feed pumps	North boiler rm	A.O. Smith M# P48K2EB7A1 3/4 HP ea.	Electric	Building	2001	55%
Heating	(2) Oil pump system circulator pumps	North boiler rm	Baldor M# M3108 1/2 HP ea.	Electric	North Boiler Room	1988	Abandoned
Heating	(3) flue updraft fan motors	North boiler rm	U.S. Electrical Motors M# F029 1 HP ea.	Electric	North Boiler Room	Est. 1988	0%
Domestic Water	(3) Domestic hot water heaters	North boiler rm	(3) A.O. Smith - 'Cyclone'	Natural Gas	Building	(1) 2004 (1) 2007 (1) 1999	50% 80% 0%
Storm water	Sump pump	North boiler rm	No nameplate 1/2 HP	Electric	Building	Est. 1999	Est. 0%, Poor Condition

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Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	(4) boilers, hot water	South boiler rm	'Power-Fin' by Lochnivar M# PBN1501 300-1500 MBH input 1275 MBH output	Natural Gas	south half of building	2008	95%
Heating	(4) Circulating return pumps	South boiler rm	Armstrong M# FQC 56B17D11008A P 3/4 HP ea.	Electric	south half of building	2008	95%
Heating	(2) Hot water supply pumps	South boiler rm	Baldor M# M2513T 15 HP ea. Paired w/ pump: Taco M# FI3011E2HAJ1L0A	Electric	south half of building	2008	95%
Heating	(2) Hot water supply pumps	South boiler rm	Baldor M# M3116T 1 HP ea. Paired w/ pump: Taco M# FI1506E2CAH1L0B	Electric	south half of building	2008	95%
Pneumatic Controls	Air Compressor, (2) motors	South boiler rm	Ingersoll-Rand M# 2-24-2D2TC S# 30T 755480 2 HP lead/lag	Electric	Building	1994	25%
Storm water	Sump pump	South boiler rm	No nameplate 1-1/2 HP	Electric	Building	Unknown	0%, poor condition
Heating / Cooling	RTU	Roof, music wing addition	Aaon M# RM-015-8-0-BB02-342 S# 200802-AMGL40063 (Gas inputs/outputs covered)	Natural Gas	Band room & offices	2008	95%
Heating / Cooling	(2) RTUs	Roof, music wing addition	Aaon M# RM-010-8-0-BA02-332 S# 200802-AMGJ40064 S# 200802-AMGJ40065 180 MBH input 146 MBH output	Natural Gas	Orchestra room, Chorus room, and offices	2008	95%

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Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating / Cooling	RTU	Roof (above cafeteria area)	Trane M# TCH150B300BA S# G36142769D	Electric	TV Studio	1992	0%, beyond expected useful life
Heating / Cooling	(3) RTUs	Roof (above cafeteria area)	Aaon M# RM-013-8-0-BA02-342 S# 200802-AMGK4006 270 MBH input 219 MBH output Aaon M# RM-025-8-0-BB02-372 S# 200802-AMGK40089 480 MBH input 389 MBH output Aaon M# RN-020-8-0-BB02-382 S# 2008120ANG804379 405 MBH input 329 MBH output	Natural Gas	Cafeteria	2008	95%
Cooling	(7) Air-cooled condensing units	Roof (above cafeteria area)	Various manufacturers (2.5 thru 3.5 ton units) Limited nameplate information available during survey	Electric	2nd floor classrooms above cafeteria	1997-2008	40% - 95%
Cooling	(26) Air-cooled condensing units	roof around 2 courtyard areas	York (18) M# HABA-T036SG (1) M# HABA-T036SB (2) M# TCGD24S21S1A (5) M# TCGD30S21S1A	Electric	2nd floor classrooms & offices - main building	2004 (1) 2007 (8) 2008 (17)	75% 90% 95%
Cooling	Condensing unit	Roof (between cafeteria & media center)	Trane / American Standard partial M# TTA120A300FA… (rest was coverd by elec. Disconnect)	Electric	2nd floor offices, behind auditorium	2005	80%
Heating / Cooling	RTU	Roof (between cafeteria & media center)	Aaon M# RM-020-8-0-BB02-362 S# 200802-AMGP40088 390 MBH input 316 MBH output	Natural Gas	Media Center	2008	95%
Cooling	RTU	Roof (between cafeteria & media center)	Trane M# TC170G300CC S# D05143291D	Natural Gas	Media Center & surrounding 1st floor classrooms	1989	0%, beyond expected useful life

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Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	Radiators - Cabinet	Through-out building	Varies	Electric	Building corridors, various rooms	Circa 1966	0%, beyond expected useful life
Heating	Radiators - Fin-tube (baseboard)	Through-out building	Varies	Electric	Building corridors, various rooms	Circa 1966	0%, beyond expected useful life
Heating / Cooling	(55+) Unit ventilators	Through-out building	Nesbitt	Electric	classrooms throughout building	2008	95%
Heating / Cooling	(4) unit ventialtors	2nd floor north wing	AAF	Electric	2nd floor north wing classrooms	Unknown	60%
Heating	(5) Unit ventilators	various class-rooms	AAF	Electric	various classrooms	Circa 1966	0%, beyond expected useful life
Heating / Cooling	(12-15) Ceiling unit ventilators	various class-rooms	Unknown	Electric	various rooms	2008	95%
Heating	(4) Cabinet unit heaters - hot water	Auto shop and wood shop rooms	McQuay (nameplate not accessible	Electric	Auto shop and wood shop rooms	Assumed 2008	Good Condition, Est. 95%
Cooling	(8-12) window AC units throughout the building	Building	Varies Approx 1 - 2 tons ea.	Electric	8-12 offices and classrooms	Varies	Varies, estimating 50%
Ventilation	(97+) Other Fans	all roofs	Varies	Electric	Varies	Varies	25-75%
Ventilation	(12) Science wing classroom exhaust fans	Science wing roof	Loren Cook (6) M# 80 CPV 80CPV CLL1 motor 1/3 HP ea. fan 520 CFM ea. (6) M# 135 CPV 135CPV CL1 motor 1/3 HP ea. Fan 1040 CFM ea.	Electric	Science wing classrooms	2008	95%

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Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating / Cooling	(8) RTUs	Science wing roof	Aaon (all) (3) M# RM-013-3-0-BA02-342 270 MBH input 219 MBH output (1) M# RM-020-3-0-BB02-342 270 MBH input 219 MBH output (1) M# RM-010-3-0-BA02-342 270 MBH input 219 MBH output (1) M# RM-015-3-0-BB02-342 270 MBH input 219 MBH output (2) M# RM-010-0-0-BA02-332 180 MBH input 146 MBH output	Natural Gas	Science wing classrooms	2008	95%
Cooling	Air-cooled condensing unit	Science wing roof	Sanyo - 'Inverter' M# CL 1271 S# 01805 74 10.9 FLA	Electric	Science wing, Elevator Machine Room	2007	90%
Domestic Water	Hot water heater with storage tank	1st floor Mech room - Science wing	Lochinvar M# PFN0752PM S# F08H00209827 750 MBH input 275 gallon storage tank	Natural Gas	Sciecne Wing	Est. 2007	90%
Heating	Electric Unit heater	1st floor Mech room - Science wing	Unknown 5kW	Electric	Science Wing mech room	Est. 2007	90%
Cooling	Air-cooled condensing unit	roof	Unknown (nameplate removed)	Electric	2nd floor classroom over south boiler room	Unknown	0%, beyond expected useful life

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Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	(2) RTUs	Roof adjacent to old Gym	Munters (nameplate not accessible during survey)	Natural Gas	Gym	Unknown (Est. 2008)	95%
Heating / Cooling	(2) RTUs	Roof adjacent to old Gym	(1) Aaon #M RM-006-3-0-BA01-332 S# 200802-AMGF40077 180 MBH input 146 MBH output (1) Trane M# YCD 181-300B (remaining nameplate info not accessible during survey)	Natural Gas	Gym / Gym rooms	2008 Unknown (Est. 1999)	95% 25%
Cooling	(2) Air-cooled condensing units	Roof adjacent to old Gym	Sanyo - 'Inverter' M# CL1872 S# 0134174 S# 0006481 7.7 FLA	Electric	Gym rooms	2008	95%
Cooling	Air-cooled condensing unit	Roof over corridor between gym and shop rooms	Lennox M# HS29-036-13Y S# 5808E27428	Electric	Shop room	2008	95%
Heating / Cooling	(2) RTUs	Roof over shop rooms	Trane M# YCD075C3LFBE S# L17101808D 120 MBH input 97.2 MBH output Aaon M# RM-004-3-0-BB01-322 S# 2007120AMGD38468	Natural Gas	Shop rooms	1996 2007	10% 85%
Cooling	(5) Air-cooled condensing units	Roof over shop rooms	(3) Trane -'XE 800' M# TTB724B100A1 (1) York M# TCGD24S21S1A (1) York M# TCGS30S21S1A	Electric	Shop rooms	1988 2008 2008	0%, beyond expected useful life 95% 95%

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Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating / Cooling	(2) RTUs	Roof over Tech rooms	Aaon M# RM-A05-3-0-BA01-322 S# 200802-AMGE40073 90 MBH input 73 MBH output Aaon M# RM-006-3-0-BA01-332 S# 200802-AMGF40072 180 MBH input 146 MBH output	Natural Gas	Tech rooms	2008	95%
Electrical	Stand-by generator	Roof over TV rooms & labs	Onan - 'GenSet' M# RS12000	Natural Gas	TV rooms / labs / etc.	Est. 2008	95%
Heating / Cooling	(3) RTUs	Roof over TV rooms & labs	(2) Aaon M# RM-007-8-0-BA01-332 S# 200802-AMGG40074 S# 200802-AMGG40075 180 MBH input 146 MBH output Aaon M# RM-008-8-0-BA02-332 S# 200802-AMGH0068 180 MBH input 146 MBH output	Natural Gas	surrounding TV rooms and labs	2008	95%
Heating / Cooling	(2) RTUs	Roof over TV rooms	Aaon M# RM-010-8-0-BA02-332 S# 200802-AMGJ40067 180 MBH input 146 MBH output Aaon M# RM-007-8-0-BA01-332 S# 200802-AMGG40076 180 MBH input 146 MBH output	Natural Gas	TV rooms	2008	95%
Cooling	(6) Air-cooled condensing units	roof	York (4) M# HABA-T036SG (2) M# TCGD24S21S1A	Electric	2nd floor classrooms across from media center courtyard	2005 2007 2008	80% 90% 95%

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Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Cooling	(6) Air-cooled condensing units	on grade	York (Varies - 3 and 3.5 ton units)	Electric	Main offices wing - 1st floor	2008	95%
Cooling	(9) Air-cooled condensing units	on grade	York (Varies - 2 thru 3 ton units)	Electric	South wing 1st floor classrooms	2008	95%
Cooling	(14) Air-cooled condensing units	on grade	(13) York (3 ton models) (1) Sanyo	Electric	South courtyard classrooms - 1st floor	2008 est. 1995	95% 0%
Cooling	(5) Air-cooled condensing units	on grade	York (Varies - 3 and 3.5 ton units)	Electric	Media center courtyard classrooms - 1st floor	2008	95%
Electrical	Transformer, air-cooled	South wing electrical closet	Sorgel S# X11809 600V - 208Y/120 150 kVA	Electric	South wing rooms and offices	Circa 1958	0%, beyond expected useful life
Cooling	Air-cooled condensing unit	roof near front entrance	McQuay M# RCS050CYY S# FBOU08090096501 (4) compressors 13 HP ea. (4) fan motors 1 HP ea.	Electric	Auditorium	2008	95%
Heating	Steam Heat air handling unit	Mezz. Above main lobby	McQuay M# CAH030GDAC	Electric	Auditorium	2008	95%
Heating	Steam Heat air handling unit	Mezz. Above art rooms	Trane (nameplate not accessible)	Electric	Guidance offices, 1st floor	Est 1995	0-10%

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Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Ventilation	(4) Wall discharge exhaust fans	Mezz. Above art rooms	Carnes (all) M# VBBA12L2111N1218 S# 19298-01 M# VBBA10K2111N12C18 S# 19298-01 1/3 HP M# VFBA12M3111N12C18 3/4 HP M# VFBA08M3112N12C18 1/3 HP	Electric	Offices/rooms served by AHU-2 Office/rooms served by AHU-1 Photo development labs Offices/rooms served by AHU-2	Est 1995	40%
Cooling	(4) Air-cooled condensing units	roof near front entrance	Trane (all) M# 2TTA0060A3000AA S# 3333TGT3F M# TTA090A300FA S#8261TBNAD M# TTR060D100A0 S# P382U4SFF M# TTB730A100A0 S# C45210893	Electric	Guidance and Main Offices	2003 2008 1999 1988	70% 95% 50% 0%, beyond expected useful life
Heating	Heat pump air handling unit	Mezz. Above main lobby	Trane M# TWE090 (rest of nameplate not accessible)	Electric	Front Entry	2007	85%
Cooling	Air-cooled condensing unit	roof near front entrance	York M# HABA-T042SG S# WOD8797544	Electric	2nd Floor Art Room?	2008	95%
Cooling	Air-cooled condensing unit	roof near front entrance	Unknown (nameplate removed/missing)	Electric	Unknown	Unknown	30%
Heating / Cooling	Steam air handling unit	Stage storage rooms	Unknown	Electric	Stage storage rooms	Est 1995	10%

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Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	Steam unit heater	Stage storage rooms	Trane (nameplate not accessible)	Electric for fan	Stage storage rooms	Unknown	60%
Ventilation	Shop exhaust system	Wood shop storage	Torit / Donaldson M# 80 CAB S# IG458245 3 HP	Electric	Wood shop	Unknown	50%
Refriger.	(3) Refrigerators	Faculty Cafeteria	Manufacturer Varies 4.7A, 5.4 A, 7A	Electric	Faculty Cafeteria	2004 and older	20% - 60%
Refriger.	(2) Vending Machines	Faculty Cafeteria	(1) Dixie-Narco M# DN 720P HVV-12 S# 77340077 9.7A (1) Unknown 3A	Electric	Faculty Cafeteria	Unknown	70%
Refriger.	(2) Vending Machines	Corridor between gym and shop rooms	(1) AMS M# AMS 35-630 S# 0132-1522 28 3 A (1) Dixie-Narco M# DN 501E MC/S11 S# 0569 6802BA 11 A	Electric	Corridor between gym and shop rooms	Unknown	70%
Refriger.	(6) Vending Machines	Cafeteria	(2) Dixie-Narco M# DN 501EHV/S11-12 11A ea. (1) Vendtronics M# VC-1100 12A (3) Unknown nameplate inaccessible	Electric	Cafeteria	Unknown	Unknown
Refriger.	Walk-in Refrigerator	Kitchen	Unknown (nameplate inaccessible)	Electric	Kitchen	Circa 1988	0-20%
Refriger.	Walk-in Freezer	Kitchen	Unknown (nameplate inaccessible)	Electric	Kitchen	Circa 1988	0-20%

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Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Refriger.	Freezer / Refrigerator	Kitchen	Delfield (nameplate inaccessible)	Electric	Kitchen	Est. 2005	70%
Refriger.	(2) Ice machines	Kitchen	Hoshizaki M# KM800MUB Hoshizaki M# B700SC	Electric	Kitchen	Est. 2005	70%
Refriger.	Reach-in ice cream chest freezer	Kitchen	AHT M# R10S100	Electric	Kitchen	2005	80%
Refriger.	(2) Reach-in coolers	Kitchen	(1) True (1) Beverage Air (Units not in use)	Electric	Kitchen	Unknown	Not In Use
Refriger.	(4) Reach-in coolers	Cafeteria	(1) Refrigeradores De Guatemala M# VR-26-BEV-TROP-2H S# 070311663 6.5A (1) Beverage Air M# MT12 6A Beverage Air M# MT15-54 7A (1) True M# GDM-33C-PT-54 S# 1-2404796 9.3A	Electric	Cafeteria	Est. 2005	80%
Heating	Steam unit ventilator	Kitchen storage	Herman Nelson M#H5500	Electric for fan	Kitchen storage	Unknown (est. origianl to building)	0%, beyond expected useful life
Heating	Steam unit heater	Kitchen storage	Unknown (nameplate inaccessible)	Electric for fan	Kitchen storage	Unknown (est. origianl to building)	0%, beyond expected useful life

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Building System	**Description**	**Location**	**Model #**	**Fuel**	**Space Served**	**Year Installed**	**Estimated Remaining Useful Life %**
Refriger.	(2) Refrigerators	Room B238	True M# T-49 1/2 HP, 115V Frigidaire M# FFU 20FC4CW3 5A	Electric	Room B238	2004	60%
Cooling	(3) Air-cooled condensing units	Athletics building roof	Sanyo - 'Inverter' (2) M# CL1872 7.7 A (1) M# CL1271 10.9 A	Electric	various athletic building rooms / offices	2008	95%
Heating / Cooling	(9) RTUs	Athletics building roof	Aaon (all) (5) M# RM-016-3-0-BA02-342 270 MBH input 219 MBH output (1) M# RM-010-3-0-BB02-332 180 MBH input 146 MBH output (2) M# RM-010-3-0-BB02-342 270 MBH input 219 MBH output (1) M# RM-008-3-0-BB-02-332 180 MBH input 146 MBH output	Natural Gas	Athletic Building gyms and rooms	2008	95%
Ventilation	5+ Rooftop exhaust fans; general, toilet, and locker/shower room exhaust	Athletics building roof	Loren Cook (various models)	Electric	Athletic Building gyms and rooms	2008	95%
Elevator	(2) Elevators with submersible hydraulic pump motor, 30 HP	South-side main High School bldg and new Science wing	ThyssenKrupp Elevator Co.	Electric	main High School bldg and new Science wing	Circa 2008	Est. 95%
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 High School, 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 approximately 5 AAF / Herman Nelson and / or Nesbitt steam and hot water unit ventilators originally installed in the building. 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 5 AAF / Herman Nelson or Nesbitt unit ventilators are operating beyond their useful operating lives. SWA evaluated replacement of all 5 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 5 new fan coil ventilators is $48,000. 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 the boiler burners - According to the 2007 ASHRAE Applications Handbook, the boiler burners in the North Boiler Room are at the end of their expected service life based on their age. This is a replacement in kind recommendation which offers negligible energy savings.

- Replace one (1) domestic water heater - According to the 2007 ASHRAE Applications Handbook, one direct vent domestic water heater in the North Boiler Room is at the end of their expected service life based on its age. This is a replacement in kind recommendation which offers negligible energy savings.

- Replace two (2) sump pumps - One sump pump in the South Boiler Room and one sump pump in a room off of the North Boiler Room appear to be in fair to poor condition and at the end of their expected service life. This is a replacement in kind recommendation which offers negligible energy savings.

- Replace two (2) Trane RTUs - According to the 2007 ASHRAE Applications Handbook, one (1) packaged 15-ton RTU serving the TV Studio and one (1) packaged 15-ton RTU serving the classrooms

adjacent to the Media Center are beyond their expected service life. SWA recommends replacement of this equipment to realize an increase in operating efficiency and to remove environmentally unfriendly refrigerants from service. This upgrade cannot be justified by energy savings alone. Please see End of Life Cycle ECM #9.

- Replace (4) Trane Condensing Units - According to the 2007 ASHRAE Applications Handbook, three (3) split system air-cooled condensing units with 2-ton capacity serving the shops and one (1) unit with 3-ton capacity serving the guidance / main offices are beyond their expected service life. SWA recommends replacement of this equipment to realize a slight increase in operating efficiency and to remove environmentally unfriendly refrigerants from service. Based on the small tonnage, this upgrade cannot be justified by energy savings alone. This is a replacement in kind recommendation which offers negligible energy savings.

- 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 two (2) condensate receiver vacuum pump sets in the North Boiler Room and one (1) condensate receiver vacuum pump set in the pump room that is behind the Auditorium. 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 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 portion of the building with steam heating is controlled by an antiquated, pneumatic temperature control system and only monitored and partly controlled (2008 equipment) by a more modern Direct Digital Control (DDC) system. The BMS should be expanded and upgraded to control the current steam unit ventilators and also 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#7) are maintained and reproducible.

- Replace (1) steam H&V unit serving the Kitchen - The steam heating only ventilation system for the Kitchen 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. Energy recovery was not considered for this application since the exhaust air from the kitchen may contain grease or other contaminants that would reduce the effectiveness and service life of an energy recovery system. This is a replacement in kind recommendation which offers negligible energy savings.

- Replace sections of the roof - The dark colored, light gravel covered built up roof sections were installed 1993 / 1996 and need to be replaced due to age and condition. In 1990 there were also dark colored EPDM roof sections installed, according to personnel, which also need to be replaced due to age.

  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 mentioned above to be replaced due to age and condition. Overall it looks that theses roof sections have reached their expectant life span. SWA recommends replacement of the 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 20,866 sq ft insulated roof replacement cost is approximately $208,660, based on RS Means 2009 (Building Construction Cost Data) and similar projects, which would provide $7,384 annual energy savings and a 28 year simple payback, which could reduce the building's energy requirements by at least 2.7 kBtu/sq ft yr. The Livingston Public Schools are eligible for a 40% state grant, which will decrease the new roof simple payback to 17 years when the December bond referendum passes.

- Replace 150 kVA transformer - the 480 to 208 VAC transformer is 1958 vintage and operating beyond its estimated useful life. This replacement in kind offers negligible energy savings since the existing unit has sturdy copper components compared to aluminum used in today's transformers.

- 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 boxes in the Kitchen. Ineffective gaskets allow infiltration of warm air into the walk-in box, which increases the run-time of the compressors.

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

- Replace / repair sections of the main center cupola, the chimney veneer and cap and some of the dormers. Water infiltration at these locations could potentially cause major energy losses.

- 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 and reach-in Drinks cooler energy misers
2.1, 2.2 & 2.3	install occupancy sensors, replace gymnasium Metal Halide lamps with T5 fixtures and incandescent lamps with CFLs
3.1& 3.2	replace motors with premium efficiency type on heating hot water circulating pumps
4	replace motors with premium efficiency type on refrigerated walk-in boxes
5	replace motors with premium efficiency type on flue updraft fans
	Description of Recommended 5-10 Year Payback ECMs
6	install 195 kW PV rooftop system
7	retro-commission mechanical equipment
	Description of Recommended End of Life Cycle ECMs
8	replace reach-in ice cream freezer with an Energy Star model
9	Replace rooftop HVAC with a high efficiency model
10	replace exhaust fans with premium efficiency units

ECM#1: *Install Vending Misers*

Description:

The High School building has four Drinks and three Snacks vending machines located in the Cafeteria and hallways, besides the 6 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: $17,281
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 4 Drinks, 3 Snacks vending machine and 6 reach-in Drink cooler energy misers - in cafeteria	www.usatech.com and established costs	3,327	none at this time	3,327	17,281	4.8	0	0.3	0	2,696	12	32,350	1.2	872	73	81	23,507	23,675

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: *Building Lighting Upgrades*

Description:

On the days of the site visits, SWA completed a lighting inventory of the High School building (see Appendix A). The existing lighting consists of mostly T8 fluorescent fixtures with electronic ballasts. Many of the lights in the High School 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, installing T5 fixtures in place of Metal Halide gymnasium lighting and replacing incandescent lamps with CFLs. 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: $20,752
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
2.1	replace (108) incandescent lamps with CFLs	RS Means, Lit Search, NJ Clean Energy Program	2,160	none at this time	2,160	10,130	2.8	0	0.7	70	1,650	7	11,062	1.3	435	62	75	8,122	13,878
2.2	install (20) occupancy sensors	RS Means, Lit Search, NJ Clean Energy Program	4,400	400	4,000	4,759	1.3	0	0.3	0	742	12	8,909	5.4	123	10	15	3,390	6,520
2.3	replace gym Metal Halide lamps with (48) T5 fixtures	RS Means, Lit Search, NJ Clean Energy Program	15,360	768	14,592	9,448	2.6	0	0.7	70	1,544	15	22,108	9.5	59	4	6	3,839	12,944

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 $400.

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 $768.

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

Description:

The South Boiler Room houses two sets of two (2) floor-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 15 Hp each pump motor, and the other two pumps are 1 Hp each, and each set operates in a lead-lag fashion. The pump motors are standard efficiency. The Livingston High School will realize energy savings by utilizing premium efficiency motors for the pumps.

Installation cost:

Estimated installed cost: $2,006
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 (2) 15 HP hot water circulator pump motors with Premium Efficiency	similar projects, DOE Motor Master + International	1,750	208	1,542	3,564	1.0	0	0.1	0	556	20	11,120	2.8	621	31	36	6,730	4,883
3.2	replace (2) 1 HP hot water circulator pump motors with Premium Efficiency	similar projects, DOE Motor Master + International	554	90	464	447	0.1	0	0.0	0	70	20	1,395	6.7	201	10	14	573	612

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.

Rebates/financial incentives:

NJ Clean Energy - Premium three-phase motors ($45-$700 per motor)
Maximum incentive amount is $298.

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

Description:

There is one walk-in cooler box and one walk-in freezer box in the Kitchen of the Livingston High School. Typically, the evaporator and condenser fans of walk-in coolers will run 24 hours per day, 7 days per week. On average, the evaporator and condenser fans of walk-in freezers will run 18 hours per day, 7 days per week, with the other 6 hours per day utilized for a defrost cycle. The motors on these fans are standard efficiency, shaded pole motors. There are (3) evaporator motors and (3) condenser fan motors for the cooler and (5) evaporator motors and (5) condenser fan motors for the freezer. Half of the motors are 1 Hp and half of the motors are fractional horsepower. The Livingston High School will realize energy savings by utilizing premium efficiency motors for these fans.

Installation cost:

Estimated installed cost: $4,072
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
4.1	replace Cooler (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	523	20	10,452	2.9	584	29	34	6,248	4,590
4.2	replace Freezer (5) 1 HP cond fan and (5) frac Hp motors with Premium Efficiency on walk-in refrigerated box	similar projects, DOE Motor Master + International	2,770	225	2,545	3,360	1.0	0	0.1	0	524	20	10,483	4.9	312	16	20	5,253	4,603

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 $360.

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#5: *Install Premium Efficiency Motors on Steam Boiler Flue Updraft Fans*

Description:

There are three (3) separate fans, one on each flue of the steam boilers in the North Boiler Room. All affected fans are 1 Hp, and each operates when the boiler is firing. The fan motors are standard efficiency. The Livingston High School will realize energy savings by utilizing premium efficiency motors for the fans.

Installation cost:

Estimated installed cost: $696
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
5	replace (3) 1 HP flue updraft fan motors with Premium Efficiency	similar projects, DOE Motor Master + International	831	135	696	1,341	0.4	0	0.0	0	209	20	4,184	3.3	501	25	30	2,416	1,837

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 each fan considered should operate for approximately 1,500 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#6: *Install 195 kW PV system*

Description:

Currently, the High School 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 195 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 High School 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 195 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 195 kW system needs approximately 847 panels, which would take up 14,857 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: $1,509,745
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	106,1132	25	624,302	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	791,621	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	964,1130		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	106,1132	25	624,302	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	791,621	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	964,1130		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 High Schools.

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: *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 High School 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
7	retro commission-ing	similar projects	160,287	none at this time	160,287	37,920	10.4	14,652	7.5	1,820	26,388	12	294,813	6.1	98	8	12	102,377	51,950

Assumptions: Since the utility bills have some accounting fluctuations, it is difficult to determine the amount of energy used for heating and cooling the High School 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 213,716. 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#8: *Replace Freezer with Energy Star Model*

Description:

On the days of the site visits, SWA observed that there is an existing ice cream chest freezer in the kitchen area which is not Energy Star rated (using approximately 4,300 kWh/yr). 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: $2,700
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
8a	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	582	13.6	-12	-1	-2	-724	426
8b	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	582	1.5	694	58	66	1,676	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#9: *Replace Rooftop HVAC Units with a High Efficiency Unit*

Description:

There is one (1) packaged 15-ton RTU serving the TV Studio and one (1) packaged 15-ton RTU serving the classrooms adjacent to the Media Center are beyond their expected service life. The units were installed in 1989 and 1992 respectively and are beyond their expected service life of 15 years. SWA recommends replacement of this equipment to gain increase in operating efficiency. This upgrade cannot be justified by energy savings alone. Replacement is recommended with a major renovation, such as the Township proposed December referendum.

The current equipment has a cooling Energy Efficiency Ratio (EER) of approximately 8.5-9.0. The new equipment should have a minimum 11.5 EER rating, preferably closer to 12.0. The higher EER will involve increased cost for the equipment over units with lower EER, but 11.5 EER is the minimum required for this equipment capacity to qualify for a NJ Clean Energy Program rebate. The equipment shall be Energy Star certified and ASHRAE 90.1 compliant. The equipment shall utilize R-410A refrigerant. The compressors shall be fully hermetic, scroll type with on demand crankcase heaters for cooling duty and induced draft gas combustion for heating duty. The evaporator fan wheel shall be steel with a corrosion-resistant finish, shall be double-inlet type with forward-curved blades and shall be dynamically balanced. Fan motors shall be continuous operation, open-drip proof with sealed, permanently lubricated ball bearings. Evaporator and condenser coils shall have aluminum lanced plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed. The heat exchanger shall be aluminized 20-gage steel coated with 1.2 mil aluminum-silicone alloy or similar for corrosion resistance.

Installation cost:

Estimated installed cost: $47,630
Source of cost estimate: S*imilar projects*

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
9a	replace (2) packaged 15-ton electric cooling rooftop HVAC unit with high efficiency units	similar projects	50,000	2,370	47,630	12,500	3.4	0	0.2	910	2,860	10	19,500	16.7	-40	-4	-8	-23,234	17,125
9b	incremental cost to replace (2) packaged 15-ton electric cooling rooftop HVAC unit with high efficiency units	similar projects	5,000	2,370	2,630	12,500	3.4	0	0.8	910	2,860	10	19,500	0.9	987	99	109	21,766	17,125

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

Rebates/financial incentives:

NJ Clean Energy - Unitary AC and split systems ($73- $92 per ton)
Maximum incentive amount is $2,370.

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#10: 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 forty-five (45) of the building roof and attic 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: $141,570
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
10a	replace 45 exhaust fans with premium efficiency units	similar projects, DOE Motor Master + International	144,000	2,430	141,570	11,475	3.2	0	0.2	2,730	4,520	10	17,901	31.3	-68	-7	<0	-103,013	15,721
10b	incremental cost to replace 45 exhaust fans with premium efficiency units	similar projects, DOE Motor Master + International	16,875	2,430	14,445	11,475	3.2	0	0.8	2,730	4,520	10	17,901	3.2	213	21	29	24,112	15,721

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 $2,430.

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

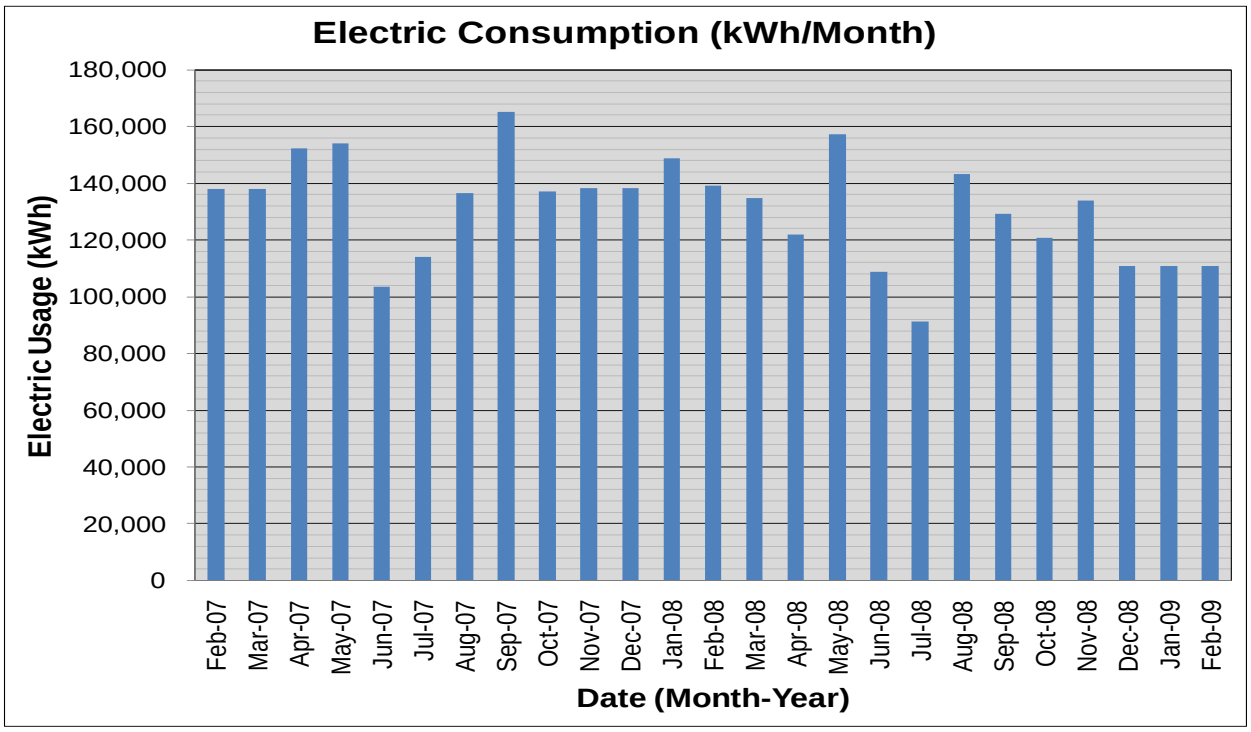
Description:

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.

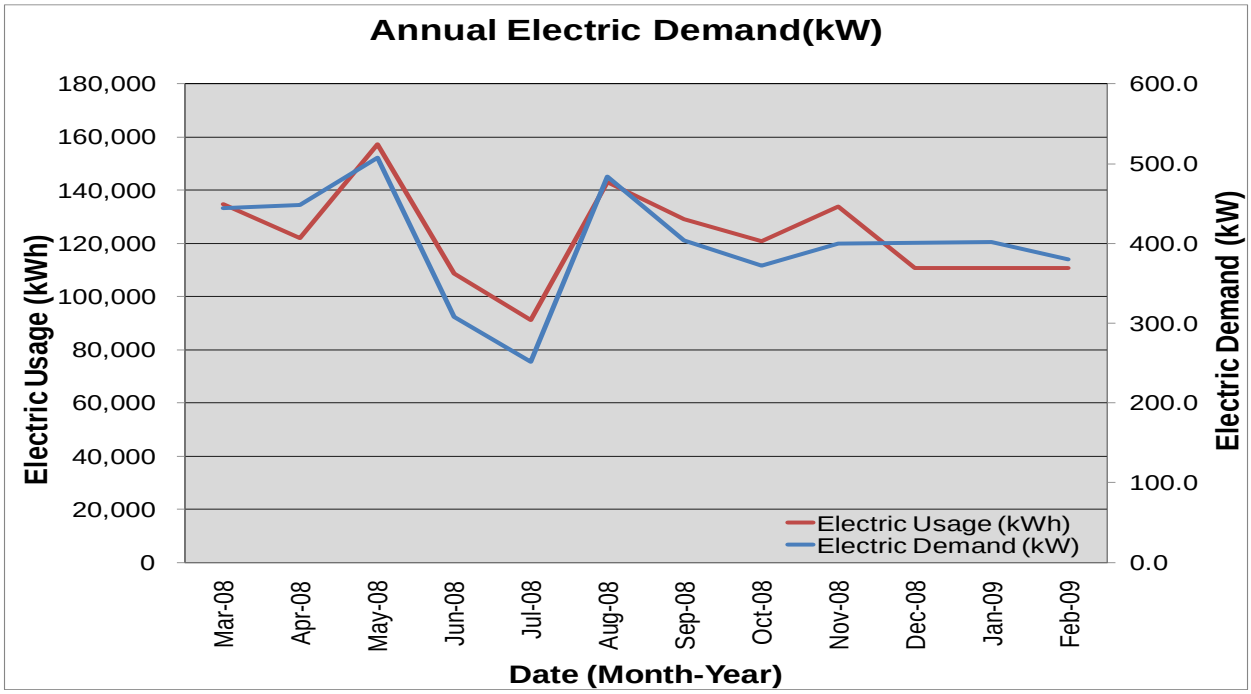
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Load profiles

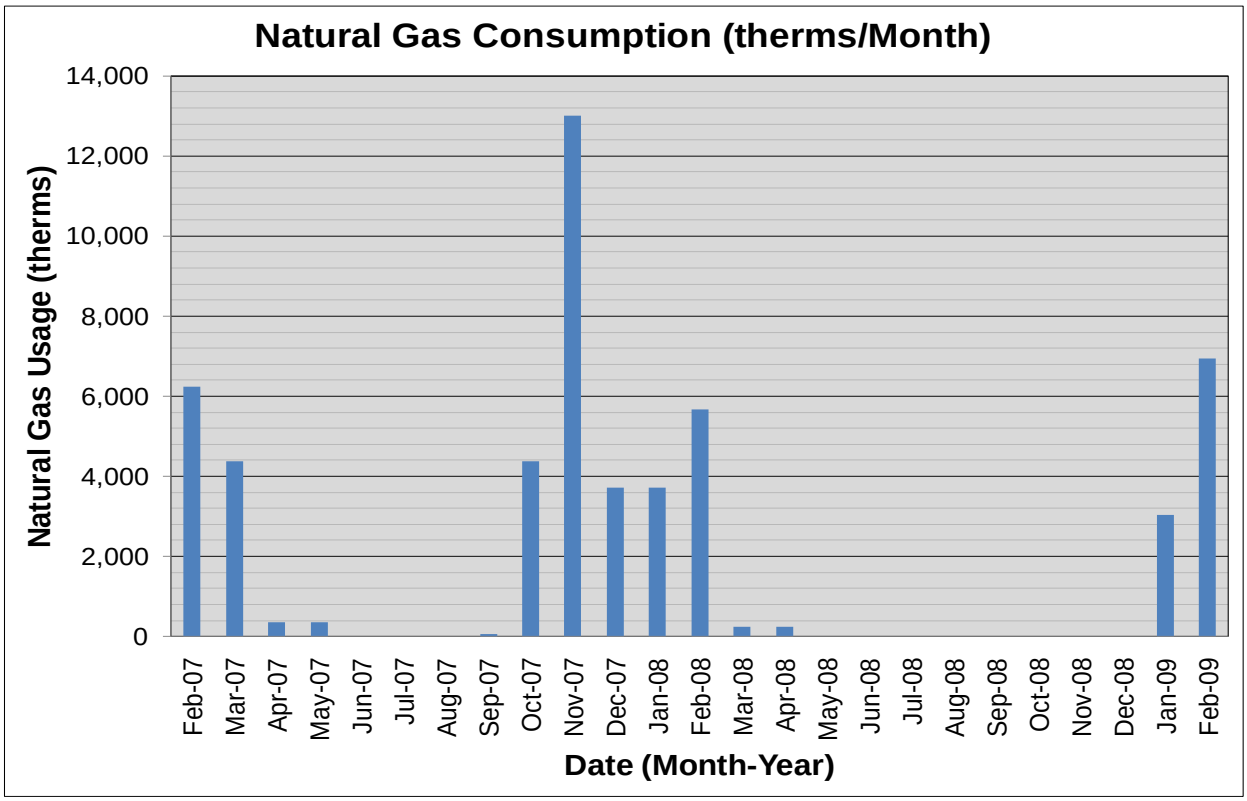
The following are charts that show the annual electric and natural gas load profiles for the Livingston High School building.

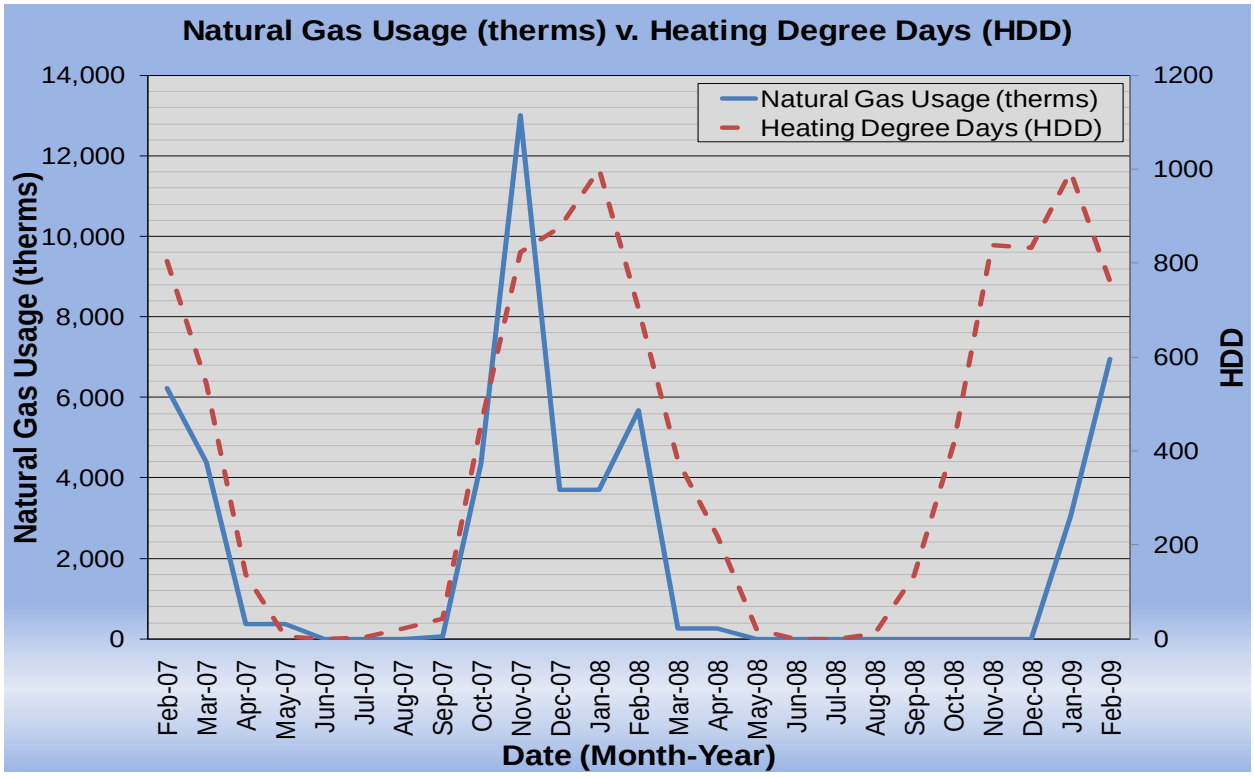


Some minor unusual electric fluctuations shown may be due to adjustments between estimated and actual meter readings. Also, note on the following chart how the electrical Demand peaks (except for a few unusual fluctuation anomalies) follow the electrical consumption peaks.



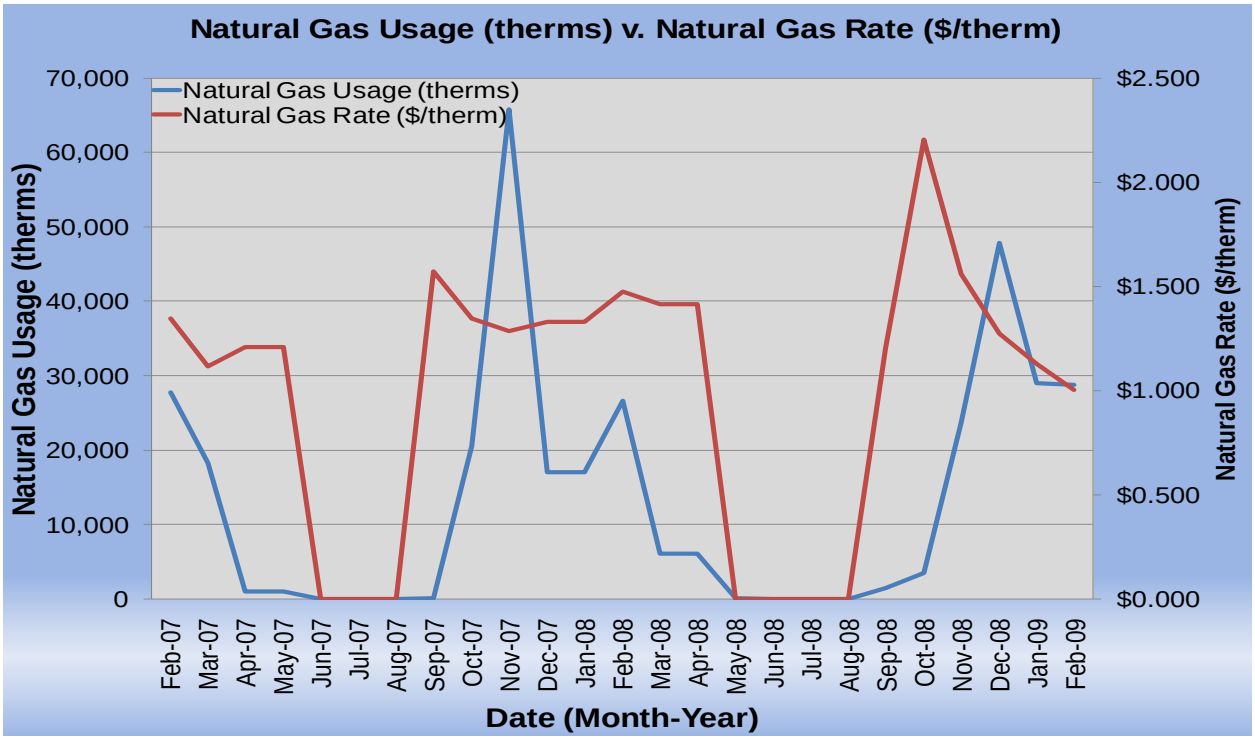
The following is a chart of the natural gas annual load profile for the building, peaking in the coldest months of the year and a chart showing natural gas consumption following the "heating degree days" curve. Some utility bills have more than one month estimated and combined.


Natural Gas Consumption (therms/Month)
Natural Gas Usage (therms)
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Feb-07
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)
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
HDD
1200
1000
800
600
400
200
0
Feb-07
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 High School main building via one gas meter (aside from the new Science Wing and the new Fitness & Wellness Center which have their independent meters) 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 rate for the High School is MPLV or Meter Product Large Volume. PSE&G acts as the transport company. The suppliers' general service rate for natural gas charges a market-rate price based on use and the High School 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 May, June, July and August cap payment are excluded from the following chart.

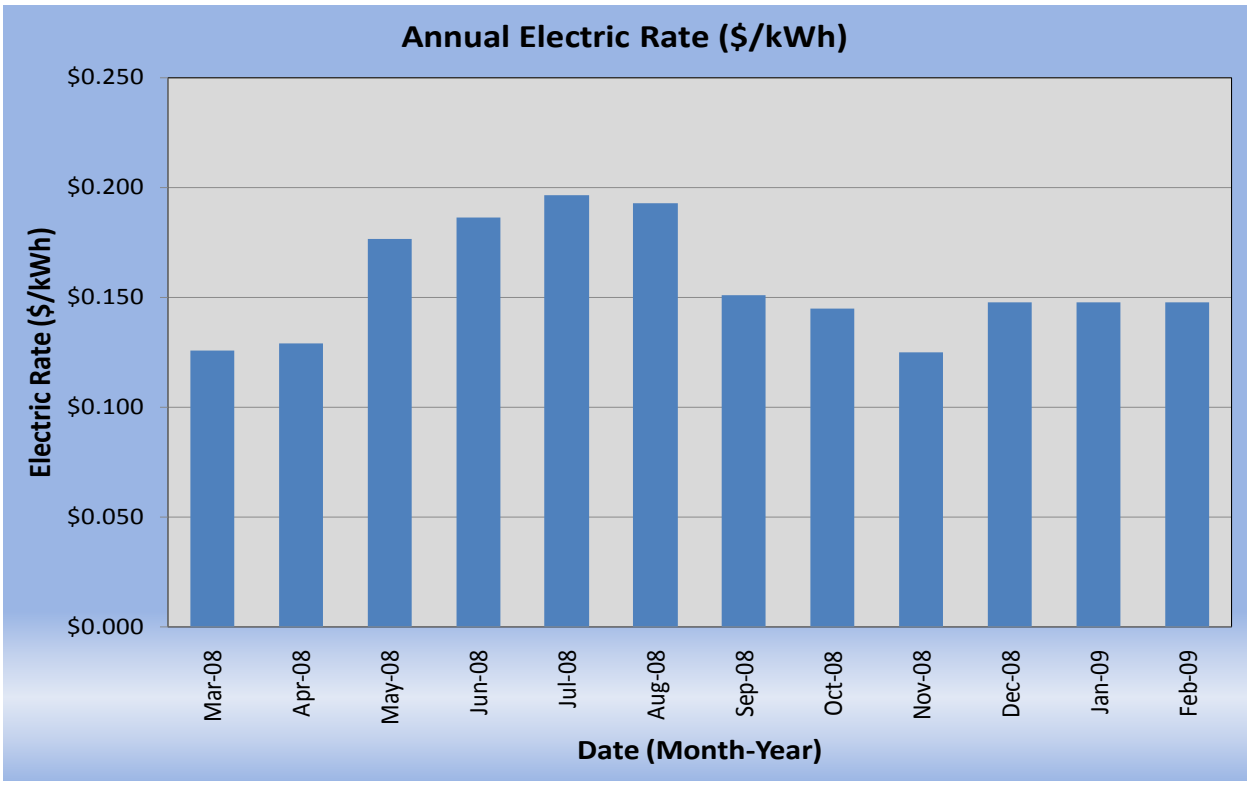


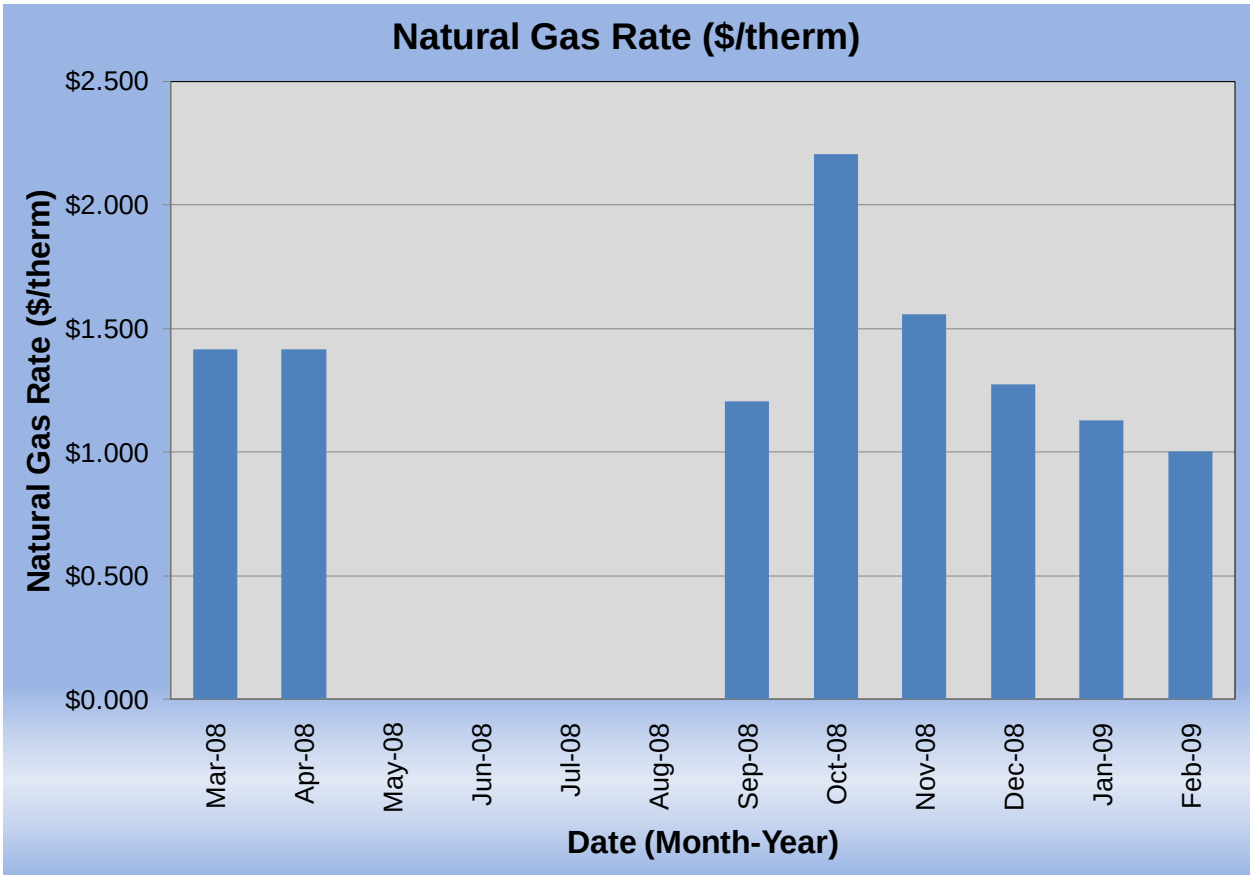
The main High School building is direct-metered (via one main meter, aside from the new Science Wing, the new Fitness & Wellness Center and the Athletic Field which have their independent meters) and currently purchases electricity from PSE&G at a general service rate. The general service rate for electric charges are market-rate based on use and the High School 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 new Science Wing, the new Fitness & Wellness Center and the Athletic Field have their independent natural gas (none for the Field) and electric meters. The High School main 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 main High School 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 29% over the most recent 12 month period. Natural gas bill analysis shows fluctuations up to 58% 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 main High School building annual utility costs are $8,107 higher for electric and $40,557 lower for natural gas for a total of $32,450 lower, 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 High School 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 High School 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 High School building monthly spending per unit of energy in 2008.




Natural Gas Rate ($/therm)
$2.500
$2.000
$1.500
$1.000
$0.500
$0.000
Natural Gas Rate ($/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

	Open Form		Existing Fixture Information													Retrofit Information													Annual Savings		
#	Building	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	**Livington HS**	**Main Office**	**Parabolic**	**E**	**4'T8**	**14**	**2**	**32**	**S**	**9**	**190**	**3**	**899**	**1,604**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**14**	**2**	**32**	**6.75**	**190**	**3**	**899**	**1,203**	**0**	**401**	**401**
2	**Livington HS**	**Main Office**	**Parabolic**	**E**	**4'T8**	**6**	**2**	**32**	**S**	**9**	**190**	**3**	**387**	**687**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**6**	**2**	**32**	**6.75**	**190**	**3**	**387**	**516**	**0**	**172**	**172**
3	Livington HS	Main Office conference rm 101	Parabolic	E	4'T8	4	2	32	S	9	190	3	259	458	N/A	Parabolic	4'T8	E	S	4	2	32	9	190	3	259	458	0	0	0
4	Livington HS	Hallway	Screw	E	CFL	2	4	31	S	16	190	2	250	766	N/A	Screw	CFL	None	S	2	4	31	16	190	2	250	766	0	0	0
5	Livington HS	Hallway	Exit sign	None	LED Exit	6	1	5	N	24	365	1	31	315	N/A	Exit sign	LED Exit	None	N	6	1	5	24	365	1	31	315	0	0	0
6	Livington HS	Hallway	Recessed	E	4'T8	16	3	32	S	16	190	4	1,540	4,864	N/A	Recessed	4'T8	E	S	16	3	32	16	190	4	1,540	4,864	0	0	0
7	Livington HS	Hallway	Screw	E	CFL	17	1	31	S	16	190	2	529	1,705	N/A	Screw	CFL	None	S	17	1	31	16	190	2	529	1,705	0	0	0
8	Livington HS	Mechanical Rm	Parabolic	E	4'T8	5	2	32	S	3	190	3	323	191	N/A	Parabolic	4'T8	E	S	5	2	32	3	190	3	323	191	0	0	0
9	Livington HS	Mechanical Rm	Exit sign	None	LED Exit	2	1	5	N	24	365	1	11	105	N/A	Exit sign	LED Exit	None	N	2	1	5	24	365	1	11	105	0	0	0
10	Livington HS	Classroom A121	Parabolic	E	4'T8	12	2	32	S	9	190	3	771	1,375	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	3	771	1,375	0	0	0
11	Livington HS	Classroom A123	Parabolic	E	4'T8	12	2	32	S	9	190	3	771	1,375	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	3	771	1,375	0	0	0
12	Livington HS	Classroom A116	Parabolic	E	4'T8	12	2	32	S	9	190	3	771	1,375	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	3	771	1,375	0	0	0
13	Livington HS	Classroom A114	Parabolic	E	4'T8	12	2	32	S	9	190	3	771	1,375	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	3	771	1,375	0	0	0
14	Livington HS	Classroom A119	Parabolic	E	4'T8	12	2	32	S	9	190	3	771	1,375	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	3	771	1,375	0	0	0
15	Livington HS	Classroom A117	Parabolic	E	4'T8	12	2	32	S	9	190	3	771	1,375	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	3	771	1,375	0	0	0
16	Livington HS	Bathroom Women	Parabolic	E	4'T8	5	2	32	S	9	190	3	323	573	N/A	Parabolic	4'T8	E	S	5	2	32	9	190	3	323	573	0	0	0
17	Livington HS	Janitor's ClosetbA114A	Parabolic	E	2'T8	1	2	16	S	2	190	1	33	13	N/A	Parabolic	2'T8	E	S	1	2	16	2	190	1	33	13	0	0	0
18	Livington HS	Office A112	Parabolic	E	4'T5	3	1	32	S	9	190	1	97	169	N/A	Parabolic	4'T5	E	S	3	1	32	9	190	1	97	169	0	0	0
19	Livington HS	Classroom A115	Parabolic	E	4'T8	12	2	32	S	9	190	3	771	1,375	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	3	771	1,375	0	0	0
20	Livington HS	Classroom A113	Parabolic	E	4'T8	6	2	32	S	9	190	3	387	687	N/A	Parabolic	4'T8	E	S	6	2	32	9	190	3	387	687	0	0	0
21	Livington HS	Classroom A111	Parabolic	E	4'T8	9	4	32	S	9	190	4	1,156	2,031	N/A	Parabolic	4'T8	E	S	9	4	32	9	190	4	1,156	2,031	0	0	0
22	Livington HS	Classroom A110	Parabolic	E	4'T8	12	3	32	S	9	190	4	1,156	2,052	N/A	Parabolic	4'T8	E	S	12	3	32	9	190	4	1,156	2,052	0	0	0
23	Livington HS	Office A109	Parabolic	E	4'T8	2	1	32	S	9	190	3	67	120	N/A	Parabolic	4'T8	E	S	2	1	32	9	190	3	67	120	0	0	0
24	Livington HS	Office A109A	Parabolic	E	4'T8	4	1	32	S	9	190	3	131	239	N/A	Parabolic	4'T8	E	S	4	1	32	9	190	3	131	239	0	0	0
25	Livington HS	Office A107	Parabolic	E	4'T8	2	2	32	S	9	190	3	131	229	N/A	Parabolic	4'T8	E	S	2	2	32	9	190	3	131	229	0	0	0
26	Livington HS	Office A105	Parabolic	E	4'T8	3	2	32	S	9	190	3	195	344	N/A	Parabolic	4'T8	E	S	3	2	32	9	190	3	195	344	0	0	0
27	Livington HS	Office A105A	Parabolic	E	4'T8	1	3	32	S	9	190	4	100	171	N/A	Parabolic	4'T8	E	S	1	3	32	9	190	4	100	171	0	0	0
28	Livington HS	Office A105D	Parabolic	E	4'T8	1	3	32	S	9	190	4	100	171	N/A	Parabolic	4'T8	E	S	1	3	32	9	190	4	100	171	0	0	0
29	Livington HS	Office A105B	Parabolic	E	4'T8	2	3	32	S	9	190	4	196	342	N/A	Parabolic	4'T8	E	S	2	3	32	9	190	4	196	342	0	0	0
30	Livington HS	Office A105C	Parabolic	E	4'T8	2	3	32	S	9	190	4	196	342	N/A	Parabolic	4'T8	E	S	2	3	32	9	190	4	196	342	0	0	0
31	Livington HS	Bathroom nurses	Parabolic	E	4'T8	1	3	32	S	9	190	4	100	171	N/A	Parabolic	4'T8	E	S	1	3	32	9	190	4	100	171	0	0	0
32	Livington HS	Hallway A105	Parabolic	E	2'T8	6	2	16	S	16	190	1	193	602	N/A	Parabolic	2'T8	E	S	6	2	16	16	190	1	193	602	0	0	0
33	Livington HS	Hallway A105 over beds	Pin-based	E	CFL	5	2	50	S	5	190	2	502	485	N/A	Pin-based	CFL	E	S	5	2	50	5	190	2	502	485	0	0	0
34	Livington HS	Classroom A108	Parabolic	E	4'T8	12	3	32	S	9	190	4	1,156	2,052	N/A	Parabolic	4'T8	E	S	12	3	32	9	190	4	1,156	2,052	0	0	0
35	Livington HS	Bathroom Men	Parabolic	E	4'T5	2	4	32	S	9	190	1	257	441	N/A	Parabolic	4'T5	E	OS	2	4	32	9	190	1	257	441	0	0	0
36	Livington HS	Janitor's Closet D161A	Parabolic	E	2'T8	1	2	16	S	2	190	1	33	13	N/A	Parabolic	2'T8	E	S	1	2	16	2	190	1	33	13	0	0	0
37	Livington HS	Classroom D163A	Parabolic	E	4'T8	12	2	32	S	9	190	3	771	1,375	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	3	771	1,375	0	0	0
38	Livington HS	Classroom D160	Parabolic	E	4'T8	8	3	32	S	9	190	4	772	1,368	N/A	Parabolic	4'T8	E	S	8	3	32	9	190	4	772	1,368	0	0	0
39	Livington HS	Classroom D160 closet	2'U-shape	E	T8 U	1	2	32	S	2	190	3	67	25	N/A	2'U-shape	T8 U	E	S	1	2	32	2	190	3	67	25	0	0	0
40	Livington HS	Classroom D162	Parabolic	E	4'T8	12	3	32	S	9	190	4	1,156	2,052	N/A	Parabolic	4'T8	E	S	12	3	32	9	190	4	1,156	2,052	0	0	0
41	Livington HS	Classroom D165	Parabolic	E	4'T8	8	4	32	S	9	190	4	1,028	1,806	N/A	Parabolic	4'T8	E	S	8	4	32	9	190	4	1,028	1,806	0	0	0
42	Livington HS	Hallway	Recessed	E	4'T8	14	3	32	S	16	190	4	1,348	4,256	N/A	Recessed	4'T8	E	S	14	3	32	16	190	4	1,348	4,256	0	0	0
43	Livington HS	Hallway	Exit sign	None	LED Exit	3	1	5	N	24	365	1	16	158	N/A	Exit sign	LED Exit	None	N	3	1	5	24	365	1	16	158	0	0	0
44	Livington HS	Hallway	Recessed	E	4'T8	11	3	32	S	16	190	4	1,060	3,344	N/A	Recessed	4'T8	E	S	11	3	32	16	190	4	1,060	3,344	0	0	0
45	Livington HS	Office B139	Parabolic	E	4'T8	3	2	32	S	9	190	3	195	344	N/A	Parabolic	4'T8	E	S	3	2	32	9	190	3	195	344	0	0	0
46	Livington HS	Storage B141C	Parabolic	E	2'T8	4	2	16	OS	2	190	1	129	50	N/A	Parabolic	2'T8	E	OS	4	2	16	2	190	1	129	50	0	0	0
47	Livington HS	Storage B141A	Parabolic	E	2'T8	1	2	16	OS	2	190	1	33	13	N/A	Parabolic	2'T8	E	OS	1	2	16	1.5	190	1	33	9	0	3	3
48	Livington HS	Storage B141B	Parabolic	E	2'T8	3	2	16	OS	2	190	1	97	38	N/A	Parabolic	2'T8	E	OS	3	2	16	2	190	1	97	38	0	0	0
49	Livington HS	Classroom B141	Parabolic	E	4'T8	26	3	32	S	9	190	4	2,500	4,446	N/A	Parabolic	4'T8	E	S	26	3	32	9	190	4	2,500	4,446	0	0	0

			Existing Fixture Information													Retrofit Information													Annual Savings		
#	Building	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)
50	Livington HS	Classroom B141	Parabolic	E	2'T8	1	2	16	S	9	190	1	33	56	N/A	Parabolic	2'T8	E	S	1	2	16	9	190	1	33	56	0	0	0
51	Livington HS	Classroom B141	Screw	E	CFL	33	2	32	S	9	190	2	2,114	3,724	N/A	Screw	CFL	E	S	33	2	32	9	190	2	2,114	3,724	0	0	0
52	Livington HS	Classroom B142	Parabolic	E	4'T8	13	3	32	S	9	190	4	1,252	2,223	N/A	Parabolic	4'T8	E	S	13	3	32	9	190	4	1,252	2,223	0	0	0
53	Livington HS	Classroom B142	2'U-shape	E	T8 U	2	2	32	S	9	190	3	131	229	N/A	2'U-shape	T8 U	E	S	2	2	32	9	190	3	131	229	0	0	0
54	Livington HS	Classroom B142	Exit sign	None	LED Exit	1	2	5	N	9	190	1	11	19	N/A	Exit sign	LED Exit	None	N	1	2	5	9	190	1	11	19	0	0	0
55	Livington HS	Storage Rm B142A	Parabolic	E	4'T8	8	2	32	S	2	190	3	515	204	N/A	Parabolic	4'T8	E	S	8	2	32	2	190	3	515	204	0	0	0
56	Livington HS	Classroom E190	Parabolic	E	4'T8	8	4	32	S	9	190	4	1,028	1,806	N/A	Parabolic	4'T8	E	S	8	4	32	9	190	4	1,028	1,806	0	0	0
57	Livington HS	Classroom D169	Parabolic	E	4'T8	20	3	32	S	9	190	4	1,924	3,420	N/A	Parabolic	4'T8	E	S	20	3	32	9	190	4	1,924	3,420	0	0	0
58	Livington HS	Classroom D169	Parabolic	E	4'T8	15	3	32	S	9	190	4	1,444	2,565	N/A	Parabolic	4'T8	E	S	15	3	32	9	190	4	1,444	2,565	0	0	0
59	Livington HS	Classroom D169	Exit sign	None	LED Exit	1	2	5	N	24	365	1	11	96	N/A	Exit sign	LED Exit	None	N	1	2	5	24	365	1	11	96	0	0	0
60	Livington HS	Office D169A	Parabolic	E	4'T8	3	3	32	S	9	190	4	292	513	N/A	Parabolic	4'T8	E	S	3	3	32	9	190	4	292	513	0	0	0
61	Livington HS	Hallway	Recessed	E	4'T8	6	3	32	S	16	190	4	580	1,824	N/A	Recessed	4'T8	E	S	6	3	32	16	190	4	580	1,824	0	0	0
62	Livington HS	Hallway	Exit sign	None	LED Exit	2	1	5	N	24	365	1	11	105	N/A	Exit sign	LED Exit	None	N	2	1	5	24	365	1	11	105	0	0	0
63	Livington HS	Staircase	Parabolic	E	4'T8	1	2	32	S	16	190	3	67	204	N/A	Parabolic	4'T8	E	S	1	2	32	16	190	3	67	204	0	0	0
64	Livington HS	Staircase	Parabolic	E	4'T8	1	2	32	S	16	190	3	67	204	N/A	Parabolic	4'T8	E	S	1	2	32	16	190	3	67	204	0	0	0
65	Livington HS	Staircase	Parabolic	E	4'T8	1	4	32	S	16	190	4	132	401	N/A	Parabolic	4'T8	E	S	1	4	32	16	190	4	132	401	0	0	0
66	Livington HS	Staircase	Parabolic	E	4'T8	1	2	32	S	16	190	3	67	204	N/A	Parabolic	4'T8	E	S	1	2	32	16	190	3	67	204	0	0	0
67	Livington HS	Classroom D167	Parabolic	E	4'T8	27	2	32	S	9	190	3	1,731	3,093	N/A	Parabolic	4'T8	E	S	27	2	32	9	190	3	1,731	3,093	0	0	0
68	Livington HS	Classroom B137	Parabolic	E	4'T8	8	4	32	S	9	190	4	1,028	1,806	N/A	Parabolic	4'T8	E	S	8	4	32	9	190	4	1,028	1,806	0	0	0
69	Livington HS	Classroom B135	Parabolic	E	4'T8	8	4	32	S	9	190	4	1,028	1,806	N/A	Parabolic	4'T8	E	S	8	4	32	9	190	4	1,028	1,806	0	0	0
70	Livington HS	Faculty B133 & 131	Parabolic	E	4'T8	30	2	32	S	9	190	3	1,923	3,437	N/A	Parabolic	4'T8	E	S	30	2	32	9	190	3	1,923	3,437	0	0	0
71	Livington HS	Faculty B133 & 131	Exit sign	None	LED Exit	4	1	5	N	24	365	1	21	210	N/A	Exit sign	LED Exit	None	N	4	1	5	24	365	1	21	210	0	0	0
72	Livington HS	Classroom D171	Parabolic	E	4'T8	15	3	32	DL	9	190	4	1,444	2,565	N/A	Parabolic	4'T8	E	DL	15	3	32	9	190	4	1,444	2,565	0	0	0
73	Livington HS	Storage D171A	Parabolic	E	4'T8	1	3	32	DL	2	190	4	100	38	N/A	Parabolic	4'T8	E	DL	1	3	32	2	190	4	100	38	0	0	0
74	Livington HS	Storage D171B	Parabolic	E	4'T8	1	2	32	DL	2	190	3	67	25	N/A	Parabolic	4'T8	E	DL	1	2	32	2	190	3	67	25	0	0	0
75	Livington HS	Classroom E194	Parabolic	E	4'T8	38	2	32	S	9	190	3	2,435	4,354	N/A	Parabolic	4'T8	E	S	38	2	32	9	190	3	2,435	4,354	0	0	0
76	Livington HS	Classroom E194	Exit sign	None	LED Exit	2	1	5	N	24	365	1	11	105	N/A	Exit sign	LED Exit	None	N	2	1	5	24	365	1	11	105	0	0	0
77	Livington HS	Classroom E192	Parabolic	E	4'T8	8	4	32	S	9	190	4	1,028	1,806	N/A	Parabolic	4'T8	E	S	8	4	32	9	190	4	1,028	1,806	0	0	0
78	Livington HS	Storage Rm E190A	Parabolic	E	4'T8	1	4	32	S	2	190	4	132	50	N/A	Parabolic	4'T8	E	S	1	4	32	2	190	4	132	50	0	0	0
79	Livington HS	Storage Rm B142B	Parabolic	E	4'T8	1	4	32	S	2	190	4	132	50	N/A	Parabolic	4'T8	E	S	1	4	32	2	190	4	132	50	0	0	0
80	Livington HS	Office A101B	Parabolic	E	4'T8	2	2	32	S	9	190	3	131	229	N/A	Parabolic	4'T8	E	S	2	2	32	9	190	3	131	229	0	0	0
81	**Livington HS**	**Main Office**	**Parabolic**	**E**	**4'T8**	**4**	**2**	**32**	**S**	**9**	**190**	**3**	**259**	**458**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**4**	**2**	**32**	**6.75**	**190**	**3**	**259**	**344**	**0**	**115**	**115**
82	**Livington HS**	**Main Office VP**	**Parabolic**	**E**	**4'T8**	**6**	**2**	**32**	**S**	**9**	**190**	**3**	**387**	**687**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**6**	**2**	**32**	**6.75**	**190**	**3**	**387**	**516**	**0**	**172**	**172**
83	Livington HS	Bathroom Women	Parabolic	E	4'T8	1	2	32	S	9	190	3	67	115	N/A	Parabolic	4'T8	E	S	1	2	32	9	190	3	67	115	0	0	0
84	Livington HS	Bathroom Women	Parabolic	E	2'T8	1	1	16	S	9	190	1	17	29	N/A	Parabolic	2'T8	E	S	1	1	16	9	190	1	17	29	0	0	0
85	**Livington HS**	**Bathroom Men**	**Parabolic**	**E**	**2'T8**	**1**	**1**	**16**	**S**	**9**	**190**	**1**	**17**	**29**	**C**	**Parabolic**	**2'T8**	**E**	**OS**	**1**	**1**	**16**	**6.75**	**190**	**1**	**17**	**22**	**0**	**7**	**7**
86	**Livington HS**	**Bathroom Men**	**Parabolic**	**E**	**4'T8**	**1**	**2**	**32**	**S**	**9**	**190**	**3**	**67**	**115**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**1**	**2**	**32**	**6.75**	**190**	**3**	**67**	**86**	**0**	**29**	**29**
87	Livington HS	Classroom A103B	Parabolic	E	4'T8	5	2	32	S	9	190	3	323	573	N/A	Parabolic	4'T8	E	S	5	2	32	9	190	3	323	573	0	0	0
88	**Livington HS**	**Main office**	**Parabolic**	**E**	**4'T8**	**10**	**2**	**32**	**S**	**9**	**190**	**3**	**643**	**1,146**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**10**	**2**	**32**	**6.75**	**190**	**3**	**643**	**859**	**0**	**286**	**286**
89	**Livington HS**	**Main office**	**Parabolic**	**E**	**4'T8**	**3**	**3**	**32**	**S**	**9**	**190**	**4**	**292**	**513**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**3**	**3**	**32**	**6.75**	**190**	**4**	**292**	**385**	**0**	**128**	**128**
90	**Livington HS**	**Main office**	**2'U-shape**	**E**	**T8 U**	**6**	**2**	**32**	**S**	**9**	**190**	**3**	**387**	**687**	**C**	**2'U-shape**	**T8 U**	**E**	**OS**	**6**	**2**	**32**	**6.75**	**190**	**3**	**387**	**516**	**0**	**172**	**172**
91	**Livington HS**	**Office A103A**	**Parabolic**	**E**	**4'T8**	**4**	**2**	**32**	**S**	**9**	**190**	**3**	**259**	**458**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**4**	**2**	**32**	**6.75**	**190**	**3**	**259**	**344**	**0**	**115**	**115**
92	Livington HS	Main office	Exit sign	None	LED Exit	4	1	5	N	24	365	1	21	210	N/A	Exit sign	LED Exit	None	N	4	1	5	24	365	1	21	210	0	0	0
93	Livington HS	Office Career planning	Parabolic	E	4'T8	6	2	32	S	9	190	3	387	687	N/A	Parabolic	4'T8	E	S	6	2	32	9	190	3	387	687	0	0	0
94	Livington HS	Office A103J	Parabolic	E	4'T8	2	2	32	S	9	190	3	131	229	N/A	Parabolic	4'T8	E	S	2	2	32	9	190	3	131	229	0	0	0
95	Livington HS	Office A103I	Parabolic	E	4'T8	2	2	32	S	9	190	3	131	229	N/A	Parabolic	4'T8	E	S	2	2	32	9	190	3	131	229	0	0	0
96	Livington HS	Office A103H	Parabolic	E	4'T8	2	2	32	S	9	190	3	131	229	N/A	Parabolic	4'T8	E	S	2	2	32	9	190	3	131	229	0	0	0
97	Livington HS	Office A103G	Parabolic	E	4'T8	2	2	32	S	9	190	3	131	229	N/A	Parabolic	4'T8	E	S	2	2	32	9	190	3	131	229	0	0	0
98	Livington HS	Office A103F	Parabolic	E	4'T8	2	2	32	S	9	190	3	131	229	N/A	Parabolic	4'T8	E	S	2	2	32	9	190	3	131	229	0	0	0
99	Livington HS	Office A103E	Parabolic	E	4'T8	2	2	32	S	9	190	3	131	229	N/A	Parabolic	4'T8	E	S	2	2	32	9	190	3	131	229	0	0	0

			Existing Fixture Information													Retrofit Information													Annual Savings		
#	Building	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)
100	Livington HS	Office A103D	Parabolic	E	4'T8	2	2	32	S	9	190	3	131	229	N/A	Parabolic	4'T8	E	S	2	2	32	9	190	3	131	229	0	0	0
101	Livington HS	Office A103C	Parabolic	E	4'T8	2	2	32	S	9	190	3	131	229	N/A	Parabolic	4'T8	E	S	2	2	32	9	190	3	131	229	0	0	0
102	Livington HS	Office A103	Parabolic	E	4'T8	6	2	32	S	9	190	3	387	687	N/A	Parabolic	4'T8	E	S	6	2	32	9	190	3	387	687	0	0	0
103	**Livington HS**	**Office A103LC**	**Parabolic**	**E**	**4'T8**	**6**	**2**	**32**	**S**	**9**	**190**	**3**	**387**	**687**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**6**	**2**	**32**	**6.75**	**190**	**3**	**387**	**516**	**0**	**172**	**172**
104	Livington HS	Hallway A	Exit sign	None	LED Exit	5	1	5	N	24	365	1	26	263	N/A	Exit sign	LED Exit	None	N	5	1	5	24	365	1	26	263	0	0	0
105	Livington HS	Hallway A	Parabolic	E	4'T8	45	3	32	S	16	190	4	4,324	13,680	N/A	Parabolic	4'T8	E	S	45	3	32	16	190	4	4,324	13,680	0	0	0
106	Livington HS	Storage Rm E183	Parabolic	E	4'T8	1	4	32	S	2	190	4	132	50	N/A	Parabolic	4'T8	E	S	1	4	32	2	190	4	132	50	0	0	0
107	Livington HS	Storage Rm E183	Parabolic	E	4'T8	5	2	32	S	2	190	3	323	127	N/A	Parabolic	4'T8	E	S	5	2	32	2	190	3	323	127	0	0	0
108	Livington HS	Janitor's Closet	Parabolic	E	4'T8	1	2	32	S	2	190	3	67	25	N/A	Parabolic	4'T8	E	S	1	2	32	2	190	3	67	25	0	0	0
109	**Livington HS**	**Bathroom Men**	**Parabolic**	**E**	**4'T8**	**2**	**4**	**32**	**S**	**9**	**190**	**4**	**260**	**451**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**2**	**4**	**32**	**6.75**	**190**	**4**	**260**	**339**	**0**	**113**	**113**
110	**Livington HS**	**Bathroom Men**	**Parabolic**	**E**	**4'T8**	**1**	**2**	**32**	**S**	**9**	**190**	**3**	**67**	**115**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**1**	**2**	**32**	**6.75**	**190**	**3**	**67**	**86**	**0**	**29**	**29**
111	Livington HS	Classroom E185	Parabolic	E	4'T8	8	4	32	S	9	190	4	1,028	1,806	N/A	Parabolic	4'T8	E	S	8	4	32	9	190	4	1,028	1,806	0	0	0
112	Livington HS	Classroom E182	Parabolic	E	4'T8	6	4	32	S	9	190	4	772	1,354	N/A	Parabolic	4'T8	E	S	6	4	32	9	190	4	772	1,354	0	0	0
113	Livington HS	Classroom E184	Parabolic	E	4'T8	8	4	32	S	9	190	4	1,028	1,806	N/A	Parabolic	4'T8	E	S	8	4	32	9	190	4	1,028	1,806	0	0	0
114	Livington HS	Classroom E186	Parabolic	E	4'T8	8	4	32	S	9	190	4	1,028	1,806	N/A	Parabolic	4'T8	E	S	8	4	32	9	190	4	1,028	1,806	0	0	0
115	Livington HS	Hallway	Recessed	E	4'T8	10	3	32	S	16	190	4	964	3,040	N/A	Recessed	4'T8	E	S	10	3	32	16	190	4	964	3,040	0	0	0
116	Livington HS	Hallway	Exit sign	None	LED Exit	10	3	5	S	24	365	1	151	1,402	N/A	Exit sign	LED Exit	None	S	10	3	5	24	365	1	151	1,402	0	0	0
117	Livington HS	Hallway	Exit sign	None	LED Exit	1	1	5	N	24	365	1	6	53	N/A	Exit sign	LED Exit	None	N	1	1	5	24	365	1	6	53	0	0	0
118	Livington HS	Staircase	Parabolic	E	4'T8	5	1	32	S	16	190	3	163	532	N/A	Parabolic	4'T8	E	S	5	1	32	16	190	3	163	532	0	0	0
119	Livington HS	Staircase	Exit sign	None	LED Exit	1	1	5	N	24	365	1	6	53	N/A	Exit sign	LED Exit	None	N	1	1	5	24	365	1	6	53	0	0	0
120	Livington HS	Classroom E188	Parabolic	E	4'T8	8	4	32	S	9	190	4	1,028	1,806	N/A	Parabolic	4'T8	E	S	8	4	32	9	190	4	1,028	1,806	0	0	0
121	Livington HS	Hallway	Recessed	E	4'T8	13	3	32	S	16	190	4	1,252	3,952	N/A	Recessed	4'T8	E	S	13	3	32	16	190	4	1,252	3,952	0	0	0
122	Livington HS	Hallway	Exit sign	None	LED Exit	2	1	5	N	24	365	1	11	105	N/A	Exit sign	LED Exit	None	N	2	1	5	24	365	1	11	105	0	0	0
123	Livington HS	Boiler Rm B143	Parabolic	E	4'T8	8	2	32	S	3	190	3	515	306	N/A	Parabolic	4'T8	E	S	8	2	32	3	190	3	515	306	0	0	0
124	**Livington HS**	**Bathroom Men**	**Parabolic**	**E**	**4'T8**	**2**	**4**	**32**	**S**	**9**	**190**	**4**	**260**	**451**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**2**	**4**	**32**	**6.75**	**190**	**4**	**260**	**339**	**0**	**113**	**113**
125	Livington HS	Bathroom Women	Parabolic	E	4'T8	2	4	32	S	9	190	4	260	451	N/A	Parabolic	4'T8	E	S	2	4	32	9	190	4	260	451	0	0	0
126	Livington HS	Entry	Parabolic	E	4'T8	1	2	32	S	16	190	3	67	204	N/A	Parabolic	4'T8	E	S	1	2	32	16	190	3	67	204	0	0	0
127	**Livington HS**	**Gymnasium**	**Parabolic**	**None**	**MH**	**48**	**1**	**150**	**S**	**14**	**190**	**9**	**7,209**	**20,301**	**T5**	**Parabolic**	**4'T5**	**E**	**S**	**48**	**3**	**28**	**14**	**190**	**1**	**4,033**	**10,853**	**9,448**	**0**	**9,448**
128	Livington HS	Gymnasium	Exit sign	None	LED Exit	4	2	5	N	24	365	1	41	385	N/A	Exit sign	LED Exit	None	N	4	2	5	24	365	1	41	385	0	0	0
129	**Livington HS**	**Office B148**	**Parabolic**	**E**	**4'T8**	**8**	**3**	**32**	**S**	**9**	**190**	**4**	**772**	**1,368**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**8**	**3**	**32**	**6.75**	**190**	**4**	**772**	**1,026**	**0**	**342**	**342**
130	**Livington HS**	**Office B146**	**Parabolic**	**E**	**4'T8**	**8**	**3**	**32**	**S**	**9**	**190**	**4**	**772**	**1,368**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**8**	**3**	**32**	**6.75**	**190**	**4**	**772**	**1,026**	**0**	**342**	**342**
131	Livington HS	Office B146	Parabolic	E	2'T8	2	2	16	S	9	190	1	65	113	N/A	Parabolic	2'T8	E	S	2	2	16	9	190	1	65	113	0	0	0
132	Livington HS	Office B148	Parabolic	E	2'T8	2	2	16	S	9	190	1	65	113	N/A	Parabolic	2'T8	E	S	2	2	16	9	190	1	65	113	0	0	0
133	Livington HS	Office B148	Exit sign	None	LED Exit	2	2	5	N	24	365	1	21	193	N/A	Exit sign	LED Exit	None	N	2	2	5	24	365	1	21	193	0	0	0
134	Livington HS	Office B146	Exit sign	None	LED Exit	2	2	5	N	24	365	1	21	193	N/A	Exit sign	LED Exit	None	N	2	2	5	24	365	1	21	193	0	0	0
135	Livington HS	Bathroom	Parabolic	E	4'T5	4	3	15	S	10	190	1	181	350	N/A	Parabolic	4' T5	E	OS	4	3	15	10	190	1	181	350	0	0	0
136	Livington HS	Bathroom	Parabolic	E	4'T5	4	3	15	S	9	190	1	181	315	N/A	Parabolic	4' T5	E	OS	4	3	15	9	190	1	181	315	0	0	0
137	Livington HS	Showers B146S	Parabolic	E	4'T5	4	3	15	MS	9	190	1	181	315	N/A	Parabolic	4' T5	E	MS	4	3	15	9	190	1	181	315	0	0	0
138	Livington HS	Showers B148S	Parabolic	E	4'T5	4	3	15	MS	9	190	1	181	315	N/A	Parabolic	4' T5	E	MS	4	3	15	9	190	1	181	315	0	0	0
139	**Livington HS**	**Office B148A**	**Parabolic**	**E**	**4'T8**	**3**	**3**	**32**	**S**	**9**	**190**	**4**	**292**	**513**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**3**	**3**	**32**	**6.75**	**190**	**4**	**292**	**385**	**0**	**128**	**128**
140	**Livington HS**	**Office B146A**	**Parabolic**	**E**	**4'T8**	**3**	**3**	**32**	**S**	**9**	**190**	**4**	**292**	**513**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**3**	**3**	**32**	**6.75**	**190**	**4**	**292**	**385**	**0**	**128**	**128**
141	Livington HS	Entry	Parabolic	E	4'T8	2	3	32	S	16	190	4	196	608	N/A	Parabolic	4'T8	E	S	2	3	32	16	190	4	196	608	0	0	0
142	Livington HS	Entry	Exit sign	None	LED Exit	2	2	5	N	16	190	1	21	67	N/A	Exit sign	LED Exit	None	N	2	2	5	16	190	1	21	67	0	0	0
143	Livington HS	Room E193	Parabolic	E	4'T8	7	3	32	S	9	190	4	676	1,197	N/A	Parabolic	4'T8	E	S	7	3	32	9	190	4	676	1,197	0	0	0
144	Livington HS	Room E193	Exit sign	None	LED Exit	3	2	5	N	24	365	1	31	289	N/A	Exit sign	LED Exit	None	N	3	2	5	24	365	1	31	289	0	0	0
145	Livington HS	Room E193	Parabolic	E	2'T8	1	2	16	S	9	190	1	33	56	N/A	Parabolic	2'T8	E	S	1	2	16	9	190	1	33	56	0	0	0
146	Livington HS	Room E193 toilet	Parabolic	E	4'T5	4	3	28	MS	9	190	1	337	581	N/A	Parabolic	4'T5	E	MS	4	3	28	9	190	1	337	581	0	0	0
147	Livington HS	Room E193S	Parabolic	E	4'T5	4	3	32	MS	9	190	1	385	663	N/A	Parabolic	4'T5	E	MS	4	3	32	9	190	1	385	663	0	0	0
148	Livington HS	Room E195	Parabolic	E	4'T5	6	3	32	S	9	190	1	577	995	N/A	Parabolic	4'T5	E	S	6	3	32	9	190	1	577	995	0	0	0
149	Livington HS	Room E195	Exit sign	None	LED Exit	1	2	5	N	24	365	1	11	96	N/A	Exit sign	LED Exit	None	N	1	2	5	24	365	1	11	96	0	0	0

			Existing Fixture Information													Retrofit Information													Annual Savings		
#	Building	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)
150	Livington HS	Room E197	Parabolic	E	4'T8	3	3	32	S	9	190	4	292	513	N/A	Parabolic	4'T8	E	S	3	3	32	9	190	4	292	513	0	0	0
151	Livington HS	Room E197	Parabolic	E	4'T8	1	3	32	S	9	190	4	100	171	N/A	Parabolic	4'T8	E	S	1	3	32	9	190	4	100	171	0	0	0
152	Livington HS	Room E191	Parabolic	E	4'T8	7	3	32	S	9	190	4	676	1,197	N/A	Parabolic	4'T8	E	S	7	3	32	9	190	4	676	1,197	0	0	0
153	Livington HS	Room E191	Exit sign	None	LED Exit	3	2	5	N	24	365	1	31	289	N/A	Exit sign	LED Exit	None	N	3	2	5	24	365	1	31	289	0	0	0
154	Livington HS	Room E191	Parabolic	E	2'T8	1	2	16	S	9	190	1	33	56	N/A	Parabolic	2'T8	E	S	1	2	16	9	190	1	33	56	0	0	0
155	Livington HS	Room E191 toilet	Parabolic	E	4'T5	4	3	32	MS	9	190	1	385	663	N/A	Parabolic	4'T5	E	MS	4	3	32	9	190	1	385	663	0	0	0
156	Livington HS	Room E191S	Parabolic	E	4'T5	4	3	32	MS	9	190	1	385	663	N/A	Parabolic	4'T5	E	MS	4	3	32	9	190	1	385	663	0	0	0
157	Livington HS	Room E187	Parabolic	E	4'T5	6	3	32	S	9	190	1	577	995	N/A	Parabolic	4'T5	E	S	6	3	32	9	190	1	577	995	0	0	0
158	Livington HS	Room E187	Exit sign	None	LED Exit	1	2	5	N	24	365	1	11	96	N/A	Exit sign	LED Exit	None	N	1	2	5	24	365	1	11	96	0	0	0
159	Livington HS	Room E189	Parabolic	E	4'T8	3	3	32	S	9	190	4	292	513	N/A	Parabolic	4'T8	E	S	3	3	32	9	190	4	292	513	0	0	0
160	Livington HS	Room E189	Parabolic	E	4'T8	1	3	32	S	9	190	4	100	171	N/A	Parabolic	4'T8	E	S	1	3	32	9	190	4	100	171	0	0	0
161	Livington HS	Storage Rm B144A	Parabolic	E	4'T8	5	3	32	MS	2	190	4	484	190	N/A	Parabolic	4'T8	E	MS	5	3	32	2	190	4	484	190	0	0	0
162	Livington HS	Hallway	Recessed	E	4'T8	12	3	32	S	16	190	4	1,156	3,648	N/A	Recessed	4'T8	E	S	12	3	32	16	190	4	1,156	3,648	0	0	0
163	Livington HS	Hallway	Exit sign	None	LED Exit	2	2	5	N	24	365	1	21	193	N/A	Exit sign	LED Exit	None	N	2	2	5	24	365	1	21	193	0	0	0
164	Livington HS	Exercise Rm E199	Parabolic	E	2'T8	10	2	16	S	12	190	1	321	752	N/A	Parabolic	2'T8	E	S	10	2	16	12	190	1	321	752	0	0	0
165	Livington HS	Exercise Rm E199	Exit sign	None	LED Exit	2	2	5	N	24	365	1	21	193	N/A	Exit sign	LED Exit	None	N	2	2	5	24	365	1	21	193	0	0	0
166	Livington HS	Exercise Rm E199	Parabolic	E	4'T8	4	3	32	S	12	190	4	388	912	N/A	Parabolic	4'T8	E	S	4	3	32	12	190	4	388	912	0	0	0
167	Livington HS	Storage Rm E199S	Parabolic	E	4'T8	4	3	32	S	2	190	4	388	152	N/A	Parabolic	4'T8	E	S	4	3	32	2	190	4	388	152	0	0	0
168	**Livington HS**	**Bathroom E199**	**Parabolic**	**E**	**4'T8**	**1**	**3**	**32**	**S**	**9**	**190**	**4**	**100**	**171**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**1**	**3**	**32**	**6.75**	**190**	**4**	**100**	**128**	**0**	**43**	**43**
169	Livington HS	Office E199A	Parabolic	E	4'T8	2	3	32	S	9	190	4	196	342	N/A	Parabolic	4'T8	E	S	2	3	32	9	190	4	196	342	0	0	0
170	**Livington HS**	**Bathroom Men**	**Parabolic**	**E**	**4'T8**	**2**	**3**	**32**	**S**	**9**	**190**	**4**	**196**	**342**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**2**	**3**	**32**	**6.75**	**190**	**4**	**196**	**257**	**0**	**86**	**86**
171	Livington HS	Janitor's Closet D1	Parabolic	E	2'T8	1	2	16	S	2	190	1	33	13	N/A	Parabolic	2'T8	E	S	1	2	16	2	190	1	33	13	0	0	0
172	**Livington HS**	**Electrical rm D164**	**Screw**	**None**	**Inc**	**12**	**1**	**60**	**S**	**3**	**190**	**0**	**720**	**410**	**CFL**	**Screw**	**CFL**	**None**	**S**	**12**	**1**	**20**	**3**	**190**	**2**	**242**	**150**	**260**	**0**	**260**
173	**Livington HS**	**Office B140**	**Parabolic**	**E**	**4'T8**	**6**	**3**	**32**	**S**	**9**	**190**	**4**	**580**	**1,026**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**6**	**3**	**32**	**6.75**	**190**	**4**	**580**	**770**	**0**	**257**	**257**
174	Livington HS	Hallway B	Parabolic	E	4'T8	18	3	32	S	16	190	4	1,732	5,472	N/A	Parabolic	4'T8	E	S	18	3	32	16	190	4	1,732	5,472	0	0	0
175	Livington HS	Hallway B	Exit sign	None	LED Exit	3	2	5	N	24	365	1	31	289	N/A	Exit sign	LED Exit	None	N	3	2	5	24	365	1	31	289	0	0	0
176	Livington HS	Hallway	Exit sign	None	LED Exit	4	2	5	N	24	365	1	41	385	N/A	Exit sign	LED Exit	None	N	4	2	5	24	365	1	41	385	0	0	0
177	Livington HS	Hallway	Parabolic	E	4'T8	6	3	32	S	16	190	4	580	1,824	N/A	Parabolic	4'T8	E	S	6	3	32	16	190	4	580	1,824	0	0	0
178	Livington HS	Hallway	Parabolic	E	2'T5	7	2	16	S	16	190	1	225	702	N/A	Parabolic	2'T5	E	S	7	2	16	16	190	1	225	702	0	0	0
179	Livington HS	Storage Rm B134C	Parabolic	E	4'T8	2	3	32	MS	2	190	4	196	76	N/A	Parabolic	4'T8	E	MS	2	3	32	2	190	4	196	76	0	0	0
180	Livington HS	Janitor's Closet B138C	Parabolic	E	4'T8	2	3	32	MS	2	190	4	196	76	N/A	Parabolic	4'T8	E	MS	2	3	32	2	190	4	196	76	0	0	0
181	Livington HS	Bathroom Women	Parabolic	E	4'T8	3	3	32	MS	9	190	4	292	513	N/A	Parabolic	4'T8	E	MS	3	3	32	9	190	4	292	513	0	0	0
182	Livington HS	Bathroom Men	Parabolic	E	4'T8	3	3	32	MS	9	190	4	292	513	N/A	Parabolic	4'T8	E	MS	3	3	32	9	190	4	292	513	0	0	0
183	Livington HS	Janitor's Closet	Parabolic	E	4'T8	1	3	32	S	2	190	4	100	38	N/A	Parabolic	4'T8	E	S	1	3	32	2	190	4	100	38	0	0	0
184	Livington HS	Classroom B138	Parabolic	E	4'T5	32	6	32	S	9	190	1	6,145	10,561	N/A	Parabolic	4'T5	E	S	32	6	32	9	190	1	6,145	10,561	0	0	0
185	Livington HS	Classroom B138	Exit sign	None	LED Exit	2	2	5	N	9	190	1	21	38	N/A	Exit sign	LED Exit	None	N	2	2	5	9	190	1	21	38	0	0	0
186	Livington HS	Classroom B134	Exit sign	None	LED Exit	2	2	5	N	9	190	1	21	38	N/A	Exit sign	LED Exit	None	N	2	2	5	9	190	1	21	38	0	0	0
187	Livington HS	Classroom B134	Parabolic	E	4'T5	32	6	32	S	9	190	1	6,145	10,561	N/A	Parabolic	4'T5	E	S	32	6	32	9	190	1	6,145	10,561	0	0	0
188	Livington HS	Classroom B132	Parabolic	E	4'T8	16	2	32	S	9	190	3	1,027	1,833	N/A	Parabolic	4'T8	E	S	16	2	32	9	190	3	1,027	1,833	0	0	0
189	Livington HS	Classroom B136	Parabolic	E	4'T8	16	2	32	S	9	190	3	1,027	1,833	N/A	Parabolic	4'T8	E	S	16	2	32	9	190	3	1,027	1,833	0	0	0
190	Livington HS	Classroom B134A	Parabolic	E	4'T8	14	2	32	S	9	190	3	899	1,604	N/A	Parabolic	4'T8	E	S	14	2	32	9	190	3	899	1,604	0	0	0
191	**Livington HS**	**Classroom B130B**	**Screw**	**None**	**Inc**	**12**	**1**	**60**	**D**	**9**	**190**	**0**	**720**	**1,231**	**CFL**	**Screw**	**CFL**	**None**	**D**	**12**	**1**	**20**	**9**	**190**	**2**	**242**	**451**	**780**	**0**	**780**
192	Livington HS	Storage Rm B134B	Parabolic	E	4'T8	6	2	32	S	2	190	3	387	153	N/A	Parabolic	4'T8	E	S	6	2	32	2	190	3	387	153	0	0	0
193	Livington HS	Classroom B130A	Parabolic	E	4'T8	6	2	32	S	9	190	3	387	687	N/A	Parabolic	4'T8	E	S	6	2	32	9	190	3	387	687	0	0	0
194	Livington HS	Bathroom Women	Parabolic	E	4'T8	2	4	32	S	9	190	4	260	451	N/A	Parabolic	4'T8	E	S	2	4	32	9	190	4	260	451	0	0	0
195	Livington HS	Staircase C1	Parabolic	E	4'T8	9	2	32	S	16	190	3	579	1,833	N/A	Parabolic	4'T8	E	S	9	2	32	16	190	3	579	1,833	0	0	0
196	Livington HS	Staircase C1	Exit sign	None	LED Exit	2	2	5	N	24	365	1	21	193	N/A	Exit sign	LED Exit	None	N	2	2	5	24	365	1	21	193	0	0	0
197	Livington HS	Hallway C	Exit sign	None	LED Exit	2	2	5	N	24	365	1	21	193	N/A	Exit sign	LED Exit	None	N	2	2	5	24	365	1	21	193	0	0	0
198	Livington HS	Hallway C	Parabolic	E	4'T8	7	3	32	S	16	190	4	676	2,128	N/A	Parabolic	4'T8	E	S	7	3	32	16	190	4	676	2,128	0	0	0
199	Livington HS	Boiler Rm C	Parabolic	E	4'T8	2	2	32	S	3	190	3	131	76	N/A	Parabolic	4'T8	E	S	2	2	32	3	190	3	131	76	0	0	0

			Existing Fixture Information													Retrofit Information													Annual Savings			
#	Building	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)	
200	Livington HS	Boiler Rm C	Parabolic	E	4'T8	2	2	32	S	3	190	3	131	76	N/A	Parabolic	4'T8	E	S	2	2	32	3	190	3	131	76	0	0	0	
201	Livington HS	Boiler Rm C	Parabolic	E	2'T8	6	2	16	S	3	190	1	193	113	N/A	Parabolic	2'T8	E	S	6	2	16	3	190	1	193	113	0	0	0	
202	Livington HS	Boiler Rm C	Parabolic	E	4'T8	4	2	32	S	3	190	3	259	153	N/A	Parabolic	4'T8	E	S	4	2	32	3	190	3	259	153	0	0	0	
203	**Livington HS**	**Boiler Rm C**	**Screw**	**None**	**Inc**	**3**	**1**	**100**	**S**	**3**	**190**	**0**	**300**	**171**	**CFL**	**Screw**	**CFL**	**None**	**S**	**3**	**1**	**33.333**	**3**	**190**	**2**	**102**	**60**	**111**	**0**	**111**	
204	Livington HS	Janitor's Closet	Parabolic	E	4'T8	7	2	32	S	2	190	3	451	178	N/A	Parabolic	4'T8	E	S	7	2	32	2	190	3	451	178	0	0	0	
205	Livington HS	Garage	Parabolic	E	4'T8	2	2	32	S	14	190	3	131	356	N/A	Parabolic	4'T8	E	S	2	2	32	14	190	3	131	356	0	0	0	
206	**Livington HS**	**Bathroom Men**	**Parabolic**	**E**	**4'T8**	**3**	**2**	**32**	**S**	**9**	**190**	**3**	**195**	**344**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**3**	**2**	**32**	**6.75**	**190**	**3**	**195**	**258**	**0**	**86**	**86**	
207	Livington HS	Bathroom Women	Parabolic	E	4'T8	4	2	32	S	9	190	3	259	458	N/A	Parabolic	4'T8	E	S	4	2	32	9	190	3	259	458	0	0	0	
208	Livington HS	Bathroom Women	Parabolic	E	4'T8	2	2	32	S	9	190	3	131	229	N/A	Parabolic	4'T8	E	S	2	2	32	9	190	3	131	229	0	0	0	
209	Livington HS	Cafe EF	Parabolic	E	2'T8	33	2	16	S	14	190	1	1,057	2,897	N/A	Parabolic	2'T8	E	S	33	2	16	14	190	1	1,057	2,897	0	0	0	
210	Livington HS	Cafe EF	Screw	E	CFL	37	1	16	S	14	190	2	594	1,772	N/A	Screw	CFL	None	S	37	1	16	14	190	2	594	1,772	0	0	0	
211	Livington HS	Cafe EF	Exit sign	None	LED Exit	3	2	5	N	24	365	1	31	289	N/A	Exit sign	LED Exit	None	N	3	2	5	24	365	1	31	289	0	0	0	
212	Livington HS	Cafe CD & AB	Exit sign	None	LED Exit	5	2	5	N	24	365	1	51	482	N/A	Exit sign	LED Exit	None	N	5	2	5	24	365	1	51	482	0	0	0	
213	Livington HS	Cafe CD & AB	Parabolic	E	2'T8	111	2	16	S	14	190	1	3,553	9,744	N/A	Parabolic	2'T8	E	S	111	2	16	14	190	1	3,553	9,744	0	0	0	
214	Livington HS	Cafe CD & AB	Screw	E	CFL	102	1	31	S	14	190	2	3,164	8,954	N/A	Screw	CFL	None	S	102	1	31	14	190	2	3,164	8,954	0	0	0	
215	Livington HS	Kitchen	Parabolic	E	4'T8	41	2	32	S	14	190	3	2,627	7,307	N/A	Parabolic	4'T8	E	S	41	2	32	14	190	3	2,627	7,307	0	0	0	
216	Livington HS	Kitchen	Exit sign	None	LED Exit	6	2	5	N	24	365	1	61	578	N/A	Exit sign	LED Exit	None	N	6	2	5	24	365	1	61	578	0	0	0	
217	Livington HS	Kitchen locker	Parabolic	E	4'T8	1	2	32	S	9	190	3	67	115	N/A	Parabolic	4'T8	E	S	1	2	32	9	190	3	67	115	0	0	0	
218	Livington HS	Kitchen bath	Parabolic	E	2'T8	1	2	16	S	9	190	1	33	56	N/A	Parabolic	2'T8	E	S	1	2	16	9	190	1	33	56	0	0	0	
219	Livington HS	Kitchen entry	Parabolic	E	4'T8	1	1	32	S	14	190	3	35	93	N/A	Parabolic	4'T8	E	S	1	1	32	14	190	3	35	93	0	0	0	
220	Livington HS	Kitchen janitors closet	Parabolic	E	2'T8	1	2	16	S	2	190	1	33	13	N/A	Parabolic	2'T8	E	S	1	2	16	2	190	1	33	13	0	0	0	
221	Livington HS	Kitchen office	Parabolic	E	2'T8	4	2	16	S	9	190	1	129	226	N/A	Parabolic	2'T8	E	S	4	2	16	9	190	1	129	226	0	0	0	
222	Livington HS	Kitchen office	Parabolic	E	2'T8	2	2	16	S	9	190	1	65	113	N/A	Parabolic	2'T8	E	S	2	2	16	9	190	1	65	113	0	0	0	
223	Livington HS	Hallway	Recessed	E	4'T8	2	3	32	S	16	190	4	196	608	N/A	Recessed	4'T8	E	S	2	3	32	16	190	4	196	608	0	0	0	
224	Livington HS	Media Center	2'U-shape	E	T8 U	1	2	32	S	14	190	3	67	178	N/A	2'U-shape	T8 U	E	S	1	2	32	14	190	3	67	178	0	0	0	
225	Livington HS	Media Center	Parabolic	E	4'T8	197	2	32	S	12	190	3	12,611	30,094	N/A	Parabolic	4'T8	E	S	197	2	32	12	190	3	12,611	30,094	0	0	0	
226	Livington HS	Media Center	Exit sign	None	LED Exit	2	2	5	N	24	365	1	21	193	N/A	Exit sign	LED Exit	None	N	2	2	5	24	365	1	21	193	0	0	0	
227	Livington HS	server rm	Parabolic	E	4'T8	1	2	32	S	9	190	3	67	115	N/A	Parabolic	4'T8	E	S	1	2	32	9	190	3	67	115	0	0	0	
228	Livington HS	Media Center ref rm	Parabolic	E	4'T8	44	2	32	S	14	190	3	2,819	7,842	N/A	Parabolic	4'T8	E	S	44	2	32	14	190	3	2,819	7,842	0	0	0	
229	Livington HS	Hallway to Media	Parabolic	E	4'T8	2	2	32	S	16	190	3	131	407	N/A	Parabolic	4'T8	E	S	2	2	32	16	190	3	131	407	0	0	0	
230	Livington HS	Media A104B	Parabolic	E	4'T8	3	4	32	S	14	190	4	388	1,053	N/A	Parabolic	4'T8	E	S	3	4	32	14	190	4	388	1,053	0	0	0	
231	**Livington HS**	**Media office**	**Parabolic**	**E**	**4'T8**	**7**	**3**	**32**	**S**	**14**	**190**	**4**	**676**	**1,862**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**7**	**3**	**32**	**10.5**	**190**	**4**	**676**	**1,397**	**0**	**466**	**466**	
232	**Livington HS**	**Media office A104C**	**Parabolic**	**E**	**4'T8**	**2**	**3**	**32**	**S**	**14**	**190**	**4**	**196**	**532**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**2**	**3**	**32**	**10.5**	**190**	**4**	**196**	**399**	**0**	**133**	**133**	
233	**Livington HS**	**Media office A104D**	**Parabolic**	**E**	**4'T8**	**2**	**3**	**32**	**S**	**14**	**190**	**4**	**196**	**532**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**2**	**3**	**32**	**10.5**	**190**	**4**	**196**	**399**	**0**	**133**	**133**	
234	Livington HS	Media storage	Parabolic	E	4'T8	9	2	32	S	2	190	3	579	229	N/A	Parabolic	4'T8	E	S	9	2	32	2	190	3	579	229	0	0	0	
235	Livington HS	Media storage C157	Parabolic	E	4'T8	16	4	32	S	2	190	4	2,052	803	N/A	Parabolic	4'T8	E	S	16	4	32	2	190	4	2,052	803	0	0	0	
236	Livington HS	Media storage C159	Parabolic	E	4'T8	6	4	32	S	2	190	4	772	301	N/A	Parabolic	4'T8	E	S	6	4	32	2	190	4	772	301	0	0	0	
237	Livington HS	Storage Rm C155	Parabolic	E	4'T8	1	2	32	S	2	190	3	67	25	N/A	Parabolic	4'T8	E	S	1	2	32	2	190	3	67	25	0	0	0	
238	Livington HS	Janitor's Closet	Parabolic	E	2'T8	1	2	16	S	2	190	1	33	13	N/A	Parabolic	2'T8	E	S	1	2	16	2	190	1	33	13	0	0	0	
239	**Livington HS**	**Bathroom Men**	**Parabolic**	**E**	**4'T8**	**1**	**4**	**32**	**S**	**9**	**190**	**4**	**132**	**226**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**1**	**4**	**32**	**6.75**	**190**	**4**	**132**	**169**	**0**	**56**	**56**	
240	Livington HS	Bathroom Women	Parabolic	E	4'T8	1	4	32	S	9	190	4	132	226	N/A	Parabolic	4'T8	E	S	1	4	32	9	190	4	132	226	0	0	0	
241	Livington HS	Bathroom Women	Parabolic	E	4'T8	2	4	32	S	9	190	4	260	451	N/A	Parabolic	4'T8	E	S	2	4	32	9	190	4	260	451	0	0	0	
242	Livington HS	Hallway C	Parabolic	E	4'T8	3	3	32	S	16	190	4	292	912	N/A	Parabolic	4'T8	E	S	3	3	32	16	190	4	292	912	0	0	0	
243	Livington HS	Hallway C	Parabolic	E	4'T8	3	3	32	S	16	190	4	292	912	N/A	Parabolic	4'T8	E	S	3	3	32	16	190	4	292	912	0	0	0	
244	Livington HS	Staircase C	Parabolic	E	4'T8	3	2	32	S	16	190	3	195	611	N/A	Parabolic	4'T8	E	S	3	2	32	16	190	3	195	611	0	0	0	
245	Livington HS	Staircase C	Parabolic	E	4'T8	1	4	32	S	16	190	4	132	401	N/A	Parabolic	4'T8	E	S	1	4	32	16	190	4	132	401	0	0	0	
246	**Livington HS**	**Electrical rm**	**Screw**	**None**	**Inc**	**1**	**1**	**120**	**S**	**3**	**190**	**0**	**120**	**68**	**CFL**	**Screw**	**CFL**	**None**	**S**	**1**	**1**	**40**	**3**	**190**	**2**	**42**	**24**	**44**	**0**	**44**	
247	Livington HS	Dressing C160	Parabolic	E	4'T8	2	4	32	S	9	190	4	260	451	N/A	Parabolic	4'T8	E	S	2	4	32	9	190	4	260	451	0	0	0	
248	Livington HS	Dressing C159	Parabolic	E	4'T8	2	4	32	S	9	190	4	260	451	N/A	Parabolic	4'T8	E	S	2	4	32	9	190	4	260	451	0	0	0	
249	Livington HS	Dressing C159	Screw	E	CFL	2	2	32	S	9	190	2	130	226	N/A	Screw	CFL	None	S	2	2	32	9	190	2	130	226	0	0	0	

			Existing Fixture Information													Retrofit Information													Annual Savings		
#	Building	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)
250	Livington HS	Dressing C160	Screw	E	CFL	2	2	32	S	9	190	2	130	226	N/A	Screw	CFL	None	S	2	2	32	9	190	2	130	226	0	0	0
251	Livington HS	Dressing C160 toilet	Parabolic	E	2'T8	1	2	16	S	9	190	1	33	56	N/A	Parabolic	2'T8	E	S	1	2	16	9	190	1	33	56	0	0	0
252	Livington HS	Dressing C159 toilet	Parabolic	E	2'T8	1	2	16	S	9	190	1	33	56	N/A	Parabolic	2'T8	E	S	1	2	16	9	190	1	33	56	0	0	0
253	**Livington HS**	**Dressing C159 shower**	**Screw**	**None**	**Inc**	**1**	**1**	**120**	**S**	**9**	**190**	**0**	**120**	**205**	**CFL**	**Screw**	**CFL**	**None**	**S**	**1**	**1**	**40**	**9**	**190**	**2**	**42**	**72**	**133**	**0**	**133**
254	**Livington HS**	**Dressing C160 shower**	**Screw**	**None**	**Inc**	**1**	**1**	**120**	**S**	**9**	**190**	**0**	**120**	**205**	**CFL**	**Screw**	**CFL**	**None**	**S**	**1**	**1**	**40**	**9**	**190**	**2**	**42**	**72**	**133**	**0**	**133**
255	Livington HS	Electrical rm C151	Parabolic	E	4'T8	10	2	32	S	3	190	3	643	382	N/A	Parabolic	4'T8	E	S	10	2	32	3	190	3	643	382	0	0	0
256	Livington HS	Storage C151S	Parabolic	E	4'T8	4	2	32	S	2	190	3	259	102	N/A	Parabolic	4'T8	E	S	4	2	32	2	190	3	259	102	0	0	0
257	Livington HS	Backstage Area	Parabolic	E	4'T8	6	2	32	S	14	190	3	387	1,069	N/A	Parabolic	4'T8	E	S	6	2	32	14	190	3	387	1,069	0	0	0
258	Livington HS	Auditorium	Pin-based	E	CFL	42	4	32	S	10	190	2	5,378	10,374	N/A	Pin-based	CFL	E	S	42	4	32	10	190	2	5,378	10,374	0	0	0
259	Livington HS	Auditorium	Exit sign	None	LED Exit	8	2	5	N	24	365	1	81	771	N/A	Exit sign	LED Exit	None	N	8	2	5	24	365	1	81	771	0	0	0
260	**Livington HS**	**Auditorium**	**Screw**	**None**	**Inc**	**42**	**1**	**150**	**D**	**10**	**190**	**0**	**6,300**	**11,970**	**CFL**	**Screw**	**CFL**	**None**	**D**	**42**	**1**	**50**	**10**	**190**	**2**	**2,102**	**4,150**	**7,820**	**0**	**7,820**
261	Livington HS	Staircase	Parabolic	E	4'T8	2	2	32	S	16	190	3	131	407	N/A	Parabolic	4'T8	E	S	2	2	32	16	190	3	131	407	0	0	0
262	Livington HS	Staircase	Parabolic	E	4'T8	1	1	32	S	16	190	3	35	106	N/A	Parabolic	4'T8	E	S	1	1	32	16	190	3	35	106	0	0	0
263	Livington HS	Staircase	Exit sign	None	LED Exit	1	2	5	N	24	365	1	11	96	N/A	Exit sign	LED Exit	None	N	1	2	5	24	365	1	11	96	0	0	0
264	Livington HS	Hallway Music	Parabolic	E	4'T8	9	3	32	S	16	190	4	868	2,736	N/A	Parabolic	4'T8	E	S	9	3	32	16	190	4	868	2,736	0	0	0
265	Livington HS	Hallway Music	Exit sign	None	LED Exit	3	2	5	N	24	365	1	31	289	N/A	Exit sign	LED Exit	None	N	3	2	5	24	365	1	31	289	0	0	0
266	Livington HS	Janitor's Closet C156	Parabolic	E	4'T8	1	4	32	S	2	190	4	132	50	N/A	Parabolic	4'T8	E	S	1	4	32	2	190	4	132	50	0	0	0
267	Livington HS	Classroom C154	Parabolic	E	2'T8	44	2	16	S	9	190	1	1,409	2,483	N/A	Parabolic	2'T8	E	S	44	2	16	9	190	1	1,409	2,483	0	0	0
268	Livington HS	Classroom C154	Screw	E	CFL	24	1	16	S	9	190	2	386	739	N/A	Screw	CFL	None	S	24	1	16	9	190	2	386	739	0	0	0
269	Livington HS	Classroom C154	Exit sign	None	LED Exit	2	2	5	N	24	365	1	21	193	N/A	Exit sign	LED Exit	None	N	2	2	5	24	365	1	21	193	0	0	0
270	Livington HS	Office C154A	Parabolic	E	4'T8	2	3	32	MS	9	190	4	196	342	N/A	Parabolic	4'T8	E	MS	2	3	32	9	190	4	196	342	0	0	0
271	Livington HS	Classroom C154B	Parabolic	E	4'T8	6	3	32	MS	9	190	4	580	1,026	N/A	Parabolic	4'T8	E	MS	6	3	32	9	190	4	580	1,026	0	0	0
272	Livington HS	Storage Rm C154S	Parabolic	E	4'T8	5	3	32	MS	2	190	4	484	190	N/A	Parabolic	4'T8	E	MS	5	3	32	2	190	4	484	190	0	0	0
273	Livington HS	Classroom C152	Parabolic	E	2'T8	30	2	16	S	9	190	1	961	1,693	N/A	Parabolic	2'T8	E	S	30	2	16	9	190	1	961	1,693	0	0	0
274	Livington HS	Classroom C152	Screw	E	CFL	20	1	35	S	9	190	2	702	1,265	N/A	Screw	CFL	None	S	20	1	35	9	190	2	702	1,265	0	0	0
275	Livington HS	Storage Rm C152S	Parabolic	E	4'T8	4	3	32	S	2	190	4	388	152	N/A	Parabolic	4'T8	E	S	4	3	32	2	190	4	388	152	0	0	0
276	**Livington HS**	**Office C152A**	**Parabolic**	**E**	**4'T8**	**4**	**3**	**32**	**S**	**9**	**190**	**4**	**388**	**684**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**4**	**3**	**32**	**6.75**	**190**	**4**	**388**	**513**	**0**	**171**	**171**
277	Livington HS	Classroom C152	Exit sign	None	LED Exit	3	2	5	N	24	365	1	31	289	N/A	Exit sign	LED Exit	None	N	3	2	5	24	365	1	31	289	0	0	0
278	Livington HS	Classroom C152B	Parabolic	E	4'T8	2	2	32	S	9	190	3	131	229	N/A	Parabolic	4'T8	E	S	2	2	32	9	190	3	131	229	0	0	0
279	Livington HS	Classroom C150	Parabolic	E	4'T8	20	4	32	S	9	190	4	2,564	4,514	N/A	Parabolic	4'T8	E	S	20	4	32	9	190	4	2,564	4,514	0	0	0
280	**Livington HS**	**Office C150A**	**Parabolic**	**E**	**4'T8**	**2**	**4**	**32**	**S**	**9**	**190**	**4**	**260**	**451**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**2**	**4**	**32**	**6.75**	**190**	**4**	**260**	**339**	**0**	**113**	**113**
281	Livington HS	Classroom C150B	Parabolic	E	4'T8	4	2	32	S	9	190	3	259	458	N/A	Parabolic	4'T8	E	S	4	2	32	9	190	3	259	458	0	0	0
282	Livington HS	Classroom C150C	Parabolic	E	4'T8	4	2	32	S	9	190	3	259	458	N/A	Parabolic	4'T8	E	S	4	2	32	9	190	3	259	458	0	0	0
283	**Livington HS**	**Bathroom Men**	**Parabolic**	**E**	**2'T8**	**1**	**2**	**16**	**S**	**9**	**190**	**1**	**33**	**56**	**C**	**Parabolic**	**2'T8**	**E**	**OS**	**1**	**2**	**16**	**6.75**	**190**	**1**	**33**	**42**	**0**	**14**	**14**
284	Livington HS	Bathroom Women	Parabolic	E	2'T8	1	2	16	S	9	190	1	33	56	N/A	Parabolic	2'T8	E	S	1	2	16	9	190	1	33	56	0	0	0
285	Livington HS	Main Entrance	Screw	E	CFL	26	1	16	S	14	190	2	418	1,245	N/A	Screw	CFL	None	S	26	1	16	14	190	2	418	1,245	0	0	0
286	Livington HS	Main Entrance foyer	Screw	E	CFL	4	2	16	S	14	190	2	130	362	N/A	Screw	CFL	None	S	4	2	16	14	190	2	130	362	0	0	0
287	Livington HS	Main Entrance foyer	Screw	E	CFL	4	2	16	S	14	190	2	130	362	N/A	Screw	CFL	None	S	4	2	16	14	190	2	130	362	0	0	0
288	Livington HS	Main Entrance foyer	Screw	E	CFL	1	4	16	S	14	190	2	66	176	N/A	Screw	CFL	None	S	1	4	16	14	190	2	66	176	0	0	0
289	Livington HS	Foyer	Exit sign	None	LED Exit	2	2	5	N	24	365	1	21	193	N/A	Exit sign	LED Exit	None	N	2	2	5	24	365	1	21	193	0	0	0
290	Livington HS	Office A201A	Parabolic	E	4'T8	2	4	32	S	9	190	4	260	451	N/A	Parabolic	4'T8	E	S	2	4	32	9	190	4	260	451	0	0	0
291	Livington HS	Office A201B	Parabolic	E	4'T8	2	4	32	S	9	190	4	260	451	N/A	Parabolic	4'T8	E	S	2	4	32	9	190	4	260	451	0	0	0
292	Livington HS	Classroom A200	Parabolic	E	4'T8	16	3	32	S	9	190	4	1,540	2,736	N/A	Parabolic	4'T8	E	S	16	3	32	9	190	4	1,540	2,736	0	0	0
293	Livington HS	Bathroom Women	Parabolic	E	2'T8	1	2	16	S	9	190	1	33	56	N/A	Parabolic	2'T8	E	S	1	2	16	9	190	1	33	56	0	0	0
294	**Livington HS**	**Bathroom Men**	**Parabolic**	**E**	**2'T8**	**1**	**2**	**16**	**S**	**9**	**190**	**1**	**33**	**56**	**C**	**Parabolic**	**2'T8**	**E**	**OS**	**1**	**2**	**16**	**6.75**	**190**	**1**	**33**	**42**	**0**	**14**	**14**
295	Livington HS	Office C34	Parabolic	E	4'T8	2	3	32	S	9	190	4	196	342	N/A	Parabolic	4'T8	E	S	2	3	32	9	190	4	196	342	0	0	0
296	Livington HS	Office C36	Parabolic	E	4'T8	2	3	32	S	9	190	4	196	342	N/A	Parabolic	4'T8	E	S	2	3	32	9	190	4	196	342	0	0	0
297	**Livington HS**	**Office C37**	**Parabolic**	**E**	**4'T8**	**2**	**4**	**32**	**S**	**9**	**190**	**4**	**260**	**451**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**2**	**4**	**32**	**6.75**	**190**	**4**	**260**	**339**	**0**	**113**	**113**
298	**Livington HS**	**Office C38**	**Parabolic**	**E**	**4'T8**	**4**	**4**	**32**	**S**	**9**	**190**	**4**	**516**	**903**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**4**	**4**	**32**	**6.75**	**190**	**4**	**516**	**677**	**0**	**226**	**226**
299	Livington HS	Storage C35	Parabolic	E	4'T8	1	2	32	S	2	190	3	67	25	N/A	Parabolic	4'T8	E	S	1	2	32	2	190	3	67	25	0	0	0

			Existing Fixture Information												Retrofit Information												Annual Savings		
#	Building	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)
300	Livington HS	Hallway	Recessed	E	4'T8	7	3	32	S	16	190	4	676	2,128	N/A	Recessed	4'T8	E	S	7	3	32	16	190	4	676	2,128	0	0	0
301	Livington HS	Hallway	Exit sign	None	LED Exi	2	2	5	S	24	365	1	21	193	N/A	Exit sign	LED Exit	None	S	2	2	5	24	365	1	21	193	0	0	0
302	Livington HS	Hallway	Recessed	E	4'T8	3	4	32	S	16	190	4	388	1,204	N/A	Recessed	4'T8	E	S	3	4	32	16	190	4	388	1,204	0	0	0
303	Livington HS	Hallway	Exit sign	None	LED Exi	1	2	5	N	24	365	1	11	96	N/A	Exit sign	LED Exit	None	N	1	2	5	24	365	1	11	96	0	0	0
304	**Livington HS**	**Office C30**	**Parabolic**	**E**	**4'T8**	**3**	**4**	**32**	**S**	**9**	**190**	**4**	**388**	**677**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**3**	**4**	**32**	**6.75**	**190**	**4**	**388**	**508**	**0**	**169**	**169**
305	Livington HS	Kitchen C32	Parabolic	E	4'T8	2	4	32	S	14	190	4	260	702	N/A	Parabolic	4'T8	E	S	2	4	32	14	190	4	260	702	0	0	0
306	**Livington HS**	**Office C31**	**Parabolic**	**E**	**4'T8**	**4**	**4**	**32**	**S**	**9**	**190**	**4**	**516**	**903**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**4**	**4**	**32**	**6.75**	**190**	**4**	**516**	**677**	**0**	**226**	**226**
307	Livington HS	Office C33	Parabolic	E	4'T8	2	4	32	S	9	190	4	260	451	N/A	Parabolic	4'T8	E	S	2	4	32	9	190	4	260	451	0	0	0
308	Livington HS	Office A202	Parabolic	E	4'T8	6	4	32	S	9	190	4	772	1,354	N/A	Parabolic	4'T8	E	S	6	4	32	9	190	4	772	1,354	0	0	0
309	**Livington HS**	**Office A204**	**Parabolic**	**E**	**4'T8**	**20**	**4**	**32**	**S**	**9**	**190**	**4**	**2,564**	**4,514**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**20**	**4**	**32**	**6.75**	**190**	**4**	**2,564**	**3,386**	**0**	**1,129**	**1,129**
310	Livington HS	Hallway A	Exit sign	None	LED Exi	4	2	5	N	24	365	1	41	385	N/A	Exit sign	LED Exit	None	N	4	2	5	24	365	1	41	385	0	0	0
311	Livington HS	Storage Rm	Parabolic	E	4'T8	1	2	32	S	2	190	3	67	25	N/A	Parabolic	4'T8	E	S	1	2	32	2	190	3	67	25	0	0	0
312	Livington HS	Bathroom Women	Parabolic	E	4'T8	2	4	32	S	9	190	4	260	451	N/A	Parabolic	4'T8	E	S	2	4	32	9	190	4	260	451	0	0	0
313	Livington HS	Classroom A206	Parabolic	E	4'T8	9	3	32	S	9	190	4	868	1,539	N/A	Parabolic	4'T8	E	S	9	3	32	9	190	4	868	1,539	0	0	0
314	Livington HS	Classroom A208	Parabolic	E	4'T8	12	2	32	S	9	190	3	771	1,375	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	3	771	1,375	0	0	0
315	Livington HS	Hallway A	Parabolic	E	4'T8	50	3	32	S	16	190	4	4,804	15,200	N/A	Parabolic	4'T8	E	S	50	3	32	16	190	4	4,804	15,200	0	0	0
316	Livington HS	Mechanical Rm	Parabolic	E	4'T8	1	2	32	S	3	190	3	67	38	N/A	Parabolic	4'T8	E	S	1	2	32	3	190	3	67	38	0	0	0
317	Livington HS	Classroom A205	Parabolic	E	4'T8	17	3	32	S	9	190	4	1,636	2,907	N/A	Parabolic	4'T8	E	S	17	3	32	9	190	4	1,636	2,907	0	0	0
318	Livington HS	Classroom A207	Parabolic	E	4'T8	17	3	32	S	9	190	4	1,636	2,907	N/A	Parabolic	4'T8	E	S	17	3	32	9	190	4	1,636	2,907	0	0	0
319	Livington HS	Classroom A207	Parabolic	E	2'T8	2	2	16	S	9	190	1	65	113	N/A	Parabolic	2'T8	E	S	2	2	16	9	190	1	65	113	0	0	0
320	Livington HS	Classroom A207 kiln	2'U-shape	E	T8 U	2	2	32	S	3	50	3	131	20	N/A	2'U-shape	T8 U	E	S	2	2	32	3	50	3	131	20	0	0	0
321	Livington HS	Classroom A207 kiln	Parabolic	E	4'T8	1	4	32	S	3	50	4	132	20	N/A	Parabolic	4'T8	E	S	1	4	32	3	50	4	132	20	0	0	0
322	Livington HS	Office A207A	Parabolic	E	4'T8	2	3	32	S	9	190	4	196	342	N/A	Parabolic	4'T8	E	S	2	3	32	9	190	4	196	342	0	0	0
323	Livington HS	Storage Rm A207B	Parabolic	E	4'T8	2	4	32	S	2	190	4	260	100	N/A	Parabolic	4'T8	E	S	2	4	32	2	190	4	260	100	0	0	0
324	Livington HS	Storage Rm A205A	Parabolic	E	4'T8	1	3	32	S	2	190	4	100	38	N/A	Parabolic	4'T8	E	S	1	3	32	2	190	4	100	38	0	0	0
325	Livington HS	Classroom A210	Parabolic	E	4'T8	12	2	32	S	9	190	3	771	1,375	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	3	771	1,375	0	0	0
326	Livington HS	Workroom A209	Parabolic	E	4'T8	2	4	32	S	9	190	4	260	451	N/A	Parabolic	4'T8	E	S	2	4	32	9	190	4	260	451	0	0	0
327	Livington HS	Classroom A211	Parabolic	E	4'T8	22	3	32	S	9	190	4	2,116	3,762	N/A	Parabolic	4'T8	E	S	22	3	32	9	190	4	2,116	3,762	0	0	0
328	Livington HS	Classroom A211 storage	Parabolic	E	4'T8	2	2	32	S	2	190	3	131	51	N/A	Parabolic	4'T8	E	S	2	2	32	2	190	3	131	51	0	0	0
329	Livington HS	Office A211	Parabolic	E	4'T8	2	2	32	S	9	190	3	131	229	N/A	Parabolic	4'T8	E	S	2	2	32	9	190	3	131	229	0	0	0
330	Livington HS	Classroom A213	Parabolic	E	4'T8	17	3	32	S	9	190	4	1,636	2,907	N/A	Parabolic	4'T8	E	S	17	3	32	9	190	4	1,636	2,907	0	0	0
331	Livington HS	Classroom A212	Parabolic	E	4'T8	12	2	32	S	9	190	3	771	1,375	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	3	771	1,375	0	0	0
332	**Livington HS**	**Bathroom Men**	**Parabolic**	**E**	**4'T8**	**2**	**2**	**32**	**S**	**9**	**190**	**3**	**131**	**229**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**2**	**2**	**32**	**6.75**	**190**	**3**	**131**	**172**	**0**	**57**	**57**
333	Livington HS	Classroom A215	Parabolic	E	4'T8	9	2	32	S	9	190	3	579	1,031	N/A	Parabolic	4'T8	E	S	9	2	32	9	190	3	579	1,031	0	0	0
334	Livington HS	Classroom A214	Parabolic	E	4'T8	12	2	32	S	9	190	3	771	1,375	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	3	771	1,375	0	0	0
335	Livington HS	Classroom A217	Parabolic	E	4'T8	9	3	32	S	9	190	4	868	1,539	N/A	Parabolic	4'T8	E	S	9	3	32	9	190	4	868	1,539	0	0	0
336	Livington HS	Hallway	Recessed	E	4'T8	3	3	32	S	16	190	4	292	912	N/A	Recessed	4'T8	E	S	3	3	32	16	190	4	292	912	0	0	0
337	Livington HS	Classroom A219	Parabolic	E	4'T8	6	2	32	S	9	190	3	387	687	N/A	Parabolic	4'T8	E	S	6	2	32	9	190	3	387	687	0	0	0
338	Livington HS	Classroom A216	Parabolic	E	4'T8	6	2	32	S	9	190	3	387	687	N/A	Parabolic	4'T8	E	S	6	2	32	9	190	3	387	687	0	0	0
339	Livington HS	Classroom A221	Parabolic	E	4'T8	15	2	32	S	9	190	3	963	1,719	N/A	Parabolic	4'T8	E	S	15	2	32	9	190	3	963	1,719	0	0	0
340	Livington HS	Classroom A223	Parabolic	E	4'T8	15	2	32	S	9	190	3	963	1,719	N/A	Parabolic	4'T8	E	S	15	2	32	9	190	3	963	1,719	0	0	0
341	Livington HS	Classroom A225	Parabolic	E	4'T8	15	2	32	S	9	190	3	963	1,719	N/A	Parabolic	4'T8	E	S	15	2	32	9	190	3	963	1,719	0	0	0
342	Livington HS	Classroom A218	Parabolic	E	4'T8	12	2	32	S	9	190	3	771	1,375	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	3	771	1,375	0	0	0
343	Livington HS	Classroom A227	Parabolic	E	4'T8	12	2	32	S	9	190	3	771	1,375	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	3	771	1,375	0	0	0
344	Livington HS	Classroom A220	Parabolic	E	4'T8	12	2	32	S	9	190	3	771	1,375	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	3	771	1,375	0	0	0
345	Livington HS	Classroom A229	Parabolic	E	4'T8	12	2	32	S	9	190	3	771	1,375	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	3	771	1,375	0	0	0
346	Livington HS	Bathroom Women	Parabolic	E	4'T8	5	2	32	S	9	190	3	323	573	N/A	Parabolic	4'T8	E	S	5	2	32	9	190	3	323	573	0	0	0
347	**Livington HS**	**Bathroom Men**	**Parabolic**	**E**	**4'T8**	**2**	**1**	**32**	**S**	**9**	**190**	**3**	**67**	**120**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**2**	**1**	**32**	**6.75**	**190**	**3**	**67**	**90**	**0**	**30**	**30**
348	**Livington HS**	**Bathroom**	**Parabolic**	**E**	**4'T8**	**2**	**1**	**32**	**S**	**9**	**190**	**3**	**67**	**120**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**2**	**1**	**32**	**6.75**	**190**	**3**	**67**	**90**	**0**	**30**	**30**
349	Livington HS	Office E281	Parabolic	E	4'T8	4	2	32	S	9	190	3	259	458	N/A	Parabolic	4'T8	E	S	4	2	32	9	190	3	259	458	0	0	0

			Existing Fixture Information												Retrofit Information												Annual Savings		
#	Building	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)
350	Livington HS	Classroom E282	Parabolic	E	4'T8	15	2	32	S	9	190	3	963	1,719	N/A	Parabolic	4'T8	E	S	15	2	32	9	190	3	963	1,719	0	0	0
351	Livington HS	Classroom E284	Parabolic	E	4'T8	15	2	32	S	12	190	3	963	2,291	N/A	Parabolic	4'T8	E	S	15	2	32	12	190	3	963	2,291	0	0	0
352	Livington HS	Classroom E285	Parabolic	E	4'T8	9	4	32	S	12	190	4	1,156	2,709	N/A	Parabolic	4'T8	E	S	9	4	32	12	190	4	1,156	2,709	0	0	0
353	Livington HS	Classroom E287	Parabolic	E	4'T8	8	3	32	S	12	190	4	772	1,824	N/A	Parabolic	4'T8	E	S	8	3	32	12	190	4	772	1,824	0	0	0
354	Livington HS	Classroom E286	Parabolic	E	4'T8	15	3	32	S	12	190	4	1,444	3,420	N/A	Parabolic	4'T8	E	S	15	3	32	12	190	4	1,444	3,420	0	0	0
355	Livington HS	Janitor's Closet E2	Parabolic	E	4'T8	2	1	32	S	2	190	3	67	27	N/A	Parabolic	4'T8	E	S	2	1	32	2	190	3	67	27	0	0	0
356	Livington HS	Storage Rm E283	Parabolic	E	4'T8	6	2	32	S	2	190	3	387	153	N/A	Parabolic	4'T8	E	S	6	2	32	2	190	3	387	153	0	0	0
357	Livington HS	Bathroom Men	Parabolic	E	4'T8	5	2	32	S	9	190	3	323	573	N/A	Parabolic	4'T8	E	S	5	2	32	9	190	3	323	573	0	0	0
358	Livington HS	Hallway	Recessed	E	4'T8	34	3	32	S	16	190	4	3,268	10,336	N/A	Recessed	4'T8	E	S	34	3	32	16	190	4	3,268	10,336	0	0	0
359	Livington HS	Hallway	Exit sign	None	LED Exit	4	2	5	N	24	365	1	41	385	N/A	Exit sign	LED Exit	None	N	4	2	5	24	365	1	41	385	0	0	0
360	Livington HS	Classroom B238	Parabolic	E	4'T8	24	4	32	S	9	190	4	3,076	5,417	N/A	Parabolic	4'T8	E	S	24	4	32	9	190	4	3,076	5,417	0	0	0
361	Livington HS	Classroom B247	Parabolic	E	4'T8	12	3	32	S	9	190	4	1,156	2,052	N/A	Parabolic	4'T8	E	S	12	3	32	9	190	4	1,156	2,052	0	0	0
362	Livington HS	Classroom B245	Parabolic	E	4'T8	9	4	32	S	9	190	4	1,156	2,031	N/A	Parabolic	4'T8	E	S	9	4	32	9	190	4	1,156	2,031	0	0	0
363	Livington HS	Classroom B234	Parabolic	E	4'T8	21	2	32	S	9	190	3	1,347	2,406	N/A	Parabolic	4'T8	E	S	21	2	32	9	190	3	1,347	2,406	0	0	0
364	Livington HS	Storage Rm B234A	Parabolic	E	4'T8	1	2	32	S	2	190	3	67	25	N/A	Parabolic	4'T8	E	S	1	2	32	2	190	3	67	25	0	0	0
365	Livington HS	Office	Parabolic	E	4'T8	1	2	32	S	9	190	3	67	115	N/A	Parabolic	4'T8	E	S	1	2	32	9	190	3	67	115	0	0	0
366	**Livington HS**	**Office B243**	**Parabolic**	**E**	**4'T8**	**3**	**4**	**32**	**S**	**9**	**190**	**4**	**388**	**677**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**3**	**4**	**32**	**6.75**	**190**	**4**	**388**	**508**	**0**	**169**	**169**
367	Livington HS	Storage rm B241	Parabolic	E	4'T8	7	2	32	S	2	190	3	451	178	N/A	Parabolic	4'T8	E	S	7	2	32	2	190	3	451	178	0	0	0
368	Livington HS	Office B234	Parabolic	E	4'T8	2	2	32	S	9	190	3	131	229	N/A	Parabolic	4'T8	E	S	2	2	32	9	190	3	131	229	0	0	0
369	Livington HS	Hallway	Recessed	E	4'T8	17	3	32	S	16	190	4	1,636	5,168	N/A	Recessed	4'T8	E	S	17	3	32	16	190	4	1,636	5,168	0	0	0
370	Livington HS	Hallway	Exit sign	None	LED Exit	2	2	5	N	24	365	1	21	193	N/A	Exit sign	LED Exit	None	N	2	2	5	24	365	1	21	193	0	0	0
371	Livington HS	Classroom D265	Parabolic	E	4'T8	12	2	32	S	9	190	3	771	1,375	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	3	771	1,375	0	0	0
372	Livington HS	Classroom D264	Parabolic	E	4'T8	12	2	32	S	9	190	3	771	1,375	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	3	771	1,375	0	0	0
373	Livington HS	Classroom D263	Parabolic	E	4'T8	12	2	32	S	9	190	3	771	1,375	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	3	771	1,375	0	0	0
374	Livington HS	Classroom D262	Parabolic	E	4'T8	12	2	32	S	9	190	3	771	1,375	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	3	771	1,375	0	0	0
375	Livington HS	Classroom D261	Parabolic	E	4'T8	12	2	32	S	9	190	3	771	1,375	N/A	Parabolic	4'T8	E	S	12	2	32	9	190	3	771	1,375	0	0	0
376	Livington HS	Janitor's Closet D2	Parabolic	E	2'T8	2	2	16	S	2	190	1	65	25	N/A	Parabolic	2'T8	E	S	2	2	16	2	190	1	65	25	0	0	0
377	Livington HS	Classroom B239	Parabolic	E	4'T8	9	3	32	S	9	190	4	868	1,539	N/A	Parabolic	4'T8	E	S	9	3	32	9	190	4	868	1,539	0	0	0
378	**Livington HS**	**Bathroom Men**	**Parabolic**	**E**	**4'T8**	**2**	**3**	**32**	**S**	**9**	**190**	**4**	**196**	**342**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**2**	**3**	**32**	**6.75**	**190**	**4**	**196**	**257**	**0**	**86**	**86**
379	Livington HS	Janitor's Closet	Parabolic	E	2'T8	1	2	16	S	2	190	1	33	13	N/A	Parabolic	2'T8	E	S	1	2	16	2	190	1	33	13	0	0	0
380	Livington HS	Classroom B232	Parabolic	E	2'T8	1	2	16	S	9	190	1	33	56	N/A	Parabolic	2'T8	E	S	1	2	16	9	190	1	33	56	0	0	0
381	Livington HS	Classroom B232	Parabolic	E	4'T8	3	2	32	S	9	190	3	195	344	N/A	Parabolic	4'T8	E	S	3	2	32	9	190	3	195	344	0	0	0
382	Livington HS	Classroom B232 Bath	Parabolic	E	4'T8	1	2	32	S	9	190	3	67	115	N/A	Parabolic	4'T8	E	S	1	2	32	9	190	3	67	115	0	0	0
383	Livington HS	Storage Rm B232A	Parabolic	E	4'T8	1	2	32	S	2	190	3	67	25	N/A	Parabolic	4'T8	E	S	1	2	32	2	190	3	67	25	0	0	0
384	Livington HS	Classroom B237	Parabolic	E	4'T8	9	4	32	S	9	190	4	1,156	2,031	N/A	Parabolic	4'T8	E	S	9	4	32	9	190	4	1,156	2,031	0	0	0
385	Livington HS	Classroom B235	Parabolic	E	4'T8	9	4	32	S	9	190	4	1,156	2,031	N/A	Parabolic	4'T8	E	S	9	4	32	9	190	4	1,156	2,031	0	0	0
386	Livington HS	Classroom B233	Parabolic	E	4'T8	9	4	32	S	9	190	4	1,156	2,031	N/A	Parabolic	4'T8	E	S	9	4	32	9	190	4	1,156	2,031	0	0	0
387	Livington HS	Classroom B231	Parabolic	E	4'T8	10	4	32	S	9	190	4	1,284	2,257	N/A	Parabolic	4'T8	E	S	10	4	32	9	190	4	1,284	2,257	0	0	0
388	Livington HS	Janitor's Closet B230A	Parabolic	E	2'T8	1	2	16	S	2	190	1	33	13	N/A	Parabolic	2'T8	E	S	1	2	16	2	190	1	33	13	0	0	0
389	Livington HS	Office B230	Parabolic	E	2'T8	1	2	16	S	9	190	1	33	56	N/A	Parabolic	2'T8	E	S	1	2	16	9	190	1	33	56	0	0	0
390	Livington HS	Office B230	Parabolic	E	4'T8	6	2	32	S	9	190	3	387	687	N/A	Parabolic	4'T8	E	S	6	2	32	9	190	3	387	687	0	0	0
391	Livington HS	Office B230 bath	Parabolic	E	4'T8	1	2	32	S	9	190	3	67	115	N/A	Parabolic	4'T8	E	S	1	2	32	9	190	3	67	115	0	0	0
392	Livington HS	Bathroom Women	Parabolic	E	4'T8	3	4	32	S	9	190	4	388	677	N/A	Parabolic	4'T8	E	S	3	4	32	9	190	4	388	677	0	0	0
393	Livington HS	Hallway	Parabolic	E	4'T8	18	3	32	S	16	190	4	1,732	5,472	N/A	Parabolic	4'T8	E	S	18	3	32	16	190	4	1,732	5,472	0	0	0
394	Livington HS	Hallway	Exit sign	None	LED Exit	3	2	5	N	24	365	1	31	289	N/A	Exit sign	LED Exit	None	N	3	2	5	24	365	1	31	289	0	0	0
395	Livington HS	Hallway	Exit sign	None	LED Exit	2	2	5	N	24	365	1	21	193	N/A	Exit sign	LED Exit	None	N	2	2	5	24	365	1	21	193	0	0	0
396	Livington HS	Hallway	Parabolic	E	4'T8	17	3	32	S	16	190	4	1,636	5,168	N/A	Parabolic	4'T8	E	S	17	3	32	16	190	4	1,636	5,168	0	0	0
397	Livington HS	Classroom Control rm	Parabolic	E	4'T8	8	2	32	S	2	190	3	515	204	N/A	Parabolic	4'T8	E	S	8	2	32	2	190	3	515	204	0	0	0
398	Livington HS	Classroom C254	Parabolic	E	4'T8	18	3	32	S	9	190	4	1,732	3,078	N/A	Parabolic	4'T8	E	S	18	3	32	9	190	4	1,732	3,078	0	0	0
399	Livington HS	TV Studio	Parabolic	E	4'T8	14	2	32	S	12	190	3	899	2,139	N/A	Parabolic	4'T8	E	S	14	2	32	12	190	3	899	2,139	0	0	0

	Open Form		Existing Fixture Information													Retrofit Information												Annual Savings		
#	Building	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)
400	Livington HS	Classroom C256A	Parabolic	E	4'T8	3	4	32	S	9	190	4	388	677	N/A	Parabolic	4'T8	E	S	3	4	32	9	190	4	388	677	0	0	0
401	Livington HS	Classroom C256A	Parabolic	E	2'T8	2	2	16	S	9	190	1	65	113	N/A	Parabolic	2'T8	E	S	2	2	16	9	190	1	65	113	0	0	0
402	**Livington HS**	**Edit rms A**	**Screw**	**None**	**Inc**	**2**	**1**	**65**	**D**	**9**	**190**	**0**	**130**	**222**	**CFL**	**Screw**	**CFL**	**None**	**D**	**2**	**1**	**21.667**	**9**	**190**	**2**	**45**	**81**	**141**	**0**	**141**
403	**Livington HS**	**Edit rms B**	**Screw**	**None**	**Inc**	**2**	**1**	**65**	**D**	**9**	**190**	**0**	**130**	**222**	**CFL**	**Screw**	**CFL**	**None**	**D**	**2**	**1**	**21.667**	**9**	**190**	**2**	**45**	**81**	**141**	**0**	**141**
404	**Livington HS**	**Edit rms C**	**Screw**	**None**	**Inc**	**2**	**1**	**65**	**D**	**9**	**190**	**0**	**130**	**222**	**CFL**	**Screw**	**CFL**	**None**	**D**	**2**	**1**	**21.667**	**9**	**190**	**2**	**45**	**81**	**141**	**0**	**141**
405	**Livington HS**	**Edit rms H**	**Screw**	**None**	**Inc**	**2**	**1**	**65**	**D**	**9**	**190**	**0**	**130**	**222**	**CFL**	**Screw**	**CFL**	**None**	**D**	**2**	**1**	**21.667**	**9**	**190**	**2**	**45**	**81**	**141**	**0**	**141**
406	**Livington HS**	**Classroom C256A**	**Screw**	**None**	**Inc**	**4**	**1**	**65**	**D**	**9**	**190**	**0**	**260**	**445**	**CFL**	**Screw**	**CFL**	**None**	**D**	**4**	**1**	**21.667**	**9**	**190**	**2**	**89**	**162**	**283**	**0**	**283**
407	Livington HS	Classroom C253	Parabolic	E	4'T8	10	3	32	S	9	190	4	964	1,710	N/A	Parabolic	4'T8	E	S	10	3	32	9	190	4	964	1,710	0	0	0
408	Livington HS	Classroom C252	Parabolic	E	4'T8	12	4	32	S	9	190	4	1,540	2,709	N/A	Parabolic	4'T8	E	S	12	4	32	9	190	4	1,540	2,709	0	0	0
409	Livington HS	Classroom C251	Parabolic	E	4'T8	20	2	32	S	9	190	3	1,283	2,291	N/A	Parabolic	4'T8	E	S	20	2	32	9	190	3	1,283	2,291	0	0	0
410	Livington HS	Classroom C251	Parabolic	E	4'T8	22	4	32	S	9	190	4	2,820	4,966	N/A	Parabolic	4'T8	E	S	22	4	32	9	190	4	2,820	4,966	0	0	0
411	Livington HS	Classroom C250	Parabolic	E	4'T8	16	4	32	S	9	190	4	2,052	3,612	N/A	Parabolic	4'T8	E	S	16	4	32	9	190	4	2,052	3,612	0	0	0
412	Livington HS	Storage Rm	Parabolic	E	4'T8	1	4	32	S	2	190	4	132	50	N/A	Parabolic	4'T8	E	S	1	4	32	2	190	4	132	50	0	0	0
413	Livington HS	Storage Rm	Parabolic	E	4'T8	1	2	32	S	2	190	3	67	25	N/A	Parabolic	4'T8	E	S	1	2	32	2	190	3	67	25	0	0	0
414	Livington HS	Janitor's Closet	Parabolic	E	2'T8	1	2	16	S	2	190	1	33	13	N/A	Parabolic	2'T8	E	S	1	2	16	2	190	1	33	13	0	0	0
415	Livington HS	Main office principals	Parabolic	E	4'T8	4	4	32	S	9	190	4	516	903	N/A	Parabolic	4'T8	E	S	4	4	32	9	190	4	516	903	0	0	0
416	Livington HS	Office E181	Parabolic	E	4'T8	3	1	32	S	9	190	3	99	180	N/A	Parabolic	4'T8	E	S	3	1	32	9	190	3	99	180	0	0	0
417	Livington HS	Exterior	Exterior	None	MH	2	1	250	T	12	365	4	504	2,225	NA	Exterior	MH	None	T	2	1	250	12	365	4	504	2,225	0	0	0
419	Livington HS	Exterior Sprinkler rm	Parabolic	E	4'T8	2	2	32	S	3	365	3	131	147	N/A	Parabolic	4'T8	E	S	2	2	32	3	365	3	131	147	0	0	0
420	Livington HS	Exterior Electrical rm	Parabolic	E	4'T8	2	2	32	S	3	365	3	131	147	N/A	Parabolic	4'T8	E	S	2	2	32	3	365	3	131	147	0	0	0
421	Livington HS	Exterior	Parabolic	E	HPS	36	1	250	T	12	365	9	9,009	40,839	T8	Parabolic	HPS	E	T	36	1	250	12	365	9	9,009	40,839	0	0	0
422	**Livington HS**	**Exterior**	**Screw**	**E**	**Inc**	**17**	**1**	**10**	**T**	**12**	**365**	**0**	**170**	**745**	**CFL**	**Screw**	**CFL**	**None**	**T**	**17**	**1**	**3.3333**	**12**	**365**	**0**	**57**	**248**	**496**	**0**	**496**
423	**Livington HS**	**Exterior**	**Screw**	**E**	**Inc**	**3**	**1**	**75**	**T**	**12**	**365**	**0**	**225**	**986**	**CFL**	**Screw**	**CFL**	**None**	**T**	**3**	**1**	**25**	**12**	**365**	**0**	**75**	**329**	**657**	**0**	**657**
424	Livington HS	Exterior	Parabolic	E	HPS	22	1	259	T	12	365	50	5,748	29,775	T8	Parabolic	HPS	E	T	22	1	259	12	365	50	5,748	29,775	0	0	0
425	Livington HS	Exterior	Parabolic	E	MH	16	1	150	T	12	365	40	2,440	13,315	T8	Parabolic	MH	E	T	16	1	150	12	365	40	2,440	13,315	0	0	0
426	**Livington HS**	**Exterior**	**Screw**	**E**	**Inc**	**1**	**1**	**70**	**T**	**12**	**365**	**0**	**70**	**307**	**CFL**	**Screw**	**CFL**	**None**	**T**	**1**	**1**	**23.333**	**12**	**365**	**0**	**23**	**102**	**204**	**0**	**204**
427	**Livington HS**	**Exterior**	**Screw**	**E**	**Inc**	**3**	**1**	**100**	**T**	**12**	**365**	**0**	**300**	**1,314**	**CFL**	**Screw**	**CFL**	**E**	**T**	**3**	**1**	**33.333**	**12**	**365**	**0**	**100**	**438**	**876**	**0**	**876**
						3,284	**1,032**	12,356				**1,259**	**252,391**	**520,845**						**3,320**	**1,035**					**252,128**	**537,347**	**19,578**	**4,759**	**24,337**

Note: Bolded items in yellow represent fixtures with proposed improvements

Total Building Floor Area (SF)	213,716
Total Interior Existing Annual Consumption (kWh)	518,326
Total Interior Proposed Annual Consumption (kWh)	493,989
Total Existing Interior Lighting Power(Watts)	251,625
Total Existing Interior Lighting Power Density (Watts/SF)	1.18
Total Proposed Interior Lighting Power(Watts)	242,353
Total Proposed Interior Power Density (Watts/SF)	1.13
Total Exterior Existing Annual Consumption (kWh)	89,799
Total Exterior Proposed Annual Consumption (kWh)	87,565
Total Existing Exterior Lighting Power(Watts)	18,728
Total Proposed Exterior Lighting Power(Watts)	18,218
Estimated Cost of Fixture Replacements ($)	$17,520
Estimated Cost of Controls Improvements ($)	$4,400
Proposed Annual Savings (kWh)	24,337
Proposed Annual Cost Savings ($)	$3,936

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