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*April 14, 2010*

**Local Government Energy Program**
**Energy Audit Final Report**

***Mullica Township Elementary & Middle School***
***Elmwood, NJ***

***Project Number: LGEA44***


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## INTRODUCTION

On December 21 & 22, 2009 Steven Winter Associates, Inc. (SWA) performed an energy audit and assessment for the Mullica Township School buildings. The audit included a review of the:

- Mullica Elementary & Middle School
- Mullica Hilda Frame School

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

This report addresses the Mullica Elementary & Middle School located at 500 Elmwood Road, Elmwood, NJ. 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 Mullica Elementary & Middle School was originally built in 1925 with several additions / renovations performed in 1953, 1964, 1965, 1967, 1971, 1983, 1993, 1999 and 2005. The building consists of 128,789 square feet of conditioned space and houses classrooms, a gymnasium, an auditorium, utility rooms and on the second floor administrative offices. The schools' current enrollment is 880 students with 121 teachers & staff. From September through June school is in session from 8:30 am to 3:30 pm, and a latchkey afterschool program utilizes the building from 3:30 pm through 6:00 pm for approx. 20 students. In the summer the facility performs the annual maintenance and upgrades are performed.

The goal of this Local Government Energy Audit (LGEA) is to provide sufficient information to the Mullica Board of Education to make decisions regarding the implementation of the most appropriate and most cost effective energy conservation measures for the Mullica Elementary & Middle School.

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. For projects awarded on or prior to December 31, 2009, 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 Mullica Elementary & Middle School located at 500 Elmwood Road, Elmwood, NJ. The Mullica Elementary & Middle School is a two-story building with a floor area of 128,789 square feet. The original structure was built in 1925, with several major additions and renovations.

Based on the field visits performed by the SWA staff on December 21 & 22, 2009 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 October 2008 to September 2009 the Mullica Elementary & Middle School consumed 790,224 kWh or $116,874 worth of electricity at an approximate rate of $0.148/kWh and 34,300 therms or $55,910 worth of natural gas at an approximate rate of $1.523/therm. The joint energy consumption for the building, including both electricity and natural gas, was 6,367 MMBtu of energy that cost a total of $172,784.

SWA has entered energy information about the Mullica Elementary & Middle School building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. This school facility received an energy performance rating of 88, and is therefore eligible to receive an Energy Star certificate / plaque for recognition of achieving this high energy rating. With such a high performance rating, SWA encourages the Mullica Board of Education to seek LEED certification for the building as well.

The Site Energy Use Intensity is 50 kBtu/$ft^2$/yr compared to the national average of school buildings consuming 78 kBtu/$ft^2$/yr. Implementing this report's recommendations will reduce use by approximately 3.1 kBtu/$ft^2$/yr, to further reduce the schools energy usage. As of April 2009, Mullica Board of Education district joined the Alliance for Competitive Energy Services (ACES) which solicits bids for electric generation services at a reduced price. As a result, the Mullica Elementary & Middle School is charged for electric supply through a third party supplier, South Jersey Energy, with Atlantic City Electric charging only the transport rate for electric service.

Based on the assessment of the Mullica Elementary & Middle School, 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

- Select NEMA Premium motors when replacing motors at the end of their useful operating lives
- An upgraded Windows-based Building Management System to replace current Siemen's DOS system – approximately $18,000 investment
- Install reflective window blinds which can save up to 20% heating and 50% cooling thermal losses through windows for approx $3.5/sqft however payback is in excess of 15 years

**Category II Recommendations: Operations and Maintenance**

- Thoroughly and evenly insulate space (with batt insulation) above the ceiling tiles
- Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly
- Maintain downspouts - Repair / install missing downspouts as needed
- Provide weather stripping / air sealing
- Repair / seal wall cracks and penetrations
- Provide water efficient fixtures and controls
- Use Energy Star labeled appliances
- Use smart power electric strips
- Create an energy educational program

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

At this time, SWA highly recommends a total of **4** Energy Conservation Measures (ECMs) for the Mullica Elementary & Middle School are summarized in the following Table 1. The total investment cost for these ECMs with incentives is **$7,523**. SWA estimates a first year savings of **$7,574** with a simple payback of **1.0 years**. SWA estimates that implementing the highly recommended ECMs will reduce the carbon footprint of the Mullica Elementary & Middle School by **70,333 lbs of $CO_2$**, which is equivalent to removing approximately 6 cars from the roads each year or avoiding the need of 171 trees to absorb the annual $CO_2$ generated. SWA also recommends **1** ECM with a total first year savings of **$44,132** that is summarized in Table 2, and **3** ECMs with a payback in excess of 15 years, as listed in Table 3.

There are various incentives that the Mullica Board of Education could apply for that could also help lower the cost of installing the ECMs, such as 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, could also assist to cover 80% of the capital investment, and because Mullica Board of Education is a local public school, they are exempt from the requirement of having a peak demand less than 200 kW over the past 12 months.

Renewable ECMs require application approval and negotiations with the utility and proof of performance. There is also a utility-sponsored loan program through Atlantic City Electric that would allow the building to pay for the installation of the PV system through a loan issued by the utility.

The following tables summarize the proposed Energy conservation Measures (ECMs) and their economic relevance. In order to clearly present the overall energy opportunities for the building and ease the decision and choice of which ECM to implement, SWA calculated each ECM independently and did not incorporate slight / potential overlaps between some of the summarized ECMs (i.e. lighting change influence on heating / cooling).

| 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, $ | est. energy & operating 1st year cost savings, $ | life of measure, yrs | est. lifetime cost savings, $ | simple payback, yrs | lifetime return on investment, % | annual return on investment, % | internal rate of return, % | net present value, $ | CO2 reduced, lbs/yr |
| 1 | Install boiler automatic flue dampers on two boilers | Published Case Studies | 1600 | none at this time | 1,600 | 0 | 0.0 | 1,800 | 1.4 | 0 | 2,741 | 12 | 32,897 | 0.6 | 1956% | 163% | 171% | 25,365 | 21,060 |
| 2 | Replace electric heater & tank with 70 MBH, State, SandBlaster M# SDV75 70NE, 75 Gal storage | similar projects | 4,695 | 140 | 4,555 | 48,240 | 40.0 | -1,893 | -0.2 | 0 | 4,257 | 10 | 42567 | 1.1 | 835 | 83 | 93 | 31,756 | 43,943 |
| 3 | Install (1) Drink and (1) Snack vending machine energy misers | www.usatech .com and established costs | 458 | none at this time | 458 | 1,891 | 0.9 | 0 | 0.1 | 0 | 280 | 12 | 3,358 | 1.6 | 633% | 53% | 61% | 2,295 | 2,591 |
| 4 | replace 2, 1 Hp cond fan and 2 fractional Hp motors with Premium Efficiency on Hartford walk-in refrigerated boxes | similar projects, DOE Motor Master + International | 1,000 | 90 | 910 | 2,000 | 0.9 | 0 | 0.1 | 0 | 296 | 12 | 3,552 | 3.1 | 290% | 24% | 31% | 2,002 | 2,740 |
| | **TOTALS** | | **7,753** | | **7,523** | **52,131** | **42** | **-93** | **1.4** | **0** | **7,574** | | **82,374** | **1.0** | **-** | **-** | **-** | **-** | **70,333** |

**Assumptions:** Discount Rate: 3.2% 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, $ | est. energy & operating 1st year cost savings, $ | life of measure, yrs | est. lifetime cost savings, $ | simple payback, yrs | lifetime return on investment, % | annual return on investment, % | internal rate of return, % | net present value, $ | CO2 reduced, lbs/yr |
| 5 | Install 50 kW Solar Photovoltaic system | Similar Projects | 350,000 | 50,000 | 300,000 | 59,000 | 50.0 | 0 | 1.6 | 0 | 44,132 | 25 | 749,300 | 6.8 | 149.8 | 6.0 | 12.6 | 865,272 | 105,640 |

| Table 3 - Recommended >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 |
| 6 | 15 New T8 fixtures to be installed with incentives | RS Means, lit search | 3,230 | 300 | 2,930 | 209 | 0.0 | 0 | 0.0 | 11 | 42 | 15 | 624 | 70.5 | -73 | -5 | NA | -2,575 | 286 |
| 7 | 4 New CFL fixtures to be installed with incentives | RS Means, lit search | 205 | none at this time | 205 | 76 | 0.0 | 0 | 0.0 | 0 | 11 | 5 | 54 | 18.9 | -74 | -15 | NA | -155 | 104 |
| 8 | 35 New occupancy sensors to be installed with incentives | RS Means, lit search | 7,700 | 700 | 7,000 | 2,586 | 0.5 | 0 | 0.1 | 0 | 383 | 15 | 5742 | 18.3 | -18 | -1 | -10 | -3,735 | 3,543 |

## 1. HISTORIC ENERGY CONSUMPTION

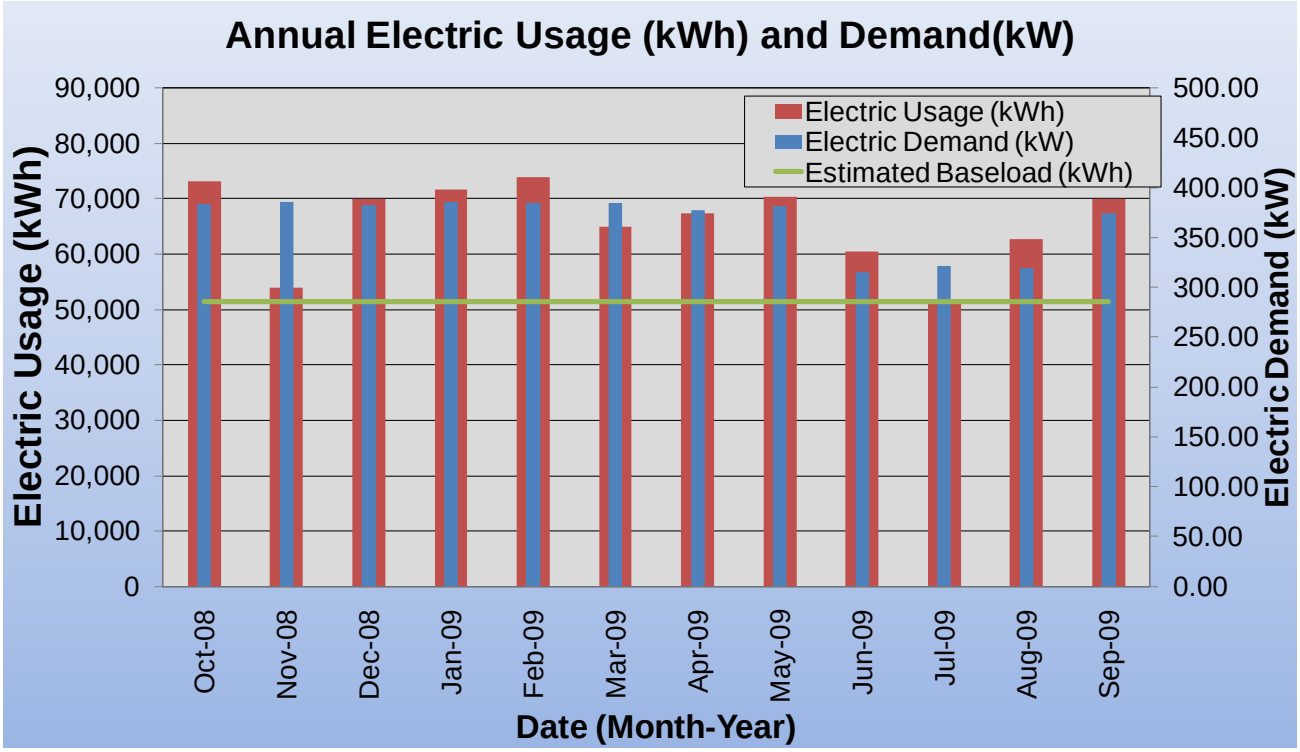
### 1.1. Energy usage and cost analysis

SWA analyzed utility bills from October 2008 through September 2009 that were received from the utility companies supplying the Mullica Elementary & Middle School with electric and natural gas.

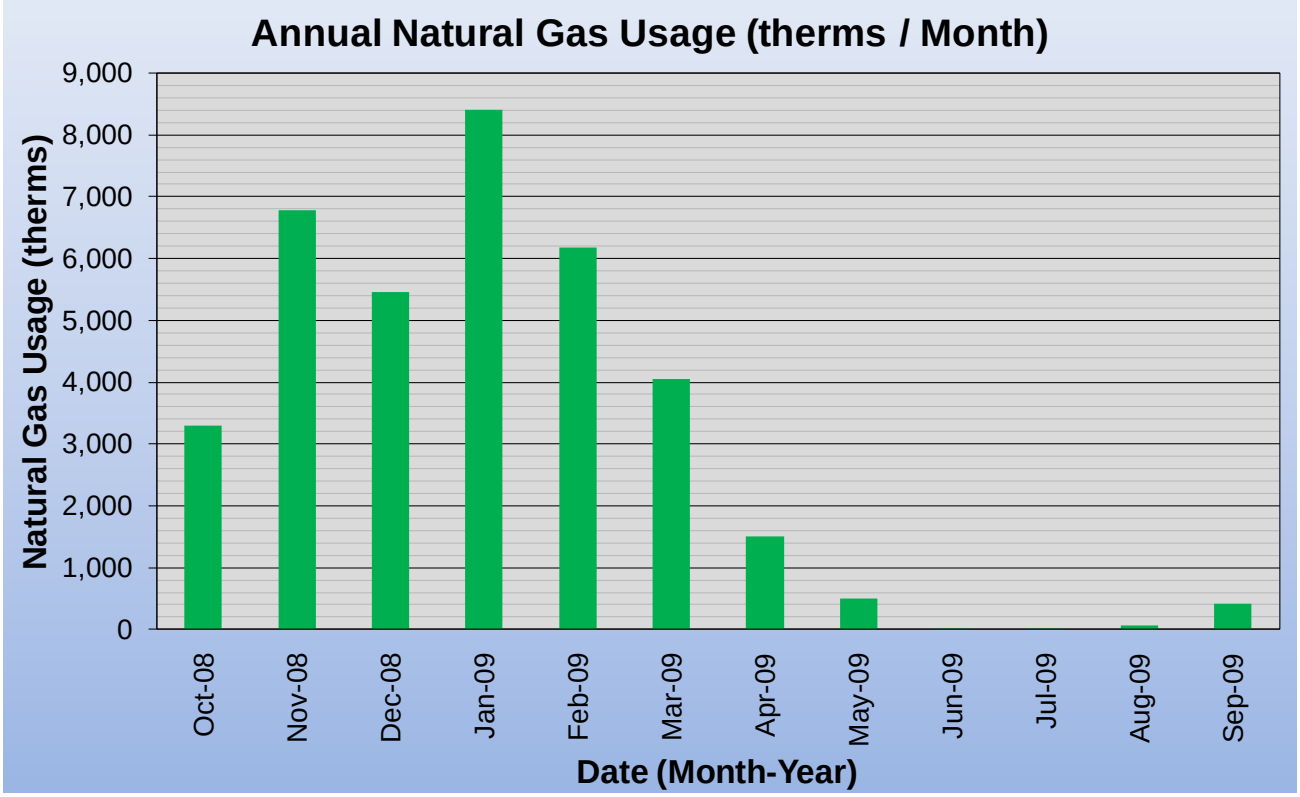
Electricity - The Mullica Elementary & Middle School is currently served by two electric meters. The Mullica Elementary & Middle School currently buys electricity from Atlantic City Electric at an average rate of **$0.148/kWh** based on 12 months of utility bills from October 2008 to September 2009. The Mullica Elementary & Middle School purchased approximately **790,224 kWh** or **$116,874** worth of electricity in the previous year. The average monthly demand was 366 kW.

Natural gas - The Mullica Elementary & Middle School is currently served by one meter for natural gas. The Mullica Elementary & Middle School currently buys natural gas from South Jersey Gas at an average aggregated rate of **$1.523/therm** based on 12 months of utility bills from October 2008 to September 2009. The Mullica Elementary & Middle School purchased approximately **34,300 therms** or **$55,910** worth of natural gas in the previous year.

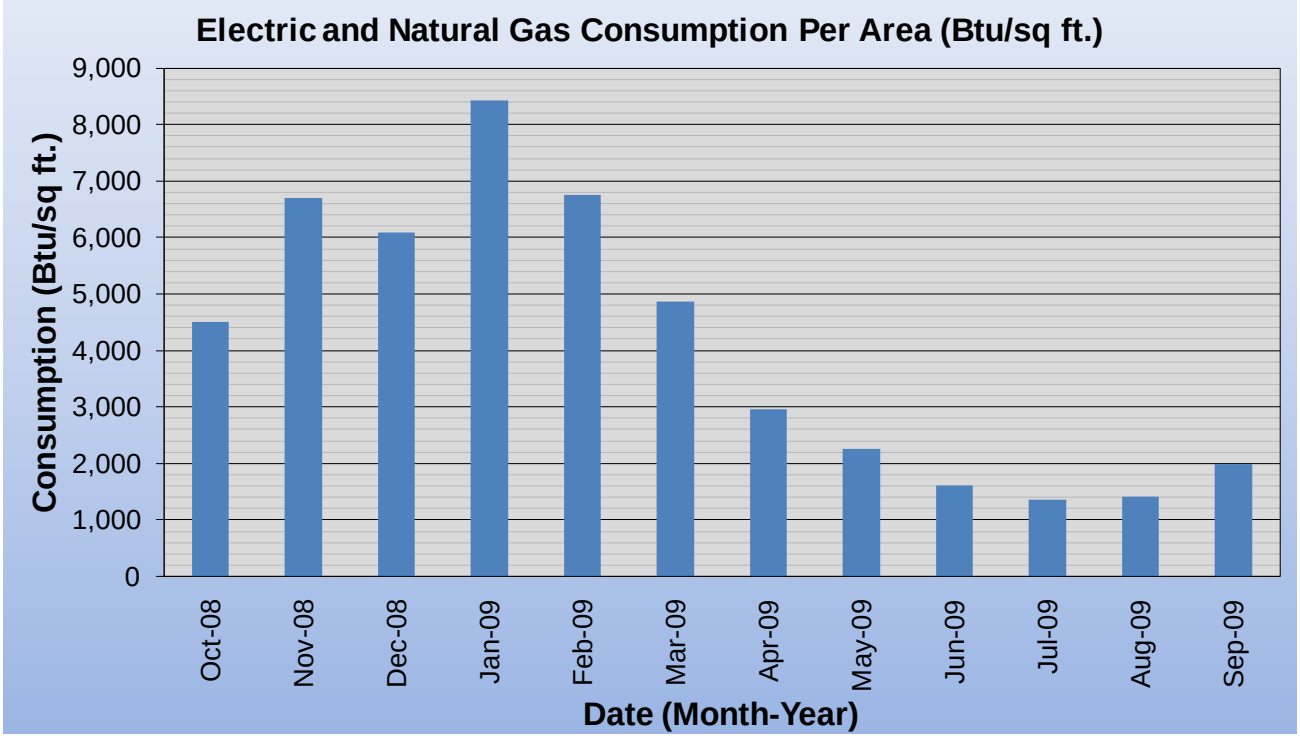
The following chart shows electricity use for the Mullica Elementary & Middle School based on utility bills for the 12 month period of October 2008 to September 2009.




The following chart shows the natural gas consumption for the Mullica Elementary & Middle School based on natural gas bills for the 12 month period of October 2008 to September 2009.

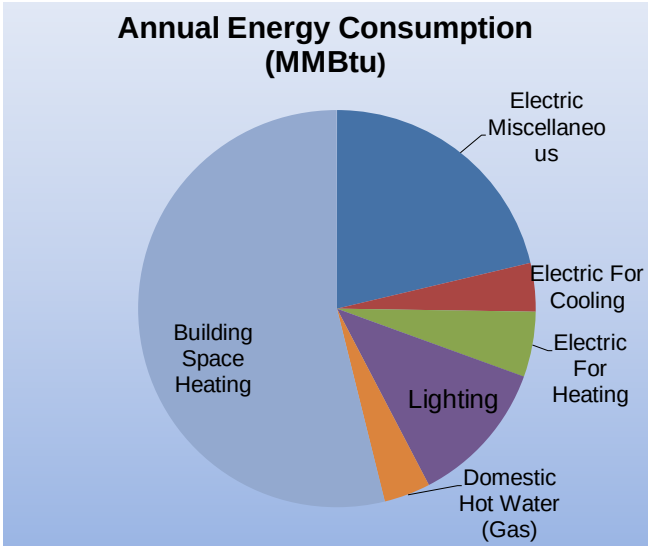


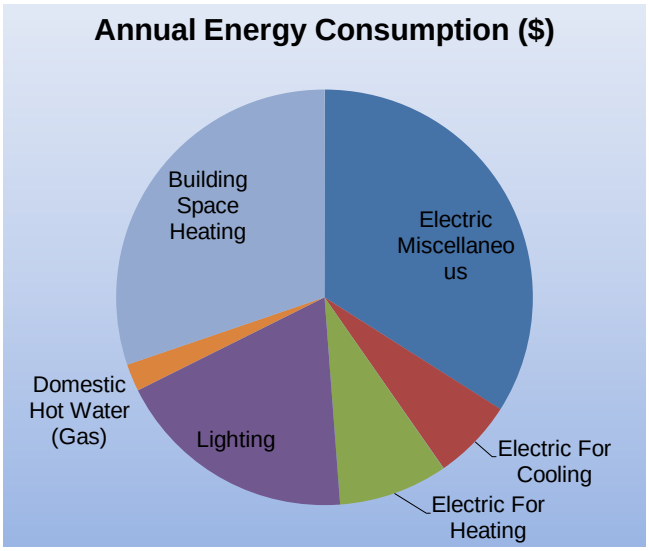

The following chart shows combined natural gas and electric consumption in Btu/sq ft for the Mullica Elementary & Middle School based on utility bills for the 12 month period of October 2008 to September 2009.



The following table and chart pies show energy use for the Mullica Elementary & Middle School based on utility bills for the 12 month period of October 2008 to September 2009. Note electrical cost at $43/MMBtu of energy is nearly 3 times as expensive to use as natural gas at $15/MMBtu.

| 2008 Annual Energy Consumption / Costs | | | | | |
|---|---|---|---|---|---|
| | **MMBtu** | **% MMBtu** | **$** | **% $** | **$/MMBtu** |
| **Electric Miscellaneous** | 1,356 | 21% | $58,770 | 34% | 43 |
| **Electric For Cooling** | 251 | 4% | $10,896 | 6% | 43 |
| **Electric For Heating** | 338 | 5% | $14,651 | 8% | 43 |
| **Lighting** | 751 | 12% | $32,558 | 19% | 43 |
| | | | | | |
| **Domestic Hot Water (Gas)** | 240 | 4% | $3,657 | 2% | 15 |
| **Building Space Heating** | 3,430 | 54% | $52,253 | 30% | 15 |
| **Totals** | 6,367 | 100% | $172,784 | 100% | 27 |
| | | | | | |
| **Total Electric Usage** | 2,696 | 42% | $116,874 | 68% | 43 |
| **Total Gas Usage** | 3,670 | 58% | $55,910 | 32% | 15 |
| **Totals** | 6,367 | 100% | $172,784 | 100% | - |




### 1.2. Utility rate

The Mullica Elementary & Middle School currently purchases electricity from Atlantic City Electric at a special consortium rate for electricity use (kWh) with a separate (kW) demand charge. The Mullica Elementary & Middle School currently pays an average rate of approximately $0.148/kWh based on the 12 months of utility bills of October 2008 to September 2009.

The Mullica Elementary & Middle School currently purchases natural gas supply from the South Jersey Gas at a general service market rate for natural gas (therms) and with the Hess Corporation acting as the transport company. There is one gas meter that provides natural gas service to the Mullica Elementary & Middle School. The average aggregated rate (supply and transport) for the meter is approximately $1.523/therm based on 12 months of utility bills for October 2008 to September 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 Mullica Elementary & Middle School building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The Mullica Elementary & Middle School building is eligible for Energy Star Rating and received a rating of 88 out of 100, which indicates that Mullica Public Schools performs better than 88% of similar schools surveyed. Because the schools Energy Star rating is above 75, it is eligible to receive a certificate and plaque for this achievement and SWA highly recommends the school apply for LEED certification.

The Site Energy Use Intensity is 50 kBtu/ft$^2$/yr compared to the national average of a school building consuming 78 kBtu/ft$^2$/yr. Implementing this report's highly recommended Energy Conservations Measures (ECMs) will reduce use by approximately 1.4 kBtu/ft$^2$/yr, with an additional 1.6 kBtu/ft$^2$/yr from the recommended ECMs. The end of life ECMs will also reduce use by 0.1 kBtu/ft$^2$/yr. These recommendations could account for 3.1 kBtu/ft$^2$/yr reduction to further reduce the schools energy consumption.

Per the LGEA program requirements, SWA has assisted the Mullica Board of Education to create an *Energy Star Portfolio Manager* account and share the Mullica Elementary & Middle 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 Mullica Board of Education (user name of "mullicatownship" with a password of "mullica3868") and TRC Energy Services (user name of TRC-LGEA).

OMB No. 2060-0347

# STATEMENT OF ENERGY PERFORMANCE
## Mullica Township - Public School

**Building ID:** 1973804
**For 12-month Period Ending:** September 30, 2009[1]
**Date SEP becomes ineligible:** N/A
**Date SEP Generated:** January 29, 2010

**Facility**
Mullica Township - Public School
500 Elwood Road
Elwood, NJ 08217

**Facility Owner**
N/A

**Primary Contact for this Facility**
N/A

**Year Built:** 1925
**Gross Floor Area (ft²):** 128,789

**Energy Performance Rating**[2] (1-100) 88

| **Site Energy Use Summary**[3] | |
|---|---|
| Electricity - Grid Purchase(kBtu) | 2,756,575 |
| Natural Gas (kBtu)[4] | 3,682,198 |
| Total Energy (kBtu) | 6,438,773 |
| **Energy Intensity**[5] | |
| Site (kBtu/ft²/yr) | 50 |
| Source (kBtu/ft²/yr) | 101 |
| **Emissions** (based on site energy use) | |
| Greenhouse Gas Emissions ($MtCO_2e$/year) | 616 |
| **Electric Distribution Utility** | |
| Pepco - Atlantic City Electric Co | |
| **National Average Comparison** | |
| National Average Site EUI | 78 |
| National Average Source EUI | 158 |
| % Difference from National Average Source EUI | -36% |
| Building Type | K-12 School |

Stamp of Certifying Professional

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

**Certifying Professional**
N/A

| **Meets Industry Standards**[6] **for Indoor Environmental Conditions:** | |
|---|---|
| Ventilation for Acceptable Indoor Air Quality | **N/A** |
| Acceptable Thermal Environmental Conditions | **N/A** |
| Adequate Illumination | **N/A** |

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. 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 Mullica Primary/Middle School building was originally built in 1925 with several additions / renovations performed in 1953, 1964, 1965, 1967, 1971, 1983, 1993, 1999 and 2005. It houses a single story elementary school on one side, a single story middle school on the other, with a two story (above the Library) section in the middle. The 2005 two story addition includes second floor Board of Education offices and meeting rooms, a library, the primary school office, the nurse's office and first 7th and 8th grade classrooms. Currently, the school consists of a total 128,789 square feet of conditioned space. Besides various types of classrooms and administrative offices for both schools, the building has multipurpose rooms, a gymnasium, art and craft rooms, kindergarten rooms, activity rooms, a kitchen, a cafeteria / auditorium with a stage, media centers, boiler and utility rooms. In the near future, there is a plan to house additional pre-kindergarten classrooms.

### 2.2. Building occupancy profiles

Occupancy for the Mullica Primary/Middle School building is approximately 880 students and 121 teachers and staff personnel. The school is in session from 8:30 am to 3:30 pm, while a latchkey afterschool program utilizes the building from 3:30 pm through 6:00 pm for approximately 20 students. There are periodic evening programs and gym activities. There is a 40 day summer program 8:00 am to 3:30 pm supervised by a staff of approximately 29 counselors and attended by approximately 112 students. During summer recess, the school is thoroughly cleaned and maintenance staff / contractors perform annual maintenance and upgrades on the building.

### 2.3. Building envelope

#### 2.3.1. Exterior Walls

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

*Exterior walls show signs of water leakage from roof and flashing compromising wall insulation*

SWA recommends caulking and re-pointing the veneer with appropriate materials to prevent further cracking due to moisture and water infiltration, especially around window sills and all other wall penetrations. Fascia and cap flashing failures need to be inspected and fixed to prevent further water damage potentially leading to structural and energy compromising issues.

Exterior wall insulation levels could not be visually verified but available construction plans of additions show some insulation between the brick veneer and CMU walls. Recent completed additions were visually inspected and found to have acceptable levels of a minimum of 2" wall insulation.

### 2.3.2. Roof

The roofs were covered with snow on the days of SWA's field visits and could not be visually inspected. The kindergarten, 2nd, 3rd and 4th grade wings have a 1993 tar with stone covered roof. The 1st grade, kitchen, stage and library wings have a 2005 EPDM roof on top of 2"- 3" screwed down polyurethane insulation. The 7th and 8th grade wing has a 2005 4"- 6" foam insulated roof. The

5th and 6th grade wing, cafeteria, craft rooms, middle school offices and gymnasium have a 1999 4"-6" foam insulated roof that is pulling away from the edges in certain places and allowing water to penetrate the exterior walls, thus compromising the insulation and having the potential to generate mold growth. The Maintenance Department has a plan from a roofing contractor to repair this, weather allowing. The support of the different roofs is either steel decking or precast concrete or fiberglass planks.

Besides the roof surface and insulation conditions, SWA noticed uncontrolled roof water runoff as well as the already mentioned cap flashing under section "2.3.1. Exterior Walls". Some downspouts may be missing, clogged and ineffective. Soffit edges show pealing paint in various places. SWA recommends all downspouts, scuppers and roof drains inspected and cleaned or repaired as necessary.


Soffit paint pealing; wet ceiling tile - most likely from a roof leak

### 2.3.3. Base

The building's base is a 4" concrete slab on grade with a perimeter footing. There weren't any reported problems with water seepage through the slab or other issues related to thermal performance or moisture, including the basement. There are 2" of rigid board insulation at the interior of the foundation walls and extending 2 feet from the foundation walls under the slab. This is standard for this type of structure. SWA does not recommend any additional insulation as it would not be cost effective. The slab edge or perimeter insulation could not be verified.

### 2.3.4. Windows

Most of the building's fixed or awning type windows were found to have been recently updated, double glazed aluminum framed low-e type window units and in good condition. Skylights were also found to be thermally insulated and in good condition. SWA recommends regular inspections of all the caulking at windows and replaced as necessary.

### 2.3.5. Exterior doors

The aluminum, hollow metal and fiberglass 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.

*Various exterior door areas needing weather stripping*

### 2.3.6. Building air tightness

Based on a visual inspection, the building was observed to be a relatively well-sealed building. There weren't any major observed deficiencies of air tightness within the building besides some of the exterior doors.

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 and windows.

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 Mullica Elementary & Middle School heating is provided by hydronic heat via coils in air handling units and unit ventilators in classrooms as well as direct-fired rooftop air handling units. Cooing is provided by rooftop units and air handling unit evaporators along with small condensing units. Hallways are not directly cooled.

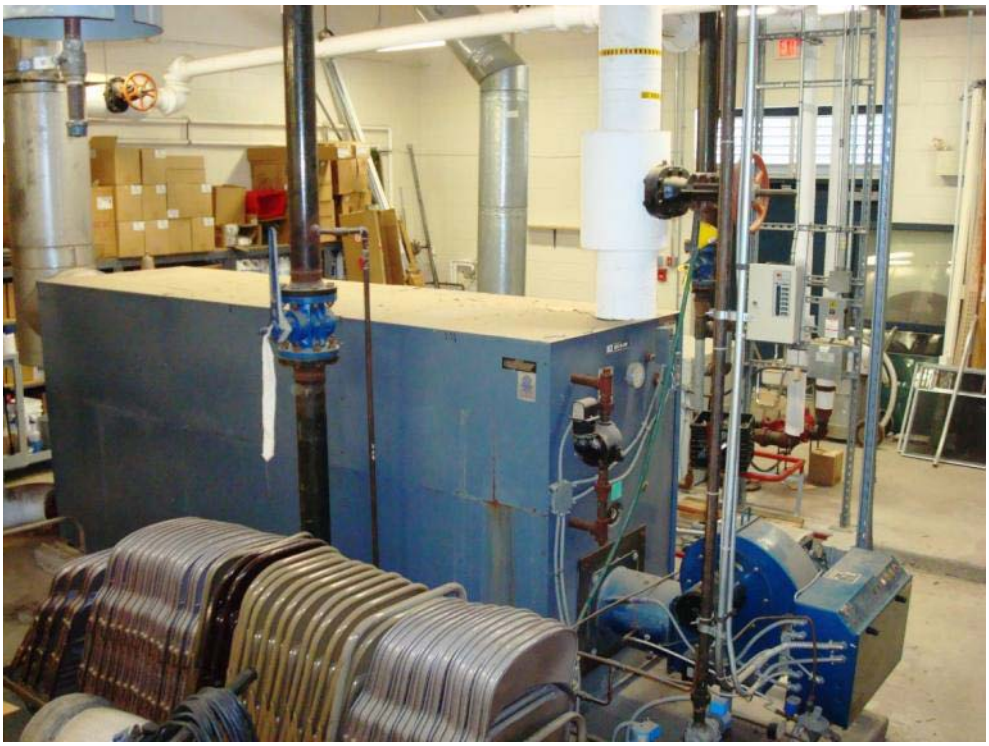
### 2.4.1. Heating

Hot water heating is provided by two boilers, one cast iron Weil McLain, 80% efficient, and one Lochinvar watertube boiler, 84% efficient. Both boilers are well within their useful life. The boilers provide hot water to ten air handling unit coils, cabinet unit heaters, approx 70 unit ventilators (one in each classroom) and fin tube radiators on the second floor. The total output heating capacity of the boilers 5,880,000 Btu/hr. The fin tube radiators on the second floor use hot water piping with fins, (which increase the heated surface area), to heat the perimeter of the space and counterbalance envelope losses.

There are also three direct-fire rooftop units which use combustion to directly heat a mixture of return air and outside air and supply it to the space via supply fans. A portion of the return air is purged from the system with exhaust fans in order to draw in outside air into the system to maintain ASHRAE ventilation requirements. The heated air from air handling units / rooftop units is sent through the above ceiling air distribution ductwork to serve occupied spaces such as the gymnasium, cafeteria, library, and offices. For these spaces there are variable air volume dampers in the ductwork which regulate the amount of air going to each space in order to maintain a temperature set point. The set point can be adjusted at local thermostats within the space. The VAV boxes are programmed to maintain at least a minimum open position for ventilation.

Heat is provided to classrooms almost entirely by unit ventilators which draw in outside air under windows, heat the air with hot water coils and fans blow the hot air into the space.

All heating equipment appears to be in good operating condition. SWA recommends installing a vent damper in the flue piping of each boiler. The damper prevents chimney losses by closing off a boiler's vent when the boiler isn't firing and has been proven to increase boiler operating efficiency by at least 3%.



*Weil McLain Natural Gas Boiler*

### 2.4.2. Cooling

The Mullica Elementary & Middle School is provided with cooling in several ways. Offices and large spaces have dedicated air handling units and rooftop units equipped with evaporator coils and condensers. The classrooms are primarily cooled by the evaporators within window unit ventilators and separate condensing units on the roof.

For the air handlers and rooftop units, outside air is drawn into the units equipped with filters, and mixes with return air from the occupied spaces via the ducted return air system above the ceiling. A small portion of the return air is purged and vented outside via an exhaust fan prior to entering the mixing box. The mixed air inside the air handler is filtered before passing through a DX coil which uses refrigerant to absorb heat and therefore cool the air. The same refrigerant is sent to the condenser section to release the heat to the atmosphere using condenser fans. The air handler blower then pushes the filtered, conditioned air to the distribution system. The air is then distributed via VAV boxes and diffusers into the building spaces. The unit ventilators have a similar cooling cycle however there is no mixing box and therefore the outside air is drawn directly from outside and passes through evaporator coils to remove heat and moisture from the air, and then a fan blows the cooled air into the space. Exhaust grilles in each classroom draw in a portion of air to be purged from the system.

Several air handling units were installed in 1992 and are approaching the end of their useful life. As the units fail, they should be replaced with high efficiency R-410a split systems. The rest of the air handling equipment has 80% remaining useful life and are generally in good condition.

*Typical classroom unit ventilator, providing outside air ventilation, heating and cooling*

### 2.4.3. Ventilation

The various spaces of the building are ventilated by exhaust fans throughout the system which purge a portion of return air before it circulates back into the supply air system. Each classroom has an exhaust grille as well as each bathroom. There is typically one exhaust fan for both bathrooms on each wing, and one exhaust fan for classrooms in each wing. A ducted exhaust fan system also serves gymnasium, all offices, cafeteria and hallways. There are approximately 25 exhaust fans installed on the roof. In general, the building fans have 80% estimated useful operating life remaining and are in good condition.

### 2.4.4. Domestic Hot Water

The domestic hot water (DHW) for the Mullica Elementary & Middle School is provided by a PolyShield Turbo Power natural gas heater with 175 gal storage and 199,000 Btu/hr capacity. This heater has 40% estimated useful operating life left and appears in good condition. Considerations should be given to replacing it with a high efficiency condensing type heater when it has reached the end of its operating life. There is also an Odis electric domestic hot water heater which was installed in 1961 and is well beyond its estimated useful life. Due to age and damage two of the four 20 kW heaters do not operate, degrading the capacity of the heater to 40 kW. SWA recommends replacing this heater with a 70,000 Btu/hr Capacity and 75 Gallon storage natural gas heater with at 85% rated thermal efficiency. There are also electric instantaneous hot water heaters installed at sinks in the library and nurse's office which have not yet been tied into the electrical system. SWA recommends keeping these heaters as backups in case there are capacity concerns for the gas heaters in the future.

*PolySheild Domestic Hot Water heater*

## 2.5. Electrical systems

### 2.5.1. Lighting

*Interior Lighting* - The Mullica Elementary & Middle School currently consists of mainly T8 fluorescent fixtures with electronic ballasts, and screw-in compact fluorescent lights. There are also sporadic use of incandescent bulbs and T12 fixtures with magnetic ballasts. Based on measurements of lighting levels for each space, there are not any vastly over-illuminated areas. SWA recommends installing occupancy sensors in 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 is detected within a set time period. Advance micro-phonic lighting sensors include sound detection as a mean to control lighting operation. SWA also recommends replacing Incandescent lamps with compact fluorescent lights which use a third or less of the wattage for comparable lumen output, and replacing T12 magnetic fixtures with higher efficiency T8 lamps and electronic ballasts. 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 efficient LED type.

*Exterior Lighting* - The exterior lighting surveyed during the building audit was found to be a primarily CFLs. Exterior lighting is controlled by photocells.

### 2.5.2. Appliances and process

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

Computers left on in the building consume a lot of energy. A typical desk top computer uses 65 to 250 watts and uses the same amount of energy when the screen saver is left on. Televisions, DVDs, stereos, computers, and kitchen appliances often have internal memories or clocks which consume approximately 3-5 watts of electricity when turned off. SWA recommends all computers and all appliances, (other than refrigerators and freezers), be plugged into power strips and turned off each evening just as the lights are turned off. The Mullica Elementary & Middle School computers are generally NOT programmed for the power save mode, to shut down after a period of time that they have not been used.

### 2.5.3. Elevators

The Mullica Elementary & Middle School is a two-story building with an Otis hydraulic elevator, using a 20HP motor. The elevator and motor appear in good condition and have 80% remaining useful life.

### 2.5.4. Other electrical systems

There are three 75 kVA electric transformers which are all well within the typical useful life.

## 3. EQUIPMENT LIST

| Building System | Description | Location | Manu. / Model # | Fuel | Space Served | Year Installed | Estimated Remaining Useful Life % |
|---|---|---|---|---|---|---|---|
| Controls | Siemens BMS, old Dos interface, wants to replace with Windows system | Virtual | NA | Electric | All areas | 2001 | 70% |
| Cooling | Approximately 70 Condensers, one for each classroom with thermostat to control, 85% Eff. | Rooftop | Trane, Lennox | Electric | All areas | 2005 | 80% |
| Cooling | Mr Slim Evaporator | Server Rm | Mitsubishi | Electric | Server Rm | 2005 | 80% |
| Cooling | Two Mr Slim Evaporators | Loading Rm 63, Rm 64 | Mitsubishi | Electric | Loading Rm 63 | 1994 | 40% |
| Domestic Hot Water | 1st FL DHW HEATER 12 KW | 1st Grade Janitor Closet | AO SMITH | ELEC | 1st Fl | 2005 | 80% |
| Domestic Hot Water | 2ND FL DHW HEATER 12 KW | 2nd Grade Janitor Closet | AO SMITH DSE-30 S#SH041049153 | ELEC | 2nd Fl | 2005 | 80% |
| Domestic Hot Water | Domestic Hot water, instantaneous heaters, installed but not yet powered | Sinks | NA | Electric | Library & Nurse Sink | 2005 | 80% |
| **Domestic Hot Water** | **Domestic Hot water Tank with two (2) operating electric hot water heaters, 20 kW each, 98% Thermal Eff.** | **DHW Rm** | **ODIS, Edwin L Wiegandle TM624W, NB#18151** | **Electric** | **All areas** | **1961** | **0%** |
| Domestic Hot Water | PolyShield Turbo Power Domestic Hot Water Heater 1/3 HP, 175 Gal Storage, 199,000 Btu/hr, 80% Eff. | Boiler Rm | 250P-175A-TP, 49584791 | Natural Gas | All areas | 1994 | 40% |
| Elevators | Otis Elevator, Schindler Hydraulic Motor, 2500 ld Capacity, 20 HP | 2nd Fl Elev. Machine Rm | Schindler , NA | NA | All areas | 2005 | 80% |
| Heating | Hot Water Watertube Boiler, ModuPak Boiler 1,800,000 Btu/hr In, 1,512,000 Out, 84% Eff. | Boiler Rm | Lochinvar Watertube Boiler CHN1800, G002258 | Natural Gas | All areas | 2001 | 70% |
| Heating | Cast Iron Boiler 5,485,000 Btu/hr IN, 4,370,000 Btu/hr Out, 80% Eff. | Boiler Rm | Weil McLain M#1788 BurnerM# WCR4-6-25, 1788-1 | Natural Gas | All areas | 1994 | 40% |
| Heating | Hot Water Pump P-3 7.5 HP 190 GPM, 85 Ft, Primary Pump, 88.5% Eff. | Boiler Rm | Bell & Gossett M2E9.625BF Marathon Motor Cat E70, 2227819 | Electric | All areas | 2001 | 70% |
| Heating | Cabinet Unit Heaters at each building entrance, in ceiling, approx. 13 total | Entrances | Trane, FFEB-04, FFEB-02 | Hot Water | Entrances | 2005 | 80% |

| Building System | Description | Location | Manu. / Model # | Fuel | Space Served | Year Installed | Estimated Remaining Useful Life % |
|---|---|---|---|---|---|---|---|
| Heating | Hot Water Return Pump, P-4, 3/4 HP, 1725 RPM, 88.5% Eff. | Boiler Rm | Bell & Gossett Part# 185332; Motor M#903582, NA | Natural Gas | All areas | 2001 | 70% |
| Heating | Two (2) Ceiling Hung HW heaters, Reznor | Kitchen | Reznor | Hot Water | Kitchen | 1981 | 0% |
| Heating | Two (2) Nesbit Ceiling Hung heater | Gym | Nesbit | Hot Water | Gym | 1981 | 0% |
| Heating | Two (2) ceiling hung Unit Heaters | Boiler Rm | Sterling HS-1448, HS3126-95 | Hot Water | Boiler Rm | 1995 | 40% |
| Heating | Hot Water Booster P-1 7.5HP, 1856 Ram, 45 Ft, Secondary Stage 2, 88.5% Eff. | Boiler Rm | Bell & Gossett M2BC7.75BF Magnetic Motor Cat E300 , 1910175 | Electric | All areas | 1994 | 40% |
| Heating | FT-1 to 5, Fin Tube Radiaton, 1135 BTUH/LF, 188 Btu/hr total | 2nd Floor Perimeter | Trane, TA | Hot Water | 2nd Floor perimeter | 2005 | 80% |
| Heating | Hot Water Booster P-2 7.5HP, 1856 Ram, 45 Ft, Secondary Stage 1, 88.5% Eff. | Boiler Rm | Bell & Gossett M2BC7.75BF Magnetic Motor Cat E300 , 1910175 | Electric | All areas | 1994 | 40% |
| Heating / Cooling | AC-1 Hot Water Heating & DX Cooling | Roof | Trane / Carrier | Electric | Rm 60 | 1992 | 30% |
| Heating / Cooling | AC-3 Hot Water Heating & DX Cooling | Roof | Trane / Carrier | Electric | Rm 58 | 1992 | 30% |
| Heating / Cooling | AC-5 Hot Water Heating & DX Cooling | Roof | Trane / Carrier | Electric | Rm 56 | 1992 | 30% |
| Heating / Cooling | AC-6 Hot Water Heating & DX Cooling | 54 Roof | Trane / Carrier | Electric | Rm 54 | 1992 | 30% |
| Heating / Cooling | AC-7 Hot Water Heating & DX Cooling | Middle School office | Trane / Carrier | Electric | Middle School office | 1992 | 30% |
| Heating / Cooling | AHU-1 | Elem office | Carrier | Electric | Elem office | 2005 | 80% |
| Heating / Cooling | AHU-2 | PE office | Carrier | Electric | PE office | 2005 | 80% |
| Heating / Cooling | AHU-3 ceiling hung air handling unit | CAFETERIA STORAGE | MBC1-FLN3, T04C16832 | Electric | Rm 41 & stage | 2005 | 80% |
| Heating / Cooling | AHU-4 | Roof | Carrier | Electric | Rm 28, 42, 44, 46 | 1992 | 30% |
| Heating / Cooling | AHU-5 | Roof | Carrier | Electric | Cafeteria | 2005 | 80% |
| Heating / Cooling | Air Handling Units | Rm 2 thru 5 & 32 thru 39 | Carrier | | Rm 2 thru 5 & 32 thru 39 | 1993 | 40% |
| Heating / Cooling | classroom unit ventilators 5 Ton | Classrooms | Carrier 40 UV, 38CK | Hot Water / Electric | Classrooms | 2004 | 80% |

| Building System | Description | Location | Manu. / Model # | Fuel | Space Served | Year Installed | Estimated Remaining Useful Life % |
|---|---|---|---|---|---|---|---|
| Heating / Cooling | classroom unit ventilators 5 Ton | Classrooms | McQuay | Hot Water / Electric | Classrooms | 1995 | 40% |
| Heating / Cooling | classroom unit ventilators 5 Ton | Classrooms | Trane | Hot Water / Electric | Classrooms | 2005 | 80% |
| Heating / Cooling | RTU-1 Gas Fired Heating & DX Cooling, 11 EER | Rooftop | Trane | Natural Gas / Electric | Rm 21 & 22 | 2005 | 80% |
| Heating / Cooling | RTU-2 Gas Fired Heating & DX Cooling, 11 EER | Rooftop | Trane | Natural Gas / Electric | 2nd Fl Offices | 2005 | 80% |
| Heating / Cooling | RTU-3 Gas Fired Heating & DX Cooling, 11 EER | Rooftop | Trane | Natural Gas / Electric | Library | 2005 | 80% |
| Heating / Cooling | Three (3) Air Handling Units with condensers, ceiling hung, 15 Tons | Gym | Carriers | Hot Water / Electric | Gym | 2005 | 80% |
| Heating / Cooling | FC-1, Fan Coil Unit, 40 MBH Cooling, 48 MBH Heating | Nurse | Carrier, Carrier, FG3A-036 | Hot Water / Electric | Nurse | 2005 | 80% |
| Lift | STAGE LIFT 750 LBS | CAFETERIA | NATIONAL WHEELOVATOR CDE42 / 90029 | Electric | Stage | 2004 | 80% |
| Lighting | See details - Appendix A | All Areas | NA | Electric | All areas | NA | NA |
| Misc Equipment | Ceramic Kiln, 5760 Watt | Rm 62 | Duncan Kiln MHDE820-2, SU001 48-E | Electric | Art Rm 62 | 1995 | 40% |
| Misc Equipment | Dishwasher, Insinger | Kitchen | Admiral 66-4, 40351 | Electric | Cafeteria | 2006 | 90% |
| Misc Equipment | Four (2) Industrial Food Warmers | Kitchen | Hobart OH1-2; 32518021AH; 14826764 | Electric | Cafeteria | 1981 | 0% |
| Misc Equipment | Harford walk-in refrigerator / Freezer | Kitchen | Harford, NA | Electric | Kitchen | 1981 | 0% |
| Misc Equipment | Hot Point Refrigerator / Freezer | Kitchen | CTXZ16RB, DG586083 | Electric | Cafeteria | 1994 | 40% |
| Misc Equipment | Hot Water Booster Heater, 54 kW | Kitchen | HATCO C-54, 14496295115 | Electric | Cafeteria | 1994 | 40% |
| Misc Equipment | Industrial Refrigerators, R-134a | Kitchen | Continental M2R | Electric | Cafeteria | 2008 | 100% |
| Misc Equipment | Industrial Refrigerators, R-134a | Kitchen | 780, D495163 | Electric | Cafeteria | 1994 | 40% |
| Transformer | 75KVA | ELEC CLOSET | SIEMENS 3F3Y075LN3 | Electric | All Areas | 2004 | 80% |
| Transformer | 75KVA | ELEC CLOSET | SIEMENS 3F3Y075K13LN3 | Electric | All Areas | 2004 | 80% |
| Transformer | GE 75 KVA TYPE QL | ELEC CLOSET | C9T23B374 | Electric | All Areas | 1993 | 40% |
| Ventilation | Several Exhaust Fans, 2 Fans per wing, approx. 25 total, most 1/4 HP | Rooftop | Greenheck | Electric | Bathrooms classrooms | 2005 | 80% |

**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 Mullica Elementary & Middle 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**

- An upgraded Windows-based Building Management System; approx. $18,000 investment

- Install reflective window blinds which can save up to 20% heating and 50% cooling of thermal losses for approx $3.5/sqft however payback is in excess of 15 years

**Category II Recommendations: Operations and Maintenance**

- Thoroughly and evenly insulate space (with batt insulation) above the ceiling tiles and plug all ceiling penetration. Check air ducting for tight gaskets that prevent conditioned air from escaping / leaking into the attic space.

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

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

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

- Repair / seal wall cracks and penetrations - SWA recommends as part of the maintenance program to properly re-caulk the flashing, and ensure that the brick façade is securely in place on a routine basis 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/ .

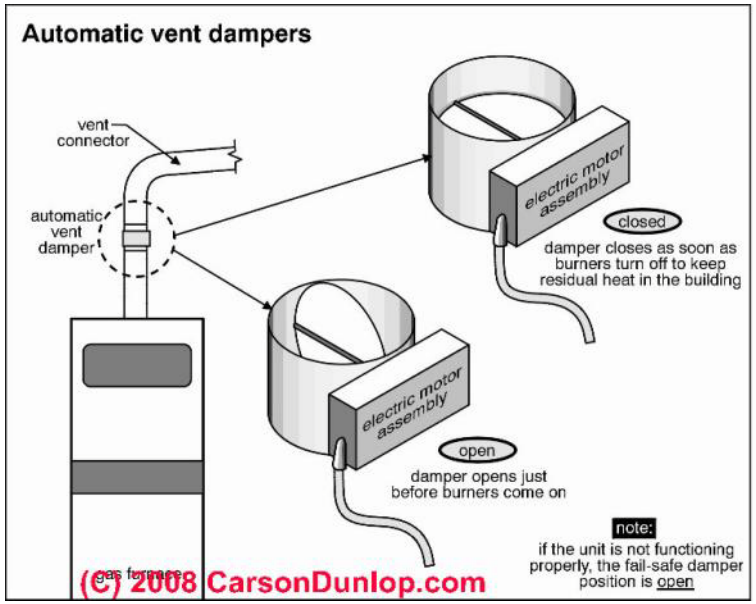
**Category III Recommendations: Energy Conservation Measures - Summary table**

| ECM# | Description of Highly Recommended 0-5 Year Payback ECMs |
|---|---|
| 1 | Install automatic vent dampers in boiler flue piping |
| 2 | Replace 40 kW Electric heater with Sandblaster 70 MBH, 75 Gal NG heater |
| 3 | Install energy misers in vending machines |
| 4 | Replace industrial refrigerator compressor motors with premium efficiency |
| | Description of Recommended 5-10 Year Payback ECMs |
| 5 | Install 50kW PV System on Roof |
| | Description of Recommended >10 Year Payback ECMs |
| 6 | Building Lighting Upgrades – Replace T12 with T8 |
| 7 | Building Lighting Upgrades – Replace Incandescent with CFL |
| 8 | Building Lighting Upgrades – Install Occupancy Sensors |

## ECM # 1: *Install Boiler Dampers*

**Description:**

The mechanical room contains two hot water boilers, one large cast iron Weil McLain boiler Model# 1788, with 4,370,000 Btu/hr output capacity and a Lochinvar water tube boiler with 1,512,000 Btu/hr output capacity. The hot water boilers are provided with vent hoods but without vent dampers installed. When a boiler is not firing the vent damper should be closed. Due to a stack effect, air is drawn into the flue from the outside and without a damper cold air enters the building through the flue, thereby degrading the heating equipment. An automatic or gravity flue damper is a device which closes the heating flue when the boiler is not firing so that cold air does not enter the building through the chimney. Studies have shown that installing a flue damper can increase boiler efficiency by 3% to 8% depending on boiler usage. When the heating system has turned off at the end of an "on" cycle of burning fuel, the automatic flue damper electric motor turns a baffle inside of the flue vent connector pipe to a position "across" the pipe so that the airflow inside the pipe is blocked or stopped as shown in the image below.




SWA recommends installing automatic vent dampers in both boiler vent ducts to fully optimize the heating system.

**Installation cost:**

Estimated installed cost: $1600 (including $600 total labor cost)
Source of cost estimate: Similar projects

**Economics (without incentives):**

| 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, $ | est. energy & operating 1st year cost savings, $ | life of measure, yrs | est. lifetime cost savings, $ | simple payback, yrs | lifetime return on investment, % | annual return on investment, % | internal rate of return, % | net present value, $ | CO2 reduced, lbs/yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Install Automatic Vent Dampers on boiler Flue piping for Two Boilers | Published Case Studies | 1600 | none at this time | 1,600 | 0 | 0.0 | 1,800 | 1.4 | 0 | 2,741 | 12 | 32,897 | 0.6 | 1956 | 163 | 171 | 25,365 | 21,060 |

**Assumptions:** Typical savings for installing vent dampers range from 3-8%, as a percentage of the energy consumption for the boilers. To be conservative SWA assumed 3% efficiency improvement on both boilers and 900 hours of operation.

**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 # 2: *Replace 40 kW DWH with 70 MBH Natural Gas DWH*

### Description:

Currently, the Mullica Elementary & Middle School has several two domestic hot water heaters, two small electric heaters and two large storage type heaters, one electric and one natural gas. The large electric heater has no visible nameplate with four heating elements within a circa 500 gallon storage tank, installed in 1961 which is well beyond its useful life. Due to age and poor condition two of the four heating elements do not operate. The remaining heating elements are rated at 20 kilowatts each, for a total operating capacity of 40 kW. Typically thermal efficiency of electric heaters is virtually 100% since all of the generated heat is transferred to the water, with thermal losses only due to the storage tank being poorly insulated. Due to age the unit is very unreliable, the storage tank is unnecessarily large, taking up significant space and the unit is not operating at full capacity..

Based on discussions with Mullica staff, SWA recommends that the existing electric heaters and tank should be replaced with a Sand blaster Model # SDV75 70NE natural gas heater with 70,000 Btu/hr capacity and 75 Gallon storage, and should be installed in the DHW room near the gymnasium. This will provide adequate supplement to the existing natural gas PolyShield domestic hot water heater located in the mechanical room. Although Mullica Schools have a special consortium electric rate, it is still more economical to use natural gas as a fuel source than electric. Current incentives through NJ Clean Energy for this type of gas heater replacement are $2 per MBH.

### Installation cost:

Estimated installed cost: $4,695 (including $2,000 labor)
Source of cost estimate: Similar projects, Quote

**Economics (with incentives):**

| 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 cost savings, $ | simple payback, yrs | lifetime return on investment, % | annual return on investment, % | internal rate of return, % | net present value, $ | $CO_2$ reduced, lbs/yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Replace electric heater with 70 MBH, State, SandBlaster M# SDV75 70NE, 75 Gal storage | similar projects | 4,695 | 140 | 4,555 | 48,240 | 40.0 | -1,893 | -0.2 | 0 | 4,257 | 10 | 42567 | 1.1 | 835 | 83 | 93 | 31,756 | 43,943 |

**Assumptions:** SWA estimated the cost of the system based on a manufacturers quote. Energy savings was calculated based on an assumption of 1206 full load hours of operation and respective rated efficiencies for each unit.

**Rebates/financial incentives:**

*NJ Clean Energy - Renewable Energy Incentive Program, Incentive based on $2 / MBH for Gas Heaters greater than 50 Gallons. Incentive amount for this application is $140 for the Mullica Elementary & Middle School.*
*www.NJCleanEnergy.com/ssb*

**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 through the Direct Install Program.*
*http://www.njcleanenergy.com/commercial-industrial/programs/direct-install*

## ECM # 3: *Install Vending Misers*

**Description:**
The Mullica Elementary & Middle School building has two vending machines in the lounge in Room 40, one is a snack machine and one is a drink machine. 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 and ensure the product stays cold.

**Installation cost:**

Estimated installed cost: $458 (includes $150 in labor)
Source of cost estimate: www.usatech.com *and established costs*

**Economics (without incentives):**

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Install (1) Drink and (1) Snack vending machine energy misers | www.usatech.com and established costs | 458 | none at this time | 458 | 1,891 | 0.9 | 0 | 0.1 | 0 | 280 | 12 | 3,358 | 1.6 | 633% | 53% | 61% | 2,295 | 2,591 |

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

Description:

There are two Harford walk-in cooler boxes in the kitchen of the Mullica Public School. Typically, the evaporator and condenser fans of walk-in coolers will run 24 hours per day, 7 days per week. The motors on these fans are standard efficiency, shaded pole motors; below is a photo of a typical assembly for a walk-in cooler. There are (2) evaporator cooler fans motors and (2) condenser fan motors. Nameplates were not very legible and it is assumed that the two fan motors are 1 Hp and the two compressor motors are fractional horsepower. The Mullica Public School will realize energy savings by utilizing premium efficiency motors for these fans.

Estimated installed cost: $1,000, including $200 labor
Source of cost estimate: Similar projects and DOE Motor Master International selection & savings analysis

Economics (with incentives):

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| replace 2, 1 Hp cond fan and 2 fractional Hp motors with Premium Efficiency on Hartford walk-in refrigerated boxes | similar projects, DOE Motor Master + International | 1,000 | 90 | 910 | 2,000 | 0.9 | 0 | 0.1 | 0 | 296 | 12 | 3,552 | 3.1 | 290 | 24 | 31 | 2,002 | 2,740 |

Assumptions: SWA calculated the savings using the DOE Motor Master International selection and calculator for 1 HP motor replacement 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, $45 for each 1 HP motor replaced. 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#5: *Install 50 kW PV system*

### Description:

Currently, the Mullica Elementary & Middle School 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 Mullica Board of Education further review installing a 50 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 Mullica Elementary & Middle School is not eligible for a 30% federal tax credit since they are a non-profit organization. Instead, the Mullica 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. Atlantic City Electric provides the ability to buy SRECs at $600 / MWh or best market offer.

The size of the system was determined using the amount of roof surface area as a limiting factor, as well as the facilities annual base load. A PV system could be installed on a portion of the sloped roof that faces South or West. A commercial multi-crystalline 123 watt panel (17.2 volts, 7.16 amps) has 10.7 square feet of surface area (11.51 watts per square foot). A 50 kW system needs approximately 400 panels which would take up 4,348 square feet. The installation of a renewable Solar Photovoltaic power generating system could serve as a good educational tool and exhibit for the community as well.

### Installation cost:

Estimated installed cost: $350,000 (labor included at $3/Watt, totaling $150,000)
Source of cost estimate: Similar projects

**Economics (with incentives):**

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Install 50 kW Solar Photo-voltaic system | Similar Projects | 350,000 | 50,000 | 300,000 | 59,000 | 50 | 0 | 1.6 | 0 | 44,132 | 25 | 749,300 | 6.8 | 149.8 | 6.0 | 12.6 | 865,272 | 105,640 |

**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 (123 Watts, Model ND-123UJF). 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 60kW or less. Incentive amount for this application is $50,000 for the Mullica Elementary & Middle School.*
*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 of $35,400 / year, based on $600/SREC, has been incorporated in the above costs for the Community Center 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# 6, 7 & 8: Building Lighting Upgrades*

**Description:**

There are several incandescent 60 Watt lights used in the building. SWA recommends replacing these lights with compact fluorescent lights with typically a third of the wattage for the same lumen output. Most of the lighting in the school is T8 lgihts with electronic ballasts but there are several T12 lights with magnetic ballast installed through out the building. SWA recommends replacing these with electronic ballast T8 fixtures for energy savings in lamp wattage and ballast wattage and increased lamp lifespan. SWA also recommends installing 35 occupancy sensors to control the lighting in rooms that do not have consistent use throughout the day such as bathrooms, storage rooms and mechanical rooms. The labor in all these installations was evaluated using prevailing electrical contractor wages.

**Installation cost:**

Estimated installed cost: $10,135, including $3,000 total labor cost
Source of cost estimate: Similar projects

**Economics (with incentives):**

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 New T8 fixtures to be installed with incentives | RS Means, lit search | 3,230 | 300 | 2,930 | 209 | 0.04 | 0 | 0.0 | 11 | 42 | 15 | 624 | 70.5 | -73 | -5 | NA | -2,575 | 286 |
| 4 New CFL fixtures to be installed with incentives | RS Means, lit search | 205 | none at this time | 205 | 76 | 0.02 | 0 | 0.0 | 0 | 11 | 5 | 54 | 18.9 | -74 | -15 | NA | -155 | 104 |
| 35 New occupancy sensors to be installed with incentives | RS Means, lit search | 7,700 | 700 | 7,000 | 2,586 | 0.54 | 0 | 0.1 | 0 | 383 | 15 | 5742 | 18.3 | -18 | -1 | -10 | -3,735 | 3,543 |
| **TOTALS** | | **11,135** | | **10,135** | **2,871** | **0.60** | **0** | **0.1** | **10** | **435** | | **6,420** | **23.29** | **-** | **-** | **-** | **-** | **3,934** |

**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 – T12 to T8 -1 &2 lamp- $25/fixture, 3&4 lamp - $30/fixture - $780 total, Wall Mounted Occupancy Sensors - $20/sensor - $700 total*

**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:**

*Wind power generation is not cost effective for this building and would not be recommended due to insufficient wind conditions in this area of New Jersey.*

### 5.3. Solar Photovoltaic

Pleases see the above recommended ECM# 5.

### 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 insufficient domestic hot water use thorough the summer months.*

### 5.6. Geothermal

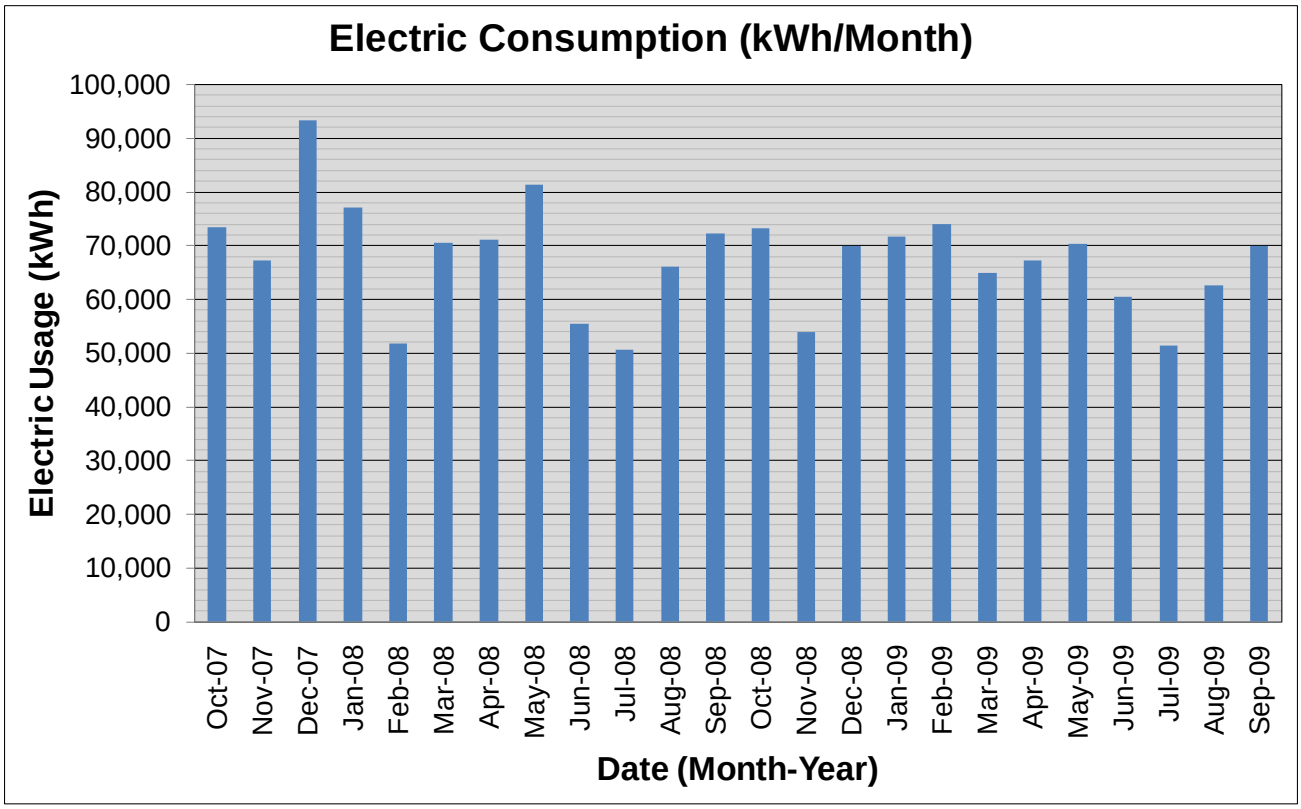
**Description:**

*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.*

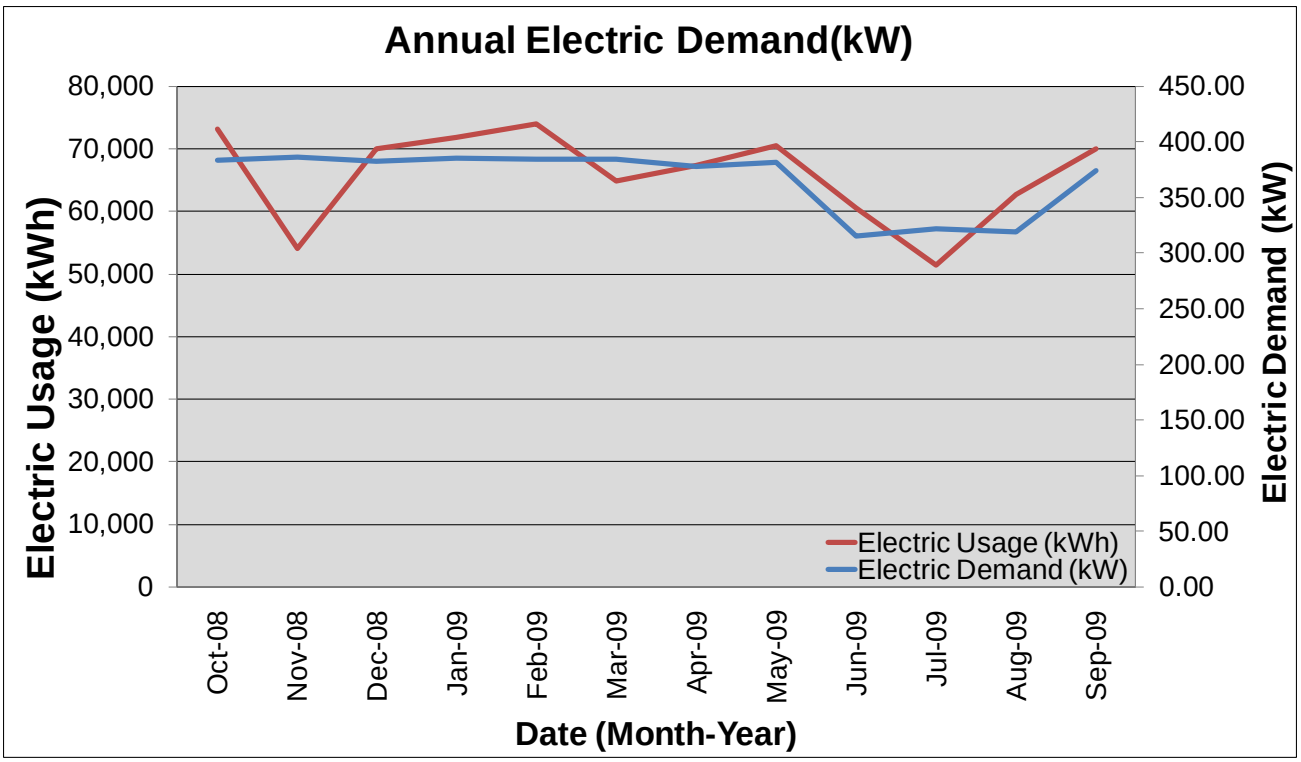
## 6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

### 6.1. Load profiles

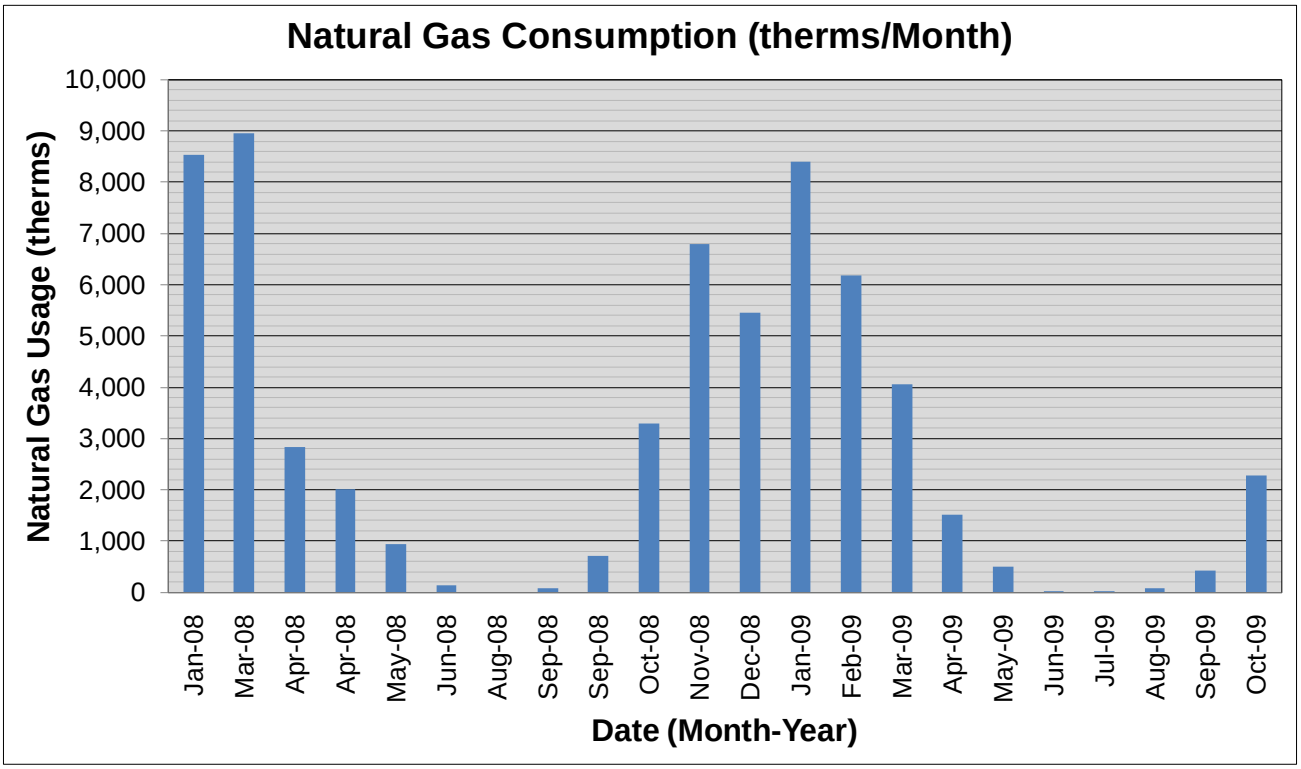
The following are charts that show the annual electric and natural gas load profiles for the Mullica Elementary & Middle School.



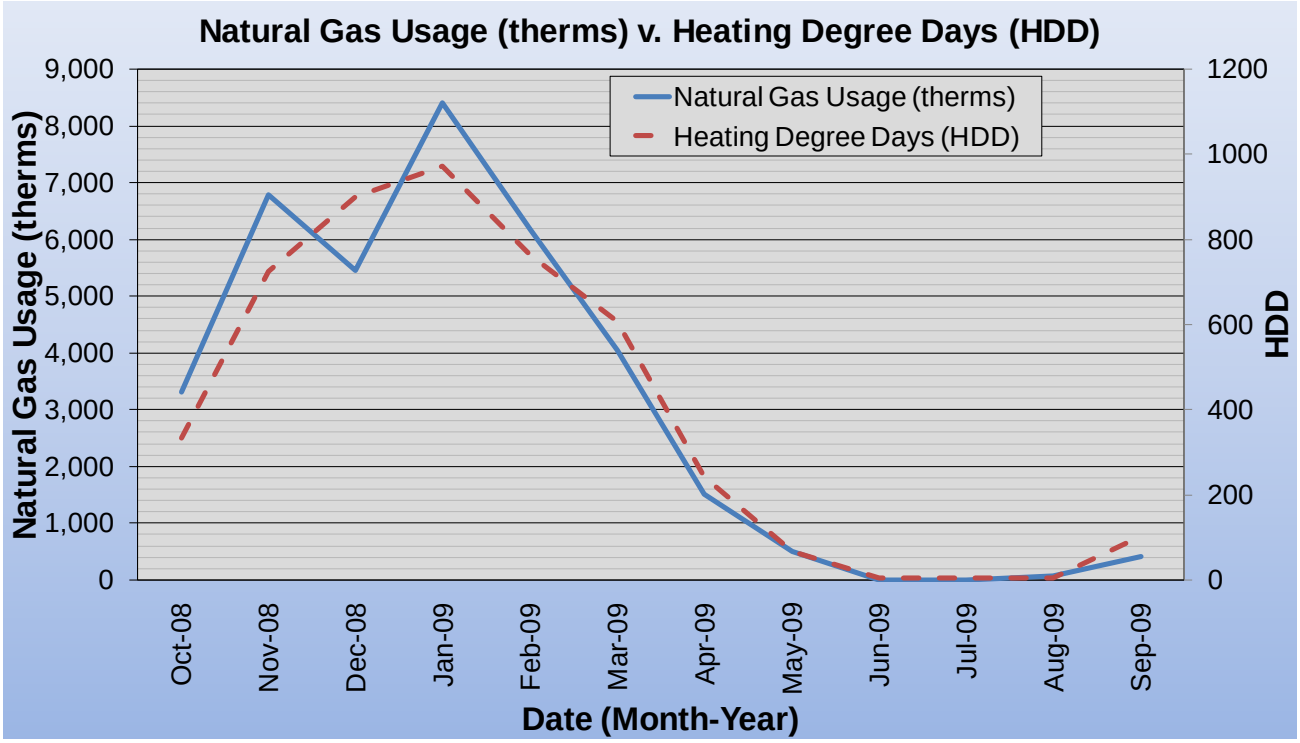

Some minor unusual electric fluctuations shown may be due to adjustments between estimated and actual meter readings. Also, note on the following chart how the electrical Demand is follows electric consumption.




The following is a chart of the natural gas annual load profile for the building, peaking in the coldest months of the year.

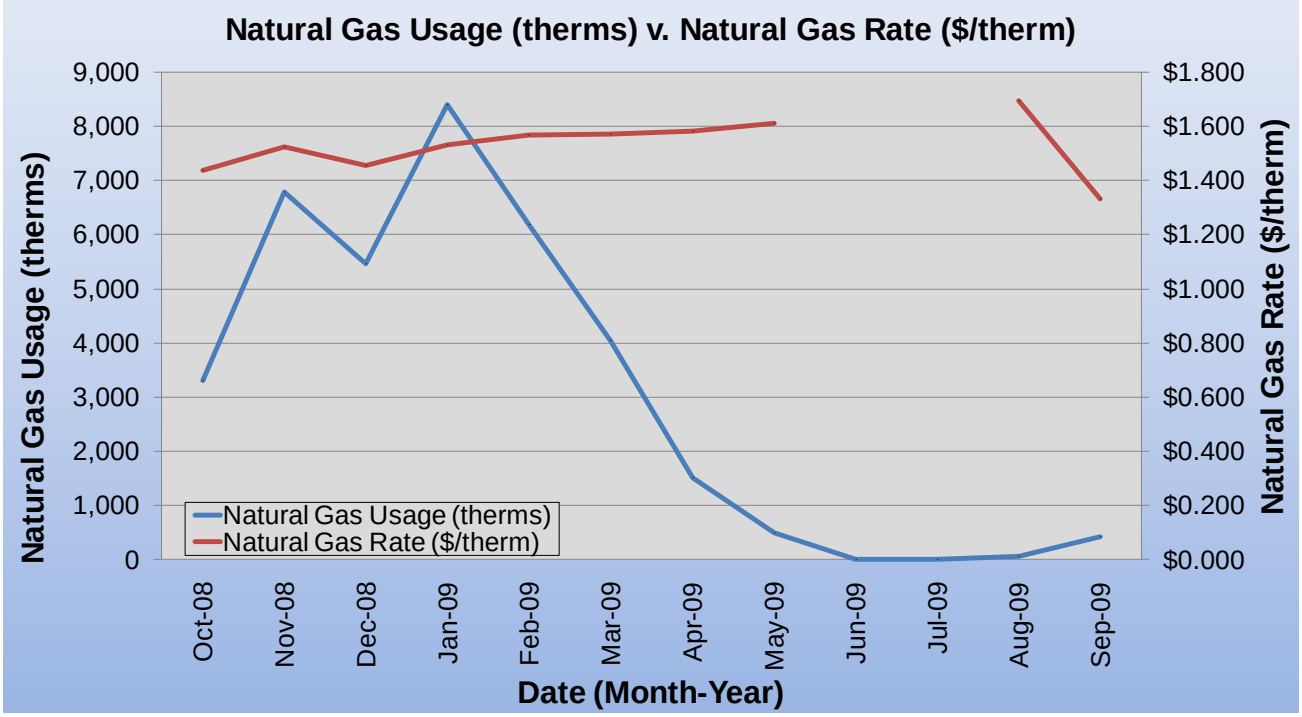


Below is a chart showing how the natural gas consumption follows the “heating degree days” curve. Some utility bills have more than one month estimated and combined.

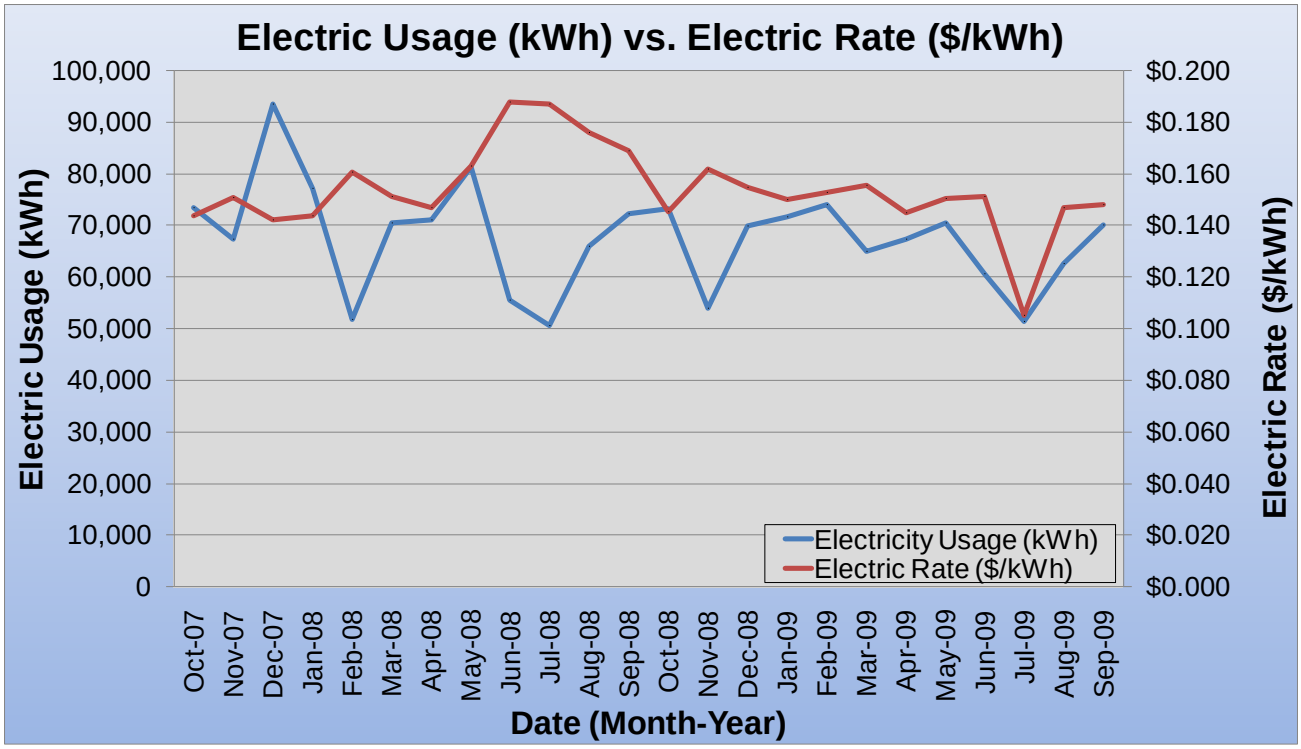



### 6.2. Tariff analysis

Currently, natural gas is provided to the Mullica Elementary & Middle School building via one gas meter with South Jersey Gas acting as the supply and Hess Corporation acting as the transport company, at a general service rate. The suppliers’ general service rate for natural gas charges a market-rate price based on use and the Mullica Elementary & Middle 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 and direct fire units. The high gas price per therm peak in the summer may be due to high energy costs that recently occurred and low use caps for the non-heating months, as is the case in June ’09 and July ’09, which have been removed from the graph as to not skew the rate scale. Although the consumption is low, the building pays for fixed costs such as meter reading charges during the summer months. The following chart shows how the natural gas rate changes with usage and time, with outliers removed.




The Mullica Elementary & Middle School is direct-metered and currently purchases electricity from Atlantic City Electric and is part of the Alliance for Competitive Energy Services (ACES), a cooperative pricing system that solicits bids for electric generation services and therefore pays at a much lower rate when compared to the average estimated NJ commercial utility rates. The Mullica Elementary & Middle School 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 electric rate follows consumption with slight increases during the cooling months, due to higher electric demands by HVAC condensing units and air handlers.

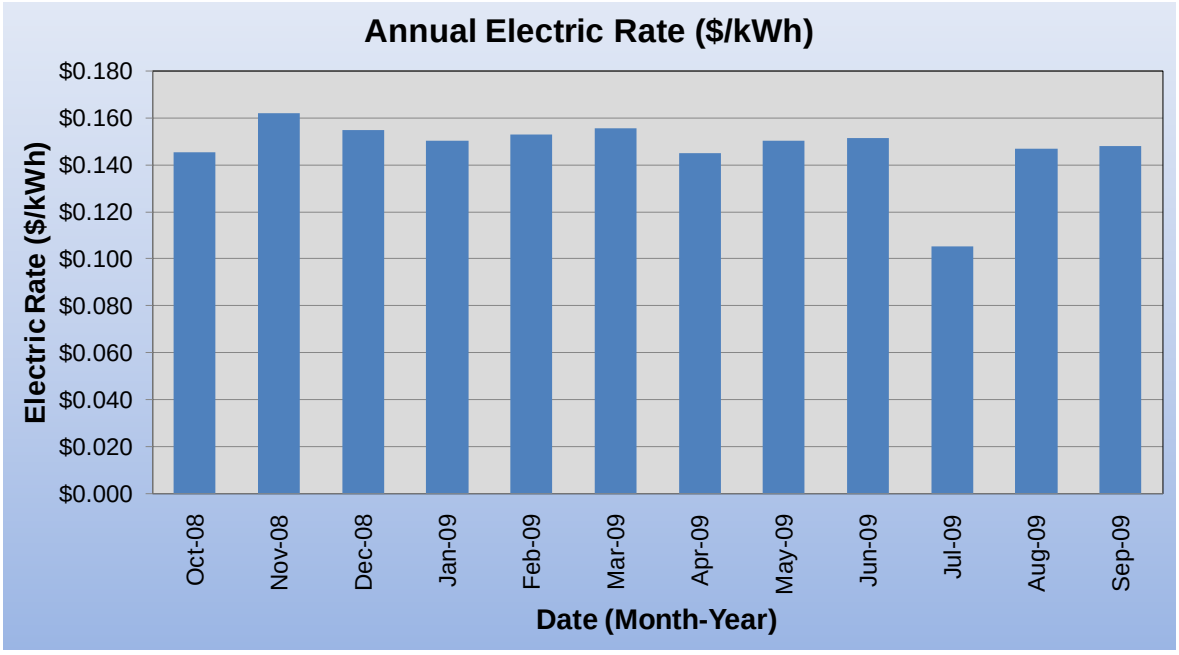


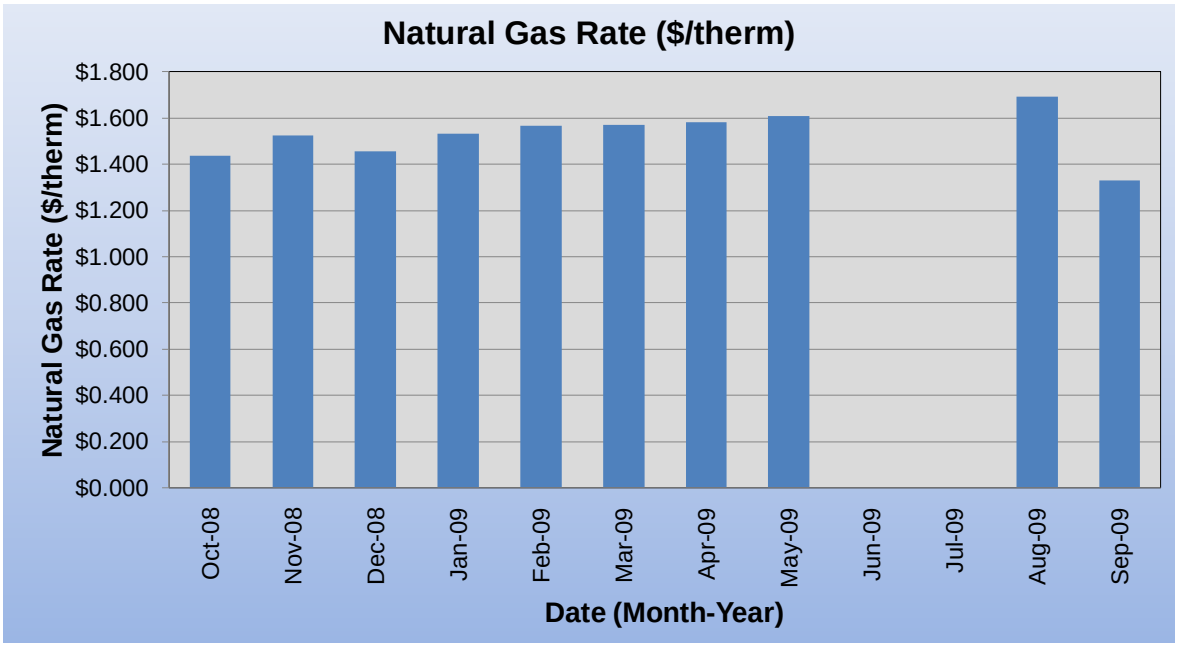

### 6.3. Energy Procurement strategies

The Mullica Elementary & Middle School receives natural gas via one incoming meter. South Jersey Gas provides transport service and Hess Corporation is the gas supplier, therefore there are two separate gas bills from each supplier. Electricity is purchased via two incoming meters for the Mullica Elementary & Middle School from Atlantic City Electric. As of April 2009, Mullica Board of Education district joined the Alliance for Competitive Energy Services (ACES) which solicits bids for electric generation services at a reduced price. As a result, the Mullica Elementary & Middle School is charged for electric supply through a third party supplier, South Jersey Energy, with Atlantic City Electric charging only the transport rate for electric service. SWA analyzed the utility rate for natural gas and electricity supply over an extended period. Electric bill analysis shows fluctuations up to 79% over the most recent 12 month period. Natural gas bill analysis shows fluctuations up to 20% 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 recent escalating energy costs, or due to changes in rate structure through the Alliance for Competitive Energy Services. The average estimated NJ commercial utility rates for electric and gas are $0.150/kWh and $1.550/therm respectively. The Mullica Elementary & Middle School annual electric rates since joining the Alliance for Competitive Energy Services in April 2009 are 5% less than the average estimated NJ commercial electric rates, and natural gas rates are on par with estimated NJ rates. SWA recommends that the Mullica Board of Education consider partnering with other school districts, municipalities, townships and communities to aggregate substantial natural gas consumption 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. Appendix B contains a complete list of third party energy suppliers for the Mullica Township Board of Education service area.

Also, the Mullica Elementary & Middle School 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 Mullica Board of Education may install a back-up emergency generator with a flex-fuel option.

The following charts show the Mullica Elementary & Middle School monthly spending per unit of energy in 2009.



## 7. METHOD OF ANALYSIS

### 7.1. Assumptions and tools (See Appendix C for more details)

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

### 7.2. Disclaimer

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

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

## Appendix A: Lighting Study

| Location | | | Existing Fixture Information | | | | | | | | | | | | Retrofit Information | | | | | | | | | | | | Annual Savings | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Marker | Floor | Room Identification | Fixture Type | Ballast | Lamp Type | # of Fixtures | # of Lamps per Fixture | Watts per Lamp | Controls | Operational Hours per Day | Operational Days per Year | Ballast Wattage | Total Watts | Energy Use kWh/year | Category | Fixture Type | Lamp Type | Ballast | Controls | # of Fixtures | # of Lamps per Fixture | Watts per Lamp | Operational Hours per Day | Operational Days per Year | Ballast Watts | Total Watts | Energy Use kWh/year | Fixture Savings (kWh) | Controls Savings (kWh) | Total Savings (kWh) |
| 1 | B | Stairwell (C16) | Recessed | E | 4'T8 | 1 | 2 | 32 | S | 16 | 260 | 6 | 70 | 291 | N/A | Recessed | 4'T8 | E | S | 1 | 2 | 32 | 16 | 260 | 6 | 70 | 291 | 0 | 0 | 0 |
| 2 | B | Boiler Rm (C10) | Parabolic | E | 4'T8 | 4 | 2 | 32 | S | 2 | 260 | 6 | 280 | 146 | C | Parabolic | 4'T8 | E | OS | 4 | 2 | 32 | 2 | 260 | 6 | 280 | 109 | 0 | 36 | 36 |
| 3 | B | Equipment Rm (C11) | Parabolic | E | 4'T8 | 5 | 2 | 32 | S | 2 | 260 | 6 | 350 | 182 | C | Parabolic | 4'T8 | E | OS | 5 | 2 | 32 | 2 | 260 | 6 | 350 | 137 | 0 | 46 | 46 |
| 4 | B | Storage (C12) | Parabolic | E | 4'T8 | 6 | 2 | 32 | S | 2 | 260 | 6 | 420 | 218 | N/A | Parabolic | 4'T8 | E | S | 6 | 2 | 32 | 2 | 260 | 6 | 420 | 218 | 0 | 0 | 0 |
| 5 | B | Storage (C14) | Parabolic | E | 4'T8 | 2 | 2 | 32 | S | 2 | 260 | 6 | 140 | 73 | N/A | Parabolic | 4'T8 | E | S | 2 | 2 | 32 | 2 | 260 | 6 | 140 | 73 | 0 | 0 | 0 |
| 6 | B | Storage (C13) | Parabolic | E | 4'T8 | 4 | 2 | 32 | S | 2 | 260 | 6 | 280 | 146 | N/A | Parabolic | 4'T8 | E | S | 4 | 2 | 32 | 2 | 260 | 6 | 280 | 146 | 0 | 0 | 0 |
| 7 | B | Hallway (C01) | Parabolic | E | 4'T8 | 16 | 2 | 32 | S | 16 | 260 | 6 | 1,120 | 4,659 | N/A | Parabolic | 4'T8 | E | S | 16 | 2 | 32 | 16 | 260 | 6 | 1120 | 4659 | 0 | 0 | 0 |
| 8 | B | Elevator Machine Rm (C03) | Parabolic | E | 4'T8 | 3 | 2 | 32 | S | 2 | 260 | 6 | 210 | 109 | N/A | Parabolic | 4'T8 | E | S | 3 | 2 | 32 | 2 | 260 | 6 | 210 | 109 | 0 | 0 | 0 |
| 9 | B | Storage (C02) | Parabolic | E | 4'T8 | 3 | 2 | 32 | S | 2 | 260 | 6 | 210 | 109 | N/A | Parabolic | 4'T8 | E | S | 3 | 2 | 32 | 2 | 260 | 6 | 210 | 109 | 0 | 0 | 0 |
| 10 | B | Pump Rm (C04) | Parabolic | E | 4'T8 | 6 | 2 | 32 | S | 2 | 260 | 6 | 420 | 218 | N/A | Parabolic | 4'T8 | E | S | 6 | 2 | 32 | 2 | 260 | 6 | 420 | 218 | 0 | 0 | 0 |
| 11 | B | Lounge (C05) | Pin | N | CFL | 12 | 1 | 18 | S | 9 | 260 | 0 | 216 | 505 | C | Pin | CFL | N | OS | 12 | 1 | 18 | 7 | 260 | 0 | 216 | 379 | 0 | 126 | 126 |
| 12 | B | Elec Rm (C0) | Parabolic | E | 4'T8 | 4 | 2 | 32 | S | 2 | 260 | 6 | 280 | 146 | N/A | Parabolic | 4'T8 | E | S | 4 | 2 | 32 | 2 | 260 | 6 | 280 | 146 | 0 | 0 | 0 |
| 13 | B | Elec Rm (C06) | Parabolic | E | 4'T8 | 3 | 2 | 32 | S | 2 | 260 | 6 | 210 | 109 | N/A | Parabolic | 4'T8 | E | S | 3 | 2 | 32 | 2 | 260 | 6 | 210 | 109 | 0 | 0 | 0 |
| 14 | B | FICC Rm (C09) | 2' U-Shape | E | 4'T8 | 8 | 2 | 32 | S | 9 | 260 | 6 | 560 | 1,310 | C | 2' U-Shape | 4'T8 | E | OS | 8 | 2 | 32 | 7 | 260 | 6 | 560 | 983 | 0 | 328 | 328 |
| 15 | B | Stairwell (C15) | Recessed | E | 4'T8 | 1 | 2 | 32 | S | 16 | 260 | 6 | 70 | 291 | N/A | Recessed | 4'T8 | E | S | 1 | 2 | 32 | 16 | 260 | 6 | 70 | 291 | 0 | 0 | 0 |
| 16 | B | Exit Sign (C01) | Exit Sign | N | LED | 5 | 1 | 5 | S | 24 | 365 | 1 | 30 | 263 | N/A | Exit Sign | LED | N | S | 5 | 1 | 5 | 24 | 365 | 1 | 30 | 263 | 0 | 0 | 0 |
| 17 | B | Exit Sign (C05) | Exit Sign | N | LED | 2 | 1 | 5 | S | 24 | 365 | 1 | 12 | 105 | N/A | Exit Sign | LED | N | S | 2 | 1 | 5 | 24 | 365 | 1 | 12 | 105 | 0 | 0 | 0 |
| 18 | 1 | Stairwell (153) | Recessed | E | 4'T8 | 1 | 2 | 32 | S | 16 | 260 | 6 | 70 | 291 | N/A | Recessed | 4'T8 | E | S | 1 | 2 | 32 | 16 | 260 | 6 | 70 | 291 | 0 | 0 | 0 |
| 19 | 1 | Girl Locker Rm (131) | Parabolic | E | 4'T8 | 7 | 2 | 32 | S | 9 | 260 | 6 | 490 | 1,147 | C | Parabolic | 4'T8 | E | OS | 7 | 2 | 32 | 7 | 260 | 6 | 490 | 860 | 0 | 287 | 287 |
| 20 | 1 | Hallway (140) | Parabolic | E | 2'T8 | 6 | 4 | 17 | S | 16 | 260 | 5 | 438 | 1,822 | N/A | Parabolic | 2'T8 | E | S | 6 | 4 | 17 | 16 | 260 | 5 | 438 | 1822 | 0 | 0 | 0 |
| 21 | 1 | Hallway (140) | Parabolic | E | 4'T8 | 4 | 2 | 32 | S | 16 | 260 | 6 | 280 | 1,165 | N/A | Parabolic | 4'T8 | E | S | 4 | 2 | 32 | 16 | 260 | 6 | 280 | 1165 | 0 | 0 | 0 |
| 22 | 1 | Boy Locker Rm (130) | Parabolic | E | 4'T8 | 7 | 2 | 32 | S | 9 | 260 | 6 | 490 | 1,147 | C | Parabolic | 4'T8 | E | OS | 7 | 2 | 32 | 7 | 260 | 6 | 490 | 860 | 0 | 287 | 287 |
| 23 | 1 | Lobby (128) | 2' U-Shape | E | 4'T8 | 6 | 4 | 32 | S | 9 | 260 | 6 | 804 | 1,881 | N/A | 2' U-Shape | 4'T8 | E | S | 6 | 4 | 32 | 9 | 260 | 6 | 804 | 1881 | 0 | 0 | 0 |
| 24 | 1 | Stairwell (152) | Recessed | E | 4'T8 | 1 | 2 | 32 | S | 16 | 260 | 6 | 70 | 291 | N/A | Recessed | 4'T8 | E | S | 1 | 2 | 32 | 16 | 260 | 6 | 70 | 291 | 0 | 0 | 0 |
| 25 | 1 | Vestibule (126) | Screw-in | N | CFL | 2 | 1 | 18 | S | 16 | 260 | 0 | 36 | 150 | N/A | Screw-in | CFL | N | S | 2 | 1 | 18 | 16 | 260 | 0 | 36 | 150 | 0 | 0 | 0 |
| 26 | 1 | Bathroom W (125) | Screw-in | N | CFL | 3 | 1 | 18 | S | 9 | 260 | 0 | 54 | 126 | C | Screw-in | CFL | N | OS | 3 | 1 | 18 | 7 | 260 | 0 | 54 | 95 | 0 | 32 | 32 |
| 27 | 1 | Bathroom M (123) | Screw-in | N | CFL | 3 | 1 | 18 | S | 9 | 260 | 0 | 54 | 126 | C | Screw-in | CFL | N | OS | 3 | 1 | 18 | 7 | 260 | 0 | 54 | 95 | 0 | 32 | 32 |
| 28 | 1 | Rec Office 127 | 2' U-Shape | E | 4'T8 | 2 | 4 | 32 | S | 9 | 260 | 6 | 268 | 627 | N/A | 2' U-Shape | 4'T8 | E | S | 2 | 4 | 32 | 9 | 260 | 6 | 268 | 627 | 0 | 0 | 0 |
| 29 | Ext | Exterior (Exterior) | Pin | E | CFL | 6 | 2 | 18 | T | 12 | 260 | 0 | 216 | 674 | N/A | Pin | CFL | E | T | 6 | 2 | 18 | 12 | 260 | 0 | 216 | 674 | 0 | 0 | 0 |
| 30 | Ext | Exterior (Exterior) | Pin | E | CFL | 6 | 1 | 18 | T | 12 | 260 | 0 | 108 | 337 | N/A | Pin | CFL | E | T | 6 | 1 | 18 | 12 | 260 | 0 | 108 | 337 | 0 | 0 | 0 |
| 31 | 1 | Vestibule (101) | Screw-in | N | CFL | 2 | 1 | 18 | S | 16 | 260 | 0 | 36 | 150 | N/A | Screw-in | CFL | N | S | 2 | 1 | 18 | 16 | 260 | 0 | 36 | 150 | 0 | 0 | 0 |
| 32 | 1 | Storage (121) | Parabolic | E | 4'T8 | 1 | 2 | 32 | S | 2 | 260 | 6 | 70 | 36 | N/A | Parabolic | 4'T8 | E | S | 1 | 2 | 32 | 2 | 260 | 6 | 70 | 36 | 0 | 0 | 0 |
| 33 | 1 | Concession (120) | Parabolic | E | 4'T8 | 1 | 2 | 32 | S | 9 | 260 | 6 | 70 | 164 | N/A | Parabolic | 4'T8 | E | S | 1 | 2 | 32 | 9 | 260 | 6 | 70 | 164 | 0 | 0 | 0 |
| 34 | 1 | Theatre Office (115) | Parabolic | E | 4'T8 | 1 | 2 | 32 | S | 2 | 260 | 6 | 70 | 36 | N/A | Parabolic | 4'T8 | E | S | 1 | 2 | 32 | 2 | 260 | 6 | 70 | 36 | 0 | 0 | 0 |
| 35 | 1 | Hallway (116) | Screw-in | N | CFL | 8 | 1 | 18 | S | 16 | 260 | 0 | 144 | 599 | N/A | Screw-in | CFL | N | S | 8 | 1 | 18 | 16 | 260 | 0 | 144 | 599 | 0 | 0 | 0 |
| 36 | 1 | Ticket Sales (119) | Parabolic | E | 4'T8 | 1 | 2 | 32 | S | 2 | 260 | 6 | 70 | 36 | N/A | Parabolic | 4'T8 | E | S | 1 | 2 | 32 | 2 | 260 | 6 | 70 | 36 | 0 | 0 | 0 |
| 37 | 1 | Coat Rm (117) | Parabolic | E | 4'T8 | 2 | 2 | 32 | S | 2 | 260 | 6 | 140 | 73 | N/A | Parabolic | 4'T8 | E | S | 2 | 2 | 32 | 2 | 260 | 6 | 140 | 73 | 0 | 0 | 0 |
| 38 | 1 | Locker Rm (134) | Screw-in | N | CFL | 4 | 1 | 18 | S | 9 | 260 | 0 | 72 | 168 | N/A | Screw-in | CFL | N | S | 4 | 1 | 18 | 9 | 260 | 0 | 72 | 168 | 0 | 0 | 0 |
| 39 | 1 | Toilet (139) | Parabolic | E | 4'T8 | 1 | 2 | 32 | S | 9 | 260 | 6 | 70 | 164 | C | Parabolic | 4'T8 | E | OS | 1 | 2 | 32 | 7 | 260 | 6 | 70 | 123 | 0 | 41 | 41 |
| 40 | 1 | Dressing (138) | Parabolic | E | 4'T8 | 1 | 2 | 32 | S | 9 | 260 | 6 | 70 | 164 | N/A | Parabolic | 4'T8 | E | S | 1 | 2 | 32 | 9 | 260 | 6 | 70 | 164 | 0 | 0 | 0 |
| 41 | 1 | Storage (141/142) | Screw-in | N | CFL | 2 | 1 | 18 | S | 2 | 260 | 0 | 36 | 19 | N/A | Screw-in | CFL | N | S | 2 | 1 | 18 | 2 | 260 | 0 | 36 | 19 | 0 | 0 | 0 |
| 42 | 1 | Kitchen (143) | Parabolic | E | 4'T8 | 2 | 2 | 32 | S | 9 | 260 | 6 | 140 | 328 | C | Parabolic | 4'T8 | E | OS | 2 | 2 | 32 | 7 | 260 | 6 | 140 | 246 | 0 | 82 | 82 |
| 43 | 1 | Hallway Theatre (146) | Parabolic | E | 2'T8 | 3 | 4 | 17 | S | 16 | 260 | 5 | 219 | 911 | N/A | Parabolic | 2'T8 | E | S | 3 | 4 | 17 | 16 | 260 | 5 | 219 | 911 | 0 | 0 | 0 |
| 44 | 1 | Dressing (148) | Parabolic | E | 4'T8 | 1 | 2 | 32 | S | 9 | 260 | 6 | 70 | 164 | C | Parabolic | 4'T8 | E | OS | 1 | 2 | 32 | 7 | 260 | 6 | 70 | 123 | 0 | 41 | 41 |
| 45 | 1 | Dressing (148) | Screw-in | N | INC | 12 | 1 | 60 | S | 9 | 260 | 0 | 720 | 1,685 | CFL | Screw-in | CFL | N | OS | 12 | 1 | 18 | 7 | 260 | 0 | 216 | 379 | 1179 | 126 | 1306 |
| 46 | 1 | Bathroom (150/151) | Parabolic | E | 4'T8 | 2 | 2 | 32 | S | 9 | 260 | 6 | 140 | 328 | C | Parabolic | 4'T8 | E | OS | 2 | 2 | 32 | 7 | 260 | 6 | 140 | 246 | 0 | 82 | 82 |
| 47 | 1 | Dressing (149) | Parabolic | E | 4'T8 | 1 | 2 | 32 | S | 9 | 260 | 6 | 70 | 164 | C | Parabolic | 4'T8 | E | OS | 1 | 2 | 32 | 7 | 260 | 6 | 70 | 123 | 0 | 41 | 41 |
| 48 | 1 | Dressing (149) | Screw-in | N | INC | 12 | 1 | 60 | S | 9 | 260 | 0 | 720 | 1,685 | CFL | Screw-in | CFL | N | OS | 12 | 1 | 18 | 7 | 260 | 0 | 216 | 379 | 1179 | 126 | 1306 |
| 49 | 1 | Stairwell (153) | Recessed | E | 4'T8 | 1 | 2 | 32 | S | 16 | 260 | 6 | 70 | 291 | N/A | Recessed | 4'T8 | E | S | 1 | 2 | 32 | 16 | 260 | 6 | 70 | 291 | 0 | 0 | 0 |
| 50 | 1 | Communications (114) | Parabolic | E | 4'T8 | 5 | 2 | 32 | S | 9 | 260 | 6 | 350 | 819 | N/A | Parabolic | 4'T8 | E | S | 5 | 2 | 32 | 9 | 260 | 6 | 350 | 819 | 0 | 0 | 0 |

| Location | | | Existing Fixture Information | | | | | | | | | | | | Retrofit Information | | | | | | | | | | | | Annual Savings | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Marker | Floor | Room Identification | Fixture Type | Ballast | Lamp Type | # of Fixtures | # of Lamps per Fixture | Watts per Lamp | Controls | Operational Hours per Day | Operational Days per Year | Ballast Wattage | Total Watts | Energy Use kWh/year | Category | Fixture Type | Lamp Type | Ballast | Controls | # of Fixtures | # of Lamps per Fixture | Watts per Lamp | Operational Hours per Day | Operational Days per Year | Ballast Watts | Total Watts | Energy Use kWh/year | Fixture Savings (kWh) | Controls Savings (kWh) | Total Savings (kWh) |
| 1 | 1 | Classroom (61) | Parabolic | E | 4'T8 | 20 | 2 | 32 | S | 9 | 190 | 6 | 1,400 | 2,394 | C | Parabolic | 4'T8 | E | DSw | 20 | 2 | 32 | 7 | 190 | 6 | 1400 | 1796 | 0 | 599 | 599 |
| 2 | 1 | Janitor's Closet (61C) | Parabolic | E | 4'T8 | 1 | 2 | 32 | S | 2 | 190 | 6 | 70 | 27 | N/A | Parabolic | 4'T8 | E | S | 1 | 2 | 32 | 2 | 190 | 6 | 70 | 27 | 0 | 0 | 0 |
| 3 | 1 | Classroom (61F) | Exit Sign | E | LED | 2 | 1 | 5 | N | 24 | 365 | 1 | 12 | 105 | N/A | Exit Sign | LED | E | N | 2 | 1 | 5 | 24 | 365 | 1 | 12 | 105 | 0 | 0 | 0 |
| 4 | 1 | Classroom (610) | Exit Sign | E | LED | 2 | 1 | 5 | N | 24 | 365 | 1 | 12 | 105 | N/A | Exit Sign | LED | E | N | 2 | 1 | 5 | 24 | 365 | 1 | 12 | 105 | 0 | 0 | 0 |
| 5 | 1 | Storage Rm (63A) | Exit Sign | E | LED | 1 | 1 | 5 | N | 24 | 365 | 1 | 6 | 53 | N/A | Exit Sign | LED | E | N | 1 | 1 | 5 | 24 | 365 | 1 | 6 | 53 | 0 | 0 | 0 |
| 6 | 1 | Storage Rm (63) | Recessed | E | 4'T8 | 6 | 2 | 32 | S | 2 | 190 | 6 | 420 | 160 | N/A | Recessed | 4'T8 | E | S | 6 | 2 | 32 | 2 | 190 | 6 | 420 | 160 | 0 | 0 | 0 |
| 7 | 1 | Office (63D) | Parabolic | E | 4'T8 | 1 | 2 | 32 | S | 9 | 190 | 6 | 70 | 120 | C | Parabolic | 4'T8 | E | OS | 1 | 2 | 32 | 7 | 190 | 6 | 70 | 90 | 0 | 30 | 30 |
| 8 | 1 | Storage Rm (64) | Recessed | E | 4'T8 | 6 | 2 | 32 | S | 2 | 190 | 6 | 420 | 160 | N/A | Recessed | 4'T8 | E | S | 6 | 2 | 32 | 2 | 190 | 6 | 420 | 160 | 0 | 0 | 0 |
| 9 | 1 | Classroom (62Z) | Parabolic | E | 4'T8 | 15 | 2 | 32 | S | 9 | 190 | 6 | 1,050 | 1,796 | N/A | Parabolic | 4'T8 | E | S | 15 | 2 | 32 | 9 | 190 | 6 | 1050 | 1796 | 0 | 0 | 0 |
| 10 | 1 | Storage Rm (62C) | Recessed | E | 4'T8 | 2 | 2 | 32 | S | 2 | 190 | 6 | 140 | 53 | C | Recessed | 4'T8 | E | OS | 2 | 2 | 32 | 2 | 190 | 6 | 140 | 40 | 0 | 13 | 13 |
| 11 | 1 | Storage Rm (62D) | Parabolic | E | 4'T8 | 1 | 2 | 32 | S | 2 | 190 | 6 | 70 | 27 | C | Parabolic | 4'T8 | E | OS | 1 | 2 | 32 | 2 | 190 | 6 | 70 | 20 | 0 | 7 | 7 |
| 12 | 1 | Office (60) | Parabolic | E | 4'T8 | 6 | 2 | 32 | S | 9 | 190 | 6 | 420 | 718 | N/A | Parabolic | 4'T8 | E | S | 6 | 2 | 32 | 9 | 190 | 6 | 420 | 718 | 0 | 0 | 0 |
| 13 | 1 | Hallway (60H) | Parabolic | E | 4'T8 | 6 | 2 | 32 | S | 16 | 190 | 6 | 420 | 1,277 | N/A | Parabolic | 4'T8 | E | S | 6 | 2 | 32 | 16 | 190 | 6 | 420 | 1277 | 0 | 0 | 0 |
| 14 | 1 | Hallway (60 h exit) | Exit Sign | E | LED | 2 | 1 | 5 | N | 24 | 365 | 1 | 12 | 105 | N/A | Exit Sign | LED | E | N | 2 | 1 | 5 | 24 | 365 | 1 | 12 | 105 | 0 | 0 | 0 |
| 15 | 1 | Classroom (58) | Parabolic | E | 4'T8 | 12 | 3 | 32 | S | 9 | 190 | 10 | 1,272 | 2,175 | N/A | Parabolic | 4'T8 | E | S | 12 | 3 | 32 | 9 | 190 | 10 | 1272 | 2175 | 0 | 0 | 0 |
| 16 | 1 | Lunch Rm (56) | Screw-in | E | CFL | 12 | 2 | 15 | S | 8 | 190 | 0 | 360 | 547 | N/A | Screw-in | CFL | E | S | 12 | 2 | 15 | 8 | 190 | 0 | 360 | 547 | 0 | 0 | 0 |
| 17 | 1 | Kitchen (56) | Parabolic | E | 4'T8 | 2 | 2 | 32 | S | 9 | 190 | 6 | 140 | 239 | N/A | Parabolic | 4'T8 | E | S | 2 | 2 | 32 | 9 | 190 | 6 | 140 | 239 | 0 | 0 | 0 |
| 18 | 1 | Storage Rm (56) | Parabolic | E | 4'T8 | 1 | 2 | 32 | S | 2 | 190 | 6 | 70 | 27 | N/A | Parabolic | 4'T8 | E | S | 1 | 2 | 32 | 2 | 190 | 6 | 70 | 27 | 0 | 0 | 0 |
| 19 | 1 | Storage Rm (56) | Parabolic | E | 4'T8 | 2 | 2 | 32 | S | 2 | 190 | 6 | 140 | 53 | N/A | Parabolic | 4'T8 | E | S | 2 | 2 | 32 | 2 | 190 | 6 | 140 | 53 | 0 | 0 | 0 |
| 20 | 1 | Bathroom Men (56) | Parabolic | E | 4'T8 | 1 | 2 | 32 | S | 9 | 190 | 6 | 70 | 120 | C | Parabolic | 4'T8 | E | OS | 1 | 2 | 32 | 7 | 190 | 6 | 70 | 90 | 0 | 30 | 30 |
| 21 | 1 | Classroom (57) | Parabolic | E | 4'T8 | 18 | 2 | 32 | S | 9 | 190 | 6 | 1,260 | 2,155 | N/A | Parabolic | 4'T8 | E | S | 18 | 2 | 32 | 9 | 190 | 6 | 1260 | 2155 | 0 | 0 | 0 |
| 22 | 1 | Storage Rm (55) | Recessed | E | 4'T8 | 8 | 2 | 32 | S | 2 | 190 | 6 | 560 | 213 | C | Recessed | 4'T8 | E | OS | 8 | 2 | 32 | 2 | 190 | 6 | 560 | 160 | 0 | 53 | 53 |
| 23 | 1 | Storage Rm (55) | Screw-in | E | Inc | 1 | 2 | 60 | S | 2 | 190 | 0 | 120 | 46 | CFL | Screw-in | CFL | E | S | 1 | 2 | 20 | 2 | 190 | 0 | 40 | 15 | 30 | 0 | 30 |
| 24 | 1 | Storage Rm (55) | Screw-in | E | Inc | 2 | 1 | 60 | S | 2 | 190 | 0 | 120 | 46 | CFL | Screw-in | CFL | E | S | 2 | 1 | 20 | 2 | 190 | 0 | 40 | 15 | 30 | 0 | 30 |
| 25 | 1 | Science Room / Laboratory (54) | Parabolic | E | 4'T8 | 12 | 2 | 32 | S | 8 | 190 | 6 | 840 | 1,277 | N/A | Parabolic | 4'T8 | E | S | 12 | 2 | 32 | 8 | 190 | 6 | 840 | 1277 | 0 | 0 | 0 |
| 26 | 1 | Bathroom Men (50's) | Recessed | E | 4'T8 | 2 | 2 | 32 | S | 9 | 190 | 6 | 140 | 239 | C | Recessed | 4'T8 | E | OS | 2 | 2 | 32 | 7 | 190 | 6 | 140 | 180 | 0 | 60 | 60 |
| 27 | 1 | Hallway (50's) | Recessed | E | 4'T8 | 9 | 2 | 32 | S | 16 | 190 | 6 | 630 | 1,915 | N/A | Recessed | 4'T8 | E | S | 9 | 2 | 32 | 16 | 190 | 6 | 630 | 1915 | 0 | 0 | 0 |
| 28 | 1 | Bathroom Women (50's) | Recessed | E | 4'T8 | 2 | 2 | 32 | S | 9 | 190 | 6 | 140 | 239 | C | Recessed | 4'T8 | E | OS | 2 | 2 | 32 | 7 | 190 | 6 | 140 | 180 | 0 | 60 | 60 |
| 29 | 1 | Office (50's) | Recessed | E | 4'T8 | 2 | 2 | 32 | S | 9 | 190 | 6 | 140 | 239 | N/A | Recessed | 4'T8 | E | S | 2 | 2 | 32 | 9 | 190 | 6 | 140 | 239 | 0 | 0 | 0 |
| **30** | **1** | **Gymnasium (Gym)** | **Parabolic** | **E** | **4'T8** | **25** | **6** | **32** | **S** | **9** | **190** | **15** | **5,175** | **8,849** | **#N/A** | **Parabolic** | **4'T8** | **E** | **S** | **25** | **6** | **32** | **9** | **190** | **15** | **5175** | **8849** | **0** | **0** | **0** |
| 31 | 1 | Gymnasium (Gym) | Exit Sign | E | LED | 4 | 1 | 5 | N | 24 | 365 | 1 | 24 | 210 | N/A | Exit Sign | LED | E | N | 4 | 1 | 5 | 24 | 365 | 1 | 24 | 210 | 0 | 0 | 0 |
| 32 | 1 | Office (51) | Parabolic | E | 4'T8 | 9 | 3 | 32 | S | 9 | 190 | 10 | 954 | 1,631 | N/A | Parabolic | 4'T8 | E | S | 9 | 3 | 32 | 9 | 190 | 10 | 954 | 1631 | 0 | 0 | 0 |
| 33 | 1 | Office (Teacher Workroom) | Parabolic | E | 4'T8 | 4 | 3 | 32 | S | 9 | 190 | 10 | 424 | 725 | N/A | Parabolic | 4'T8 | E | S | 4 | 3 | 32 | 9 | 190 | 10 | 424 | 725 | 0 | 0 | 0 |
| 34 | 1 | Pantry (Teacher Pantry) | Recessed | E | 4'T8 | 4 | 2 | 32 | S | 9 | 190 | 6 | 280 | 479 | N/A | Recessed | 4'T8 | E | S | 4 | 2 | 32 | 9 | 190 | 6 | 280 | 479 | 0 | 0 | 0 |
| 35 | 1 | Bathroom (Teacher BR) | Recessed | E | 4'T8 | 1 | 2 | 32 | S | 9 | 190 | 6 | 70 | 120 | C | Recessed | 4'T8 | E | OS | 1 | 2 | 32 | 7 | 190 | 6 | 70 | 90 | 0 | 30 | 30 |
| 36 | 1 | Office (Middle School) | Parabolic | E | 4'T8 | 7 | 2 | 32 | S | 9 | 190 | 6 | 490 | 838 | N/A | Parabolic | 4'T8 | E | S | 7 | 2 | 32 | 9 | 190 | 6 | 490 | 838 | 0 | 0 | 0 |
| **37** | **1** | **Office (Middle School)** | **Screw-in** | **E** | **CFL** | **8** | **8** | **26** | **S** | **9** | **190** | **0** | **1,664** | **2,845** | **#N/A** | **Screw-in** | **CFL** | **N** | **S** | **8** | **8** | **26** | **9** | **190** | **0** | **1664** | **2845** | **0** | **0** | **0** |
| 38 | 1 | Office (Middle School) | Parabolic | E | 4'T8 | 2 | 2 | 32 | S | 9 | 190 | 6 | 140 | 239 | N/A | Parabolic | 4'T8 | E | S | 2 | 2 | 32 | 9 | 190 | 6 | 140 | 239 | 0 | 0 | 0 |
| 39 | 1 | Hallway (50S H) | Recessed | E | 2'T8 | 4 | 2 | 17 | S | 16 | 190 | 3 | 148 | 450 | N/A | Recessed | 2'T8 | E | S | 4 | 2 | 17 | 16 | 190 | 3 | 148 | 450 | 0 | 0 | 0 |
| 40 | 1 | Hallway (50S H) | Exit Sign | E | LED | 2 | 1 | 5 | N | 24 | 365 | 1 | 12 | 105 | N/A | Exit Sign | LED | E | N | 2 | 1 | 5 | 24 | 365 | 1 | 12 | 105 | 0 | 0 | 0 |
| 41 | 1 | Mechanical Rm (DHW Room) | Screw-in | E | CFL | 2 | 1 | 26 | S | 2 | 190 | 0 | 52 | 20 | N/A | Screw-in | CFL | E | S | 2 | 1 | 26 | 2 | 190 | 0 | 52 | 20 | 0 | 0 | 0 |
| 42 | 1 | Classroom (71) | Recessed | E | 4'T8 | 18 | 2 | 32 | S | 9 | 190 | 6 | 1,260 | 2,155 | N/A | Recessed | 4'T8 | E | S | 18 | 2 | 32 | 9 | 190 | 6 | 1260 | 2155 | 0 | 0 | 0 |
| 43 | 1 | Classroom (73) | Recessed | E | 4'T8 | 18 | 2 | 32 | S | 9 | 190 | 6 | 1,260 | 2,155 | N/A | Recessed | 4'T8 | E | S | 18 | 2 | 32 | 9 | 190 | 6 | 1260 | 2155 | 0 | 0 | 0 |
| 44 | 1 | Gymnasium STORAGE 74 (72) | Recessed | E | 4'T8 | 12 | 2 | 32 | S | 2 | 190 | 6 | 840 | 319 | N/A | Recessed | 4'T8 | E | S | 12 | 2 | 32 | 2 | 190 | 6 | 840 | 319 | 0 | 0 | 0 |
| 45 | 1 | Office (Gym) | Recessed | E | 4'T8 | 4 | 2 | 32 | S | 9 | 190 | 6 | 280 | 479 | N/A | Recessed | 4'T8 | E | S | 4 | 2 | 32 | 9 | 190 | 6 | 280 | 479 | 0 | 0 | 0 |
| 46 | 1 | Bathroom (Gym) | Screw-in | E | CFL | 2 | 1 | 26 | S | 9 | 190 | 0 | 52 | 89 | C | Screw-in | CFL | E | OS | 2 | 1 | 26 | 7 | 190 | 0 | 52 | 67 | 0 | 22 | 22 |
| 47 | 1 | Mechanical Rm (Electrical Rm) | Screw-in | E | CFL | 4 | 1 | 26 | S | 2 | 190 | 0 | 104 | 40 | N/A | Screw-in | CFL | E | S | 4 | 1 | 26 | 2 | 190 | 0 | 104 | 40 | 0 | 0 | 0 |
| 48 | 1 | Mechanical Rm (Electrical Rm) | Exit Sign | E | LED | 1 | 1 | 5 | N | 24 | 365 | 1 | 6 | 53 | N/A | Exit Sign | LED | E | N | 1 | 1 | 5 | 24 | 365 | 1 | 6 | 53 | 0 | 0 | 0 |
| 49 | 1 | Bathroom Women (70's) | Screw-in | E | CFL | 1 | 1 | 26 | S | 9 | 190 | 0 | 26 | 44 | C | Screw-in | CFL | E | OS | 1 | 1 | 26 | 7 | 190 | 0 | 26 | 33 | 0 | 11 | 11 |
| 50 | 1 | Bathroom Men (70's) | Screw-in | E | CFL | 1 | 1 | 26 | S | 9 | 190 | 0 | 26 | 44 | C | Screw-in | CFL | E | OS | 1 | 1 | 26 | 7 | 190 | 0 | 26 | 33 | 0 | 11 | 11 |

| Location | | | Existing Fixture Information | | | | | | | | | | | | Retrofit Information | | | | | | | | | | | | Annual Savings | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Marker | Floor | Room Identification | Fixture Type | Ballast | Lamp Type | # of Fixtures | # of Lamps per Fixture | Watts per Lamp | Controls | Operational Hours per Day | Operational Days per Year | Ballast Wattage | Total Watts | Energy Use kWh/year | Category | Fixture Type | Lamp Type | Ballast | Controls | # of Fixtures | # of Lamps per Fixture | Watts per Lamp | Operational Hours per Day | Operational Days per Year | Ballast Watts | Total Watts | Energy Use kWh/year | Fixture Savings (kWh) | Controls Savings (kWh) | Total Savings (kWh) |
| 51 | 1 | Bathroom Men (70's) | Recessed | E | 4'T8 | 2 | 2 | 32 | S | 9 | 190 | 6 | 140 | 239 | C | Recessed | 4'T8 | E | OS | 2 | 2 | 32 | 7 | 190 | 6 | 140 | 180 | 0 | 60 | 60 |
| 52 | 1 | Break Room (70's) | Recessed | E | 2'T8 | 1 | 2 | 17 | S | 9 | 190 | 3 | 37 | 63 | C | Recessed | 2'T8 | E | OS | 1 | 2 | 17 | 7 | 190 | 3 | 37 | 47 | 0 | 16 | 16 |
| 53 | 1 | Bathroom Men (70's) | Recessed | E | 2'T8 | 2 | 2 | 17 | S | 9 | 190 | 3 | 74 | 127 | C | Recessed | 2'T8 | E | OS | 2 | 2 | 17 | 7 | 190 | 3 | 74 | 95 | 0 | 32 | 32 |
| 54 | 1 | Classroom (77) | Recessed | E | 4'T8 | 18 | 2 | 32 | S | 9 | 190 | 6 | 1,260 | 2,155 | N/A | Recessed | 4'T8 | E | S | 18 | 2 | 32 | 9 | 190 | 6 | 1260 | 2155 | 0 | 0 | 0 |
| 55 | 1 | Classroom (78) | Recessed | E | 4'T8 | 18 | 2 | 32 | S | 9 | 190 | 6 | 1,260 | 2,155 | N/A | Recessed | 4'T8 | E | S | 18 | 2 | 32 | 9 | 190 | 6 | 1260 | 2155 | 0 | 0 | 0 |
| 56 | 1 | Classroom (80) | Recessed | E | 4'T8 | 18 | 2 | 32 | S | 9 | 190 | 6 | 1,260 | 2,155 | N/A | Recessed | 4'T8 | E | S | 18 | 2 | 32 | 9 | 190 | 6 | 1260 | 2155 | 0 | 0 | 0 |
| 57 | 1 | Classroom (79) | Recessed | E | 4'T8 | 18 | 2 | 32 | S | 9 | 190 | 6 | 1,260 | 2,155 | N/A | Recessed | 4'T8 | E | S | 18 | 2 | 32 | 9 | 190 | 6 | 1260 | 2155 | 0 | 0 | 0 |
| 58 | 1 | Classroom (82) | Recessed | E | 4'T8 | 18 | 2 | 32 | S | 9 | 190 | 6 | 1,260 | 2,155 | N/A | Recessed | 4'T8 | E | S | 18 | 2 | 32 | 9 | 190 | 6 | 1260 | 2155 | 0 | 0 | 0 |
| 59 | 1 | Classroom (81) | Recessed | E | 4'T8 | 18 | 2 | 32 | S | 9 | 190 | 6 | 1,260 | 2,155 | N/A | Recessed | 4'T8 | E | S | 18 | 2 | 32 | 9 | 190 | 6 | 1260 | 2155 | 0 | 0 | 0 |
| 60 | 1 | Classroom (84) | Recessed | E | 4'T8 | 18 | 2 | 32 | S | 9 | 190 | 6 | 1,260 | 2,155 | N/A | Recessed | 4'T8 | E | S | 18 | 2 | 32 | 9 | 190 | 6 | 1260 | 2155 | 0 | 0 | 0 |
| 61 | 1 | Classroom (83) | Recessed | E | 4'T8 | 18 | 2 | 32 | S | 9 | 190 | 6 | 1,260 | 2,155 | N/A | Recessed | 4'T8 | E | S | 18 | 2 | 32 | 9 | 190 | 6 | 1260 | 2155 | 0 | 0 | 0 |
| 62 | 1 | Classroom (86) | Recessed | E | 4'T8 | 18 | 2 | 32 | S | 9 | 190 | 6 | 1,260 | 2,155 | N/A | Recessed | 4'T8 | E | S | 18 | 2 | 32 | 9 | 190 | 6 | 1260 | 2155 | 0 | 0 | 0 |
| 63 | 1 | Classroom (85) | Recessed | E | 4'T8 | 18 | 2 | 32 | S | 9 | 190 | 6 | 1,260 | 2,155 | N/A | Recessed | 4'T8 | E | S | 18 | 2 | 32 | 9 | 190 | 6 | 1260 | 2155 | 0 | 0 | 0 |
| 64 | 1 | Hallway (80's) | Exit Sign | E | LED | 7 | 1 | 5 | N | 24 | 365 | 1 | 42 | 368 | N/A | Exit Sign | LED | E | N | 7 | 1 | 5 | 24 | 365 | 1 | 42 | 368 | 0 | 0 | 0 |
| 65 | 1 | Hallway (80's) | Screw-in | N | CFL | 2 | 1 | 26 | S | 16 | 190 | 0 | 52 | 158 | N/A | Screw-in | CFL | N | S | 2 | 1 | 26 | 16 | 190 | 0 | 52 | 158 | 0 | 0 | 0 |
| 66 | 1 | Hallway (80's) | Recessed | E | 2'T8 | 14 | 2 | 17 | S | 16 | 190 | 3 | 518 | 1,575 | N/A | Recessed | 2'T8 | E | S | 14 | 2 | 17 | 16 | 190 | 3 | 518 | 1575 | 0 | 0 | 0 |
| 67 | 1 | Hallway (90's) | Recessed | E | 4'T8 | 19 | 2 | 32 | S | 16 | 190 | 6 | 1,330 | 4,043 | N/A | Recessed | 4'T8 | E | S | 19 | 2 | 32 | 16 | 190 | 6 | 1330 | 4043 | 0 | 0 | 0 |
| 68 | 1 | Hallway (90's) | Exit Sign | E | LED | 5 | 1 | 5 | N | 24 | 365 | 1 | 30 | 263 | N/A | Exit Sign | LED | E | N | 5 | 1 | 5 | 24 | 365 | 1 | 30 | 263 | 0 | 0 | 0 |
| 69 | 1 | Bathroom Women (90's) | Recessed | E | 4'T8 | 1 | 2 | 32 | S | 9 | 190 | 6 | 70 | 120 | C | Recessed | 4'T8 | E | OS | 1 | 2 | 32 | 7 | 190 | 6 | 70 | 90 | 0 | 30 | 30 |
| 70 | 1 | Bathroom Women (90's) | Recessed | E | 2'T8 | 2 | 2 | 17 | S | 9 | 190 | 3 | 74 | 127 | C | Recessed | 2'T8 | E | OS | 2 | 2 | 17 | 7 | 190 | 3 | 74 | 95 | 0 | 32 | 32 |
| 71 | 1 | JANITOR Closet (90's) | Recessed | E | 4'T8 | 1 | 2 | 32 | S | 2 | 190 | 6 | 70 | 27 | N/A | Recessed | 4'T8 | E | S | 1 | 2 | 32 | 2 | 190 | 6 | 70 | 27 | 0 | 0 | 0 |
| 72 | 1 | Bathroom Men (90's) | Recessed | E | 4'T8 | 1 | 2 | 32 | S | 9 | 190 | 6 | 70 | 120 | C | Recessed | 4'T8 | E | OS | 1 | 2 | 32 | 7 | 190 | 6 | 70 | 90 | 0 | 30 | 30 |
| 73 | 1 | Janitor's Closet (90's) | Recessed | E | 4'T8 | 1 | 1 | 32 | S | 2 | 190 | 3 | 35 | 13 | N/A | Recessed | 4'T8 | E | S | 1 | 1 | 32 | 2 | 190 | 3 | 35 | 13 | 0 | 0 | 0 |
| 74 | 1 | COMPUTER LAB (90) | Parabolic | E | 4'T8 | 18 | 3 | 32 | S | 9 | 190 | 10 | 1,908 | 3,263 | N/A | Parabolic | 4'T8 | E | S | 18 | 3 | 32 | 9 | 190 | 10 | 1908 | 3263 | 0 | 0 | 0 |
| 75 | 1 | Classroom (91) | Parabolic | E | 4'T8 | 12 | 3 | 32 | S | 9 | 190 | 10 | 1,272 | 2,175 | N/A | Parabolic | 4'T8 | E | S | 12 | 3 | 32 | 9 | 190 | 10 | 1272 | 2175 | 0 | 0 | 0 |
| 76 | 1 | Classroom (92) | Parabolic | E | 4'T8 | 6 | 3 | 32 | S | 9 | 190 | 10 | 636 | 1,088 | N/A | Parabolic | 4'T8 | E | S | 6 | 3 | 32 | 9 | 190 | 10 | 636 | 1088 | 0 | 0 | 0 |
| 77 | 1 | Classroom (93) | Parabolic | E | 4'T8 | 12 | 3 | 32 | S | 9 | 190 | 10 | 1,272 | 2,175 | N/A | Parabolic | 4'T8 | E | S | 12 | 3 | 32 | 9 | 190 | 10 | 1272 | 2175 | 0 | 0 | 0 |
| 78 | 1 | Classroom (94) | Parabolic | E | 4'T8 | 12 | 3 | 32 | S | 9 | 190 | 10 | 1,272 | 2,175 | N/A | Parabolic | 4'T8 | E | S | 12 | 3 | 32 | 9 | 190 | 10 | 1272 | 2175 | 0 | 0 | 0 |
| 79 | 1 | Classroom (95) | Parabolic | E | 4'T8 | 12 | 3 | 32 | S | 9 | 190 | 10 | 1,272 | 2,175 | N/A | Parabolic | 4'T8 | E | S | 12 | 3 | 32 | 9 | 190 | 10 | 1272 | 2175 | 0 | 0 | 0 |
| 80 | 1 | Classroom (96) | Parabolic | E | 4'T8 | 12 | 3 | 32 | S | 9 | 190 | 10 | 1,272 | 2,175 | N/A | Parabolic | 4'T8 | E | S | 12 | 3 | 32 | 9 | 190 | 10 | 1272 | 2175 | 0 | 0 | 0 |
| 81 | 1 | Classroom (97) | Parabolic | E | 4'T8 | 12 | 3 | 32 | S | 9 | 190 | 10 | 1,272 | 2,175 | N/A | Parabolic | 4'T8 | E | S | 12 | 3 | 32 | 9 | 190 | 10 | 1272 | 2175 | 0 | 0 | 0 |
| 82 | 1 | Classroom (98) | Parabolic | E | 4'T8 | 12 | 3 | 32 | S | 9 | 190 | 10 | 1,272 | 2,175 | N/A | Parabolic | 4'T8 | E | S | 12 | 3 | 32 | 9 | 190 | 10 | 1272 | 2175 | 0 | 0 | 0 |
| 83 | 1 | Classroom (99) | Parabolic | E | 4'T8 | 12 | 3 | 32 | S | 9 | 190 | 10 | 1,272 | 2,175 | N/A | Parabolic | 4'T8 | E | S | 12 | 3 | 32 | 9 | 190 | 10 | 1272 | 2175 | 0 | 0 | 0 |
| 84 | 1 | Hallway (40's) | Recessed | E | 4'T8 | 11 | 2 | 32 | S | 16 | 190 | 6 | 770 | 2,341 | N/A | Recessed | 4'T8 | E | S | 11 | 2 | 32 | 16 | 190 | 6 | 770 | 2341 | 0 | 0 | 0 |
| 85 | 1 | Hallway (40's) | Exit Sign | E | LED | 4 | 1 | 5 | N | 24 | 365 | 1 | 24 | 210 | N/A | Exit Sign | LED | E | N | 4 | 1 | 5 | 24 | 365 | 1 | 24 | 210 | 0 | 0 | 0 |
| 86 | 1 | Classroom (46) | Parabolic | E | 4'T8 | 5 | 3 | 32 | S | 9 | 190 | 10 | 530 | 906 | N/A | Parabolic | 4'T8 | E | S | 5 | 3 | 32 | 9 | 190 | 10 | 530 | 906 | 0 | 0 | 0 |
| 87 | 1 | Bathroom Men (40's) | Recessed | E | 4'T8 | 2 | 3 | 32 | S | 9 | 190 | 10 | 212 | 363 | C | Recessed | 4'T8 | E | OS | 2 | 3 | 32 | 7 | 190 | 10 | 212 | 272 | 0 | 91 | 91 |
| 88 | 1 | Classroom (44) | Parabolic | E | 4'T8 | 5 | 3 | 32 | S | 9 | 190 | 10 | 530 | 906 | N/A | Parabolic | 4'T8 | E | S | 5 | 3 | 32 | 9 | 190 | 10 | 530 | 906 | 0 | 0 | 0 |
| 89 | 1 | Office (Cafeteria) | Recessed | E | 4'T8 | 1 | 2 | 32 | S | 9 | 190 | 6 | 70 | 120 | C | Recessed | 4'T8 | E | OS | 1 | 2 | 32 | 7 | 190 | 6 | 70 | 90 | 0 | 30 | 30 |
| 90 | 1 | Kitchen (Cafeteria) | Recessed | E | 4'T8 | 11 | 2 | 32 | S | 9 | 190 | 6 | 770 | 1,317 | N/A | Recessed | 4'T8 | E | S | 11 | 2 | 32 | 9 | 190 | 6 | 770 | 1317 | 0 | 0 | 0 |
| 91 | 1 | Kitchen (Cafeteria) | Exit Sign | E | LED | 1 | 1 | 5 | N | 24 | 365 | 1 | 6 | 53 | N/A | Exit Sign | LED | E | N | 1 | 1 | 5 | 24 | 365 | 1 | 6 | 53 | 0 | 0 | 0 |
| 92 | 1 | CAFETERIA (Cafeteria) | Recessed | E | 2'T8 | 30 | 3 | 17 | S | 9 | 190 | 4 | 1,650 | 2,822 | N/A | Recessed | 2'T8 | E | S | 30 | 3 | 17 | 9 | 190 | 4 | 1650 | 2822 | 0 | 0 | 0 |
| 93 | 1 | CAFETERIA (Cafeteria) | Exit Sign | E | LED | 4 | 1 | 5 | N | 24 | 365 | 1 | 24 | 210 | N/A | Exit Sign | LED | E | N | 4 | 1 | 5 | 24 | 365 | 1 | 24 | 210 | 0 | 0 | 0 |
| 94 | 1 | CAFETERIA (Cafeteria) | Screw-in | E | CFL | 20 | 1 | 26 | S | 9 | 190 | 0 | 520 | 889 | N/A | Screw-in | CFL | E | S | 20 | 1 | 26 | 9 | 190 | 0 | 520 | 889 | 0 | 0 | 0 |
| 95 | 1 | CAFETERIA (Cafeteria) | Screw-in | E | CFL | 4 | 1 | 26 | S | 9 | 190 | 0 | 104 | 178 | N/A | Screw-in | CFL | E | S | 4 | 1 | 26 | 9 | 190 | 0 | 104 | 178 | 0 | 0 | 0 |
| 96 | 1 | CAFETERIA (Cafeteria) | Screw-in | E | CFL | 9 | 1 | 75 | S | 9 | 190 | 0 | 675 | 1,154 | N/A | Screw-in | CFL | E | S | 9 | 1 | 75 | 9 | 190 | 0 | 675 | 1154 | 0 | 0 | 0 |
| 97 | 1 | Storage Rm (Cafeteria) | Recessed | E | 4'T8 | 8 | 2 | 32 | S | 2 | 190 | 6 | 560 | 213 | N/A | Recessed | 4'T8 | E | S | 8 | 2 | 32 | 2 | 190 | 6 | 560 | 213 | 0 | 0 | 0 |
| 98 | 1 | STAGE (Stage) | Recessed | E | 4'T8 | 11 | 2 | 32 | S | 8 | 190 | 6 | 770 | 1,170 | N/A | Recessed | 4'T8 | E | S | 11 | 2 | 32 | 8 | 190 | 6 | 770 | 1170 | 0 | 0 | 0 |
| 99 | 1 | STAGE (Stage) | Exit Sign | E | LED | 2 | 1 | 5 | N | 24 | 365 | 1 | 12 | 105 | N/A | Exit Sign | LED | E | N | 2 | 1 | 5 | 24 | 365 | 1 | 12 | 105 | 0 | 0 | 0 |
| 100 | 1 | STAGE (Stage) | Screw-in | E | CFL | 11 | 1 | 75 | S | 8 | 190 | 0 | 825 | 1,254 | N/A | Screw-in | CFL | E | S | 11 | 1 | 75 | 8 | 190 | 0 | 825 | 1254 | 0 | 0 | 0 |

| Location | | | Existing Fixture Information | | | | | | | | | | | | Retrofit Information | | | | | | | | | | | | | Annual Savings | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Marker | Floor | Room Identification | Fixture Type | Ballast | Lamp Type | # of Fixtures | # of Lamps per Fixture | Watts per Lamp | Controls | Operational Hours per Day | Operational Days per Year | Ballast Wattage | Total Watts | Energy Use kWh/year | Category | Fixture Type | Lamp Type | Ballast | Controls | # of Fixtures | # of Lamps per Fixture | Watts per Lamp | Operational Hours per Day | Operational Days per Year | Ballast Watts | Total Watts | Energy Use kWh/year | Fixture Savings (kWh) | Controls Savings (kWh) | Total Savings (kWh) |
| 101 | 1 | STAGE (Stage) | Screw-in | E | Inc | 125 | 1 | 75 | S | 8 | 190 | 0 | 9,375 | 14,250 | NA | Screw-in | Inc | E | S | 125 | 1 | 75 | 8 | 190 | 0 | 9375 | 14250 | 0 | 0 | 0 |
| 102 | 1 | Bathroom (Stage) | Recessed | E | 4'T8 | 2 | 3 | 32 | S | 9 | 190 | 10 | 212 | 363 | C | Recessed | 4'T8 | E | OS | 2 | 3 | 32 | 7 | 190 | 10 | 212 | 272 | 0 | 91 | 91 |
| 103 | 1 | Classroom (42) | Parabolic | E | 4'T8 | 13 | 3 | 32 | S | 9 | 190 | 10 | 1,378 | 2,356 | N/A | Parabolic | 4'T8 | E | S | 13 | 3 | 32 | 9 | 190 | 10 | 1378 | 2356 | 0 | 0 | 0 |
| 104 | 1 | DINING RM (40's) | Parabolic | E | 4'T8 | 11 | 2 | 32 | S | 9 | 190 | 6 | 770 | 1,317 | N/A | Parabolic | 4'T8 | E | S | 11 | 2 | 32 | 9 | 190 | 6 | 770 | 1317 | 0 | 0 | 0 |
| 105 | 1 | JANITOR Closet (40's) | Recessed | E | 4'T8 | 2 | 2 | 32 | S | 2 | 190 | 6 | 140 | 53 | N/A | Recessed | 4'T8 | E | S | 2 | 2 | 32 | 2 | 190 | 6 | 140 | 53 | 0 | 0 | 0 |
| 106 | 1 | ELEC RM (40's) | Recessed | E | 4'T8 | 1 | 2 | 32 | S | 2 | 190 | 6 | 70 | 27 | N/A | Recessed | 4'T8 | E | S | 1 | 2 | 32 | 2 | 190 | 6 | 70 | 27 | 0 | 0 | 0 |
| 107 | 1 | Bathroom Women (40's) | Recessed | E | 4'T8 | 6 | 2 | 32 | S | 9 | 190 | 6 | 420 | 718 | C | Recessed | 4'T8 | E | OS | 6 | 2 | 32 | 7 | 190 | 6 | 420 | 539 | 0 | 180 | 180 |
| 108 | 1 | Bathroom Men (40's) | Recessed | E | 4'T8 | 5 | 2 | 32 | S | 9 | 190 | 6 | 350 | 599 | C | Recessed | 4'T8 | E | OS | 5 | 2 | 32 | 7 | 190 | 6 | 350 | 449 | 0 | 150 | 150 |
| 109 | 1 | Hallway (30'S) | Recessed | E | 4'T8 | 25 | 1 | 32 | S | 16 | 190 | 3 | 875 | 2,660 | N/A | Recessed | 4'T8 | E | S | 25 | 1 | 32 | 16 | 190 | 3 | 875 | 2660 | 0 | 0 | 0 |
| 110 | 1 | Hallway (30'S) | Screw-in | E | CFL | 6 | 2 | 26 | S | 16 | 190 | 0 | 312 | 948 | N/A | Screw-in | CFL | E | S | 6 | 2 | 26 | 16 | 190 | 0 | 312 | 948 | 0 | 0 | 0 |
| 111 | 1 | Hallway (30'S) | Exit Sign | E | LED | 2 | 1 | 5 | N | 24 | 365 | 1 | 12 | 105 | N/A | Exit Sign | LED | E | N | 2 | 1 | 5 | 24 | 365 | 1 | 12 | 105 | 0 | 0 | 0 |
| 112 | 1 | Hallway (30'S) | Recessed | E | 4'T8 | 4 | 2 | 32 | S | 16 | 190 | 6 | 280 | 851 | N/A | Recessed | 4'T8 | E | S | 4 | 2 | 32 | 16 | 190 | 6 | 280 | 851 | 0 | 0 | 0 |
| 113 | 1 | Classroom (MUSIC) | Parabolic | E | 4'T8 | 14 | 3 | 32 | S | 9 | 190 | 10 | 1,484 | 2,538 | N/A | Parabolic | 4'T8 | E | S | 14 | 3 | 32 | 9 | 190 | 10 | 1484 | 2538 | 0 | 0 | 0 |
| 114 | 1 | Classroom (39) | Parabolic | E | 4'T8 | 12 | 2 | 32 | S | 9 | 190 | 6 | 840 | 1,436 | N/A | Parabolic | 4'T8 | E | S | 12 | 2 | 32 | 9 | 190 | 6 | 840 | 1436 | 0 | 0 | 0 |
| 115 | 1 | Classroom (36) | Parabolic | E | 4'T8 | 12 | 2 | 32 | S | 9 | 190 | 6 | 840 | 1,436 | N/A | Parabolic | 4'T8 | E | S | 12 | 2 | 32 | 9 | 190 | 6 | 840 | 1436 | 0 | 0 | 0 |
| 116 | 1 | Classroom (34) | Parabolic | E | 4'T8 | 12 | 2 | 32 | S | 9 | 190 | 6 | 840 | 1,436 | N/A | Parabolic | 4'T8 | E | S | 12 | 2 | 32 | 9 | 190 | 6 | 840 | 1436 | 0 | 0 | 0 |
| 117 | 1 | Classroom (32) | Parabolic | E | 4'T8 | 12 | 2 | 32 | S | 9 | 190 | 6 | 840 | 1,436 | N/A | Parabolic | 4'T8 | E | S | 12 | 2 | 32 | 9 | 190 | 6 | 840 | 1436 | 0 | 0 | 0 |
| 118 | 1 | Classroom (35) | Parabolic | E | 4'T8 | 12 | 2 | 32 | S | 9 | 190 | 6 | 840 | 1,436 | N/A | Parabolic | 4'T8 | E | S | 12 | 2 | 32 | 9 | 190 | 6 | 840 | 1436 | 0 | 0 | 0 |
| 119 | 1 | Classroom (33) | Parabolic | E | 4'T8 | 12 | 2 | 32 | S | 9 | 190 | 6 | 840 | 1,436 | N/A | Parabolic | 4'T8 | E | S | 12 | 2 | 32 | 9 | 190 | 6 | 840 | 1436 | 0 | 0 | 0 |
| 120 | 1 | Mechanical Room (Mechanical Rm) | Recessed | E | 4'T8 | 12 | 2 | 32 | S | 2 | 190 | 6 | 840 | 319 | N/A | Recessed | 4'T8 | E | S | 12 | 2 | 32 | 2 | 190 | 6 | 840 | 319 | 0 | 0 | 0 |
| 121 | 1 | LOBBY (Lobby) | Screw-in | E | CFL | 2 | 1 | 26 | S | 9 | 190 | 0 | 52 | 89 | N/A | Screw-in | CFL | E | S | 2 | 1 | 26 | 9 | 190 | 0 | 52 | 89 | 0 | 0 | 0 |
| 122 | 1 | Hallway (Kindergarten) | Screw-in | E | CFL | 6 | 1 | 26 | S | 16 | 190 | 0 | 156 | 474 | N/A | Screw-in | CFL | E | S | 6 | 1 | 26 | 16 | 190 | 0 | 156 | 474 | 0 | 0 | 0 |
| 123 | 1 | Hallway (Kindergarten) | Exit Sign | E | LED | 3 | 1 | 5 | N | 24 | 365 | 1 | 18 | 158 | N/A | Exit Sign | LED | E | N | 3 | 1 | 5 | 24 | 365 | 1 | 18 | 158 | 0 | 0 | 0 |
| 124 | 1 | Hallway (Kindergarten) | Screw-in | E | CFL | 10 | 2 | 26 | S | 16 | 190 | 0 | 520 | 1,581 | N/A | Screw-in | CFL | E | S | 10 | 2 | 26 | 16 | 190 | 0 | 520 | 1581 | 0 | 0 | 0 |
| 125 | 1 | Classroom (5) | Parabolic | E | 4'T8 | 17 | 2 | 32 | S | 9 | 190 | 6 | 1,190 | 2,035 | N/A | Parabolic | 4'T8 | E | S | 17 | 2 | 32 | 9 | 190 | 6 | 1190 | 2035 | 0 | 0 | 0 |
| 126 | 1 | Classroom (5) | Exit Sign | E | LED | 1 | 1 | 5 | N | 24 | 365 | 1 | 6 | 53 | N/A | Exit Sign | LED | E | N | 1 | 1 | 5 | 24 | 365 | 1 | 6 | 53 | 0 | 0 | 0 |
| 127 | 1 | Classroom (4) | Parabolic | E | 4'T8 | 17 | 2 | 32 | S | 9 | 190 | 6 | 1,190 | 2,035 | N/A | Parabolic | 4'T8 | E | S | 17 | 2 | 32 | 9 | 190 | 6 | 1190 | 2035 | 0 | 0 | 0 |
| 128 | 1 | Classroom (4) | Exit Sign | E | LED | 1 | 1 | 5 | N | 24 | 365 | 1 | 6 | 53 | N/A | Exit Sign | LED | E | N | 1 | 1 | 5 | 24 | 365 | 1 | 6 | 53 | 0 | 0 | 0 |
| 129 | 1 | Classroom (3) | Parabolic | E | 4'T8 | 17 | 2 | 32 | S | 9 | 190 | 6 | 1,190 | 2,035 | N/A | Parabolic | 4'T8 | E | S | 17 | 2 | 32 | 9 | 190 | 6 | 1190 | 2035 | 0 | 0 | 0 |
| 130 | 1 | Classroom (3) | Exit Sign | E | LED | 1 | 1 | 5 | N | 24 | 365 | 1 | 6 | 53 | N/A | Exit Sign | LED | E | N | 1 | 1 | 5 | 24 | 365 | 1 | 6 | 53 | 0 | 0 | 0 |
| 131 | 1 | Classroom (2) | Parabolic | E | 4'T8 | 17 | 2 | 32 | S | 9 | 190 | 6 | 1,190 | 2,035 | N/A | Parabolic | 4'T8 | E | S | 17 | 2 | 32 | 9 | 190 | 6 | 1190 | 2035 | 0 | 0 | 0 |
| 132 | 1 | Classroom (2) | Exit Sign | E | LED | 1 | 1 | 5 | N | 24 | 365 | 1 | 6 | 53 | N/A | Exit Sign | LED | E | N | 1 | 1 | 5 | 24 | 365 | 1 | 6 | 53 | 0 | 0 | 0 |
| 133 | 1 | Classroom (1) | Parabolic | E | 4'T8 | 13 | 3 | 32 | S | 9 | 190 | 10 | 1,378 | 2,356 | N/A | Parabolic | 4'T8 | E | S | 13 | 3 | 32 | 9 | 190 | 10 | 1378 | 2356 | 0 | 0 | 0 |
| 134 | 1 | Hallway (2ND GRADE) | Exit Sign | E | LED | 2 | 1 | 5 | N | 24 | 365 | 1 | 12 | 105 | N/A | Exit Sign | LED | E | N | 2 | 1 | 5 | 24 | 365 | 1 | 12 | 105 | 0 | 0 | 0 |
| 135 | 1 | Hallway (3rd GRADE) | Parabolic | E | 4'T8 | 13 | 2 | 32 | S | 16 | 190 | 6 | 910 | 2,766 | N/A | Parabolic | 4'T8 | E | S | 13 | 2 | 32 | 16 | 190 | 6 | 910 | 2766 | 0 | 0 | 0 |
| 136 | 1 | Classroom (13) | Recessed | E | 4'T8 | 12 | 2 | 32 | S | 9 | 190 | 6 | 840 | 1,436 | N/A | Recessed | 4'T8 | E | S | 12 | 2 | 32 | 9 | 190 | 6 | 840 | 1436 | 0 | 0 | 0 |
| 137 | 1 | Bathroom (13) | Recessed | E | 4'T8 | 1 | 2 | 32 | S | 9 | 190 | 6 | 70 | 120 | N/A | Recessed | 4'T8 | E | S | 1 | 2 | 32 | 9 | 190 | 6 | 70 | 120 | 0 | 0 | 0 |
| 138 | 1 | Classroom (12) | Recessed | E | 4'T8 | 13 | 2 | 32 | S | 9 | 190 | 6 | 910 | 1,556 | N/A | Recessed | 4'T8 | E | S | 13 | 2 | 32 | 9 | 190 | 6 | 910 | 1556 | 0 | 0 | 0 |
| 139 | 1 | Classroom (12) | Recessed | E | 4'T8 | 2 | 2 | 32 | S | 9 | 190 | 6 | 140 | 239 | N/A | Recessed | 4'T8 | E | S | 2 | 2 | 32 | 9 | 190 | 6 | 140 | 239 | 0 | 0 | 0 |
| 140 | 1 | Classroom (15) | Recessed | E | 4'T8 | 12 | 2 | 32 | S | 9 | 190 | 6 | 840 | 1,436 | N/A | Recessed | 4'T8 | E | S | 12 | 2 | 32 | 9 | 190 | 6 | 840 | 1436 | 0 | 0 | 0 |
| 141 | 1 | Classroom (15) | Recessed | E | 4'T8 | 1 | 2 | 32 | S | 9 | 190 | 6 | 70 | 120 | N/A | Recessed | 4'T8 | E | S | 1 | 2 | 32 | 9 | 190 | 6 | 70 | 120 | 0 | 0 | 0 |
| 142 | 1 | Classroom (14) | Recessed | E | 4'T8 | 13 | 2 | 32 | S | 9 | 190 | 6 | 910 | 1,556 | N/A | Recessed | 4'T8 | E | S | 13 | 2 | 32 | 9 | 190 | 6 | 910 | 1556 | 0 | 0 | 0 |
| 143 | 1 | Classroom (14) | Recessed | E | 4'T8 | 1 | 2 | 32 | S | 9 | 190 | 6 | 70 | 120 | N/A | Recessed | 4'T8 | E | S | 1 | 2 | 32 | 9 | 190 | 6 | 70 | 120 | 0 | 0 | 0 |
| 144 | 1 | Storage Rm (17) | Recessed | E | 4'T8 | 3 | 2 | 32 | S | 2 | 190 | 6 | 210 | 80 | N/A | Recessed | 4'T8 | E | S | 3 | 2 | 32 | 2 | 190 | 6 | 210 | 80 | 0 | 0 | 0 |
| 145 | 1 | Classroom (16) | Recessed | E | 4'T8 | 6 | 3 | 32 | S | 9 | 190 | 10 | 636 | 1,088 | N/A | Recessed | 4'T8 | E | S | 6 | 3 | 32 | 9 | 190 | 10 | 636 | 1088 | 0 | 0 | 0 |
| 146 | 1 | Closet (16) | Screw-in | E | CFL | 1 | 1 | 26 | S | 2 | 190 | 0 | 26 | 10 | N/A | Screw-in | CFL | E | S | 1 | 1 | 26 | 2 | 190 | 0 | 26 | 10 | 0 | 0 | 0 |
| 147 | 1 | JANITOR Closet (Custodian) | Screw-in | E | INC | 1 | 1 | 60 | S | 2 | 190 | 0 | 60 | 23 | CFL | Screw-in | CFL | E | S | 1 | 1 | 20 | 2 | 190 | 0 | 20 | 8 | 15 | 0 | 15 |
| 148 | 1 | Bathroom Men (BOYS) | Recessed | E | 4'T8 | 2 | 2 | 32 | S | 9 | 190 | 6 | 140 | 239 | C | Recessed | 4'T8 | E | OS | 2 | 2 | 32 | 7 | 190 | 6 | 140 | 180 | 0 | 60 | 60 |
| 149 | 1 | Bathroom Women (GIRS) | Recessed | E | 4'T8 | 2 | 2 | 32 | S | 9 | 190 | 6 | 140 | 239 | C | Recessed | 4'T8 | E | DSw | 2 | 2 | 32 | 7 | 190 | 6 | 140 | 180 | 0 | 60 | 60 |
| 150 | 1 | Classroom (19) | Recessed | E | 4'T8 | 10 | 2 | 32 | S | 9 | 190 | 6 | 700 | 1,197 | N/A | Recessed | 4'T8 | E | S | 10 | 2 | 32 | 9 | 190 | 6 | 700 | 1197 | 0 | 0 | 0 |

| Location | | | Existing Fixture Information | | | | | | | | | | | | Retrofit Information | | | | | | | | | | | | Annual Savings | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Marker | Floor | Room Identification | Fixture Type | Ballast | Lamp Type | # of Fixtures | # of Lamps per Fixture | Watts per Lamp | Controls | Operational Hours per Day | Operational Days per Year | Ballast Wattage | Total Watts | Energy Use kWh/year | Category | Fixture Type | Lamp Type | Ballast | Controls | # of Fixtures | # of Lamps per Fixture | Watts per Lamp | Operational Hours per Day | Operational Days per Year | Ballast Watts | Total Watts | Energy Use kWh/year | Fixture Savings (kWh) | Controls Savings (kWh) | Total Savings (kWh) |
| 151 | 1 | Bathroom (19) | Recessed | E | 4'T8 | 1 | 2 | 32 | S | 9 | 190 | 6 | 70 | 120 | C | Recessed | 4'T8 | E | OS | 1 | 2 | 32 | 7 | 190 | 6 | 70 | 90 | 0 | 30 | 30 |
| 152 | 1 | Closet (Closet) | Recessed | E | 4'T8 | 1 | 3 | 32 | S | 2 | 190 | 10 | 106 | 40 | N/A | Recessed | 4'T8 | E | S | 1 | 3 | 32 | 2 | 190 | 10 | 106 | 40 | 0 | 0 | 0 |
| 153 | 1 | Classroom (24) | Recessed | E | 4'T8 | 10 | 2 | 32 | S | 9 | 190 | 6 | 700 | 1,197 | N/A | Recessed | 4'T8 | E | S | 10 | 2 | 32 | 9 | 190 | 6 | 700 | 1197 | 0 | 0 | 0 |
| 154 | 1 | Hallway (Elementary ) | Exit Sign | E | LED | 5 | 1 | 5 | N | 24 | 365 | 1 | 30 | 263 | N/A | Exit Sign | LED | E | N | 5 | 1 | 5 | 24 | 365 | 1 | 30 | 263 | 0 | 0 | 0 |
| 155 | 1 | Hallway (Elementary ) | Recessed | E | 4'T8 | 10 | 2 | 32 | S | 16 | 190 | 6 | 700 | 2,128 | N/A | Recessed | 4'T8 | E | S | 10 | 2 | 32 | 16 | 190 | 6 | 700 | 2128 | 0 | 0 | 0 |
| 156 | 1 | Office (Nurse) | Recessed | E | 4'T8 | 9 | 3 | 32 | S | 9 | 190 | 10 | 954 | 1,631 | N/A | Recessed | 4'T8 | E | S | 9 | 3 | 32 | 9 | 190 | 10 | 954 | 1631 | 0 | 0 | 0 |
| 157 | 1 | NURSE (Nurse) | Recessed | E | 4'T8 | 4 | 2 | 32 | S | 9 | 190 | 6 | 280 | 479 | N/A | Recessed | 4'T8 | E | S | 4 | 2 | 32 | 9 | 190 | 6 | 280 | 479 | 0 | 0 | 0 |
| 158 | 1 | BATHROOM (Nurse) | Recessed | E | 4'T8 | 1 | 3 | 32 | S | 9 | 190 | 10 | 106 | 181 | C | Recessed | 4'T8 | E | OS | 1 | 3 | 32 | 7 | 190 | 10 | 106 | 136 | 0 | 45 | 45 |
| 159 | 1 | Office (Elementary ) | Recessed | E | 4'T8 | 10 | 3 | 32 | S | 9 | 190 | 10 | 1,060 | 1,813 | N/A | Recessed | 4'T8 | E | S | 10 | 3 | 32 | 9 | 190 | 10 | 1060 | 1813 | 0 | 0 | 0 |
| 160 | 1 | Office PANTRY (Elementary ) | Screw-in | E | CFL | 12 | 2 | 26 | S | 9 | 190 | 0 | 624 | 1,067 | N/A | Screw-in | CFL | E | S | 12 | 2 | 26 | 9 | 190 | 0 | 624 | 1067 | 0 | 0 | 0 |
| 161 | 1 | PRINCIPAL Office (Elementary ) | Recessed | E | 4'T8 | 4 | 3 | 32 | S | 9 | 190 | 10 | 424 | 725 | N/A | Recessed | 4'T8 | E | S | 4 | 3 | 32 | 9 | 190 | 10 | 424 | 725 | 0 | 0 | 0 |
| 162 | 1 | Office (Elementary ) | Recessed | E | 4'T8 | 4 | 2 | 32 | S | 9 | 190 | 6 | 280 | 479 | N/A | Recessed | 4'T8 | E | S | 4 | 2 | 32 | 9 | 190 | 6 | 280 | 479 | 0 | 0 | 0 |
| 163 | 1 | Office PANTRY (Elementary ) | Recessed | E | 4'T5 | 2 | 1 | 28 | S | 9 | 190 | 3 | 62 | 106 | N/A | Recessed | 4'T5 | E | S | 2 | 1 | 28 | 9 | 190 | 3 | 62 | 106 | 0 | 0 | 0 |
| 164 | 1 | STAIRWELL (STAIR) | Recessed | E | 4'T8 | 4 | 2 | 32 | S | 16 | 190 | 6 | 280 | 851 | N/A | Recessed | 4'T8 | E | S | 4 | 2 | 32 | 16 | 190 | 6 | 280 | 851 | 0 | 0 | 0 |
| 165 | 1 | ELEC RM (ELEC RM) | Recessed | E | 4'T8 | 1 | 2 | 32 | S | 2 | 190 | 6 | 70 | 27 | N/A | Recessed | 4'T8 | E | S | 1 | 2 | 32 | 2 | 190 | 6 | 70 | 27 | 0 | 0 | 0 |
| 166 | 1 | LOBBY (Elementary ) | Screw-in | E | CFL | 1 | 3 | 26 | S | 9 | 190 | 0 | 78 | 133 | N/A | Screw-in | CFL | E | S | 1 | 3 | 26 | 9 | 190 | 0 | 78 | 133 | 0 | 0 | 0 |
| 167 | 1 | Hallway (1ST GRADE) | Recessed | E | 4'T8 | 9 | 2 | 32 | S | 16 | 190 | 6 | 630 | 1,915 | N/A | Recessed | 4'T8 | E | S | 9 | 2 | 32 | 16 | 190 | 6 | 630 | 1915 | 0 | 0 | 0 |
| 168 | 1 | Hallway (1ST GRADE) | Exit Sign | E | LED | 2 | 1 | 5 | N | 24 | 365 | 1 | 12 | 105 | N/A | Exit Sign | LED | E | N | 2 | 1 | 5 | 24 | 365 | 1 | 12 | 105 | 0 | 0 | 0 |
| 169 | 1 | Classroom (6) | Parabolic | E | 4'T8 | 12 | 3 | 32 | S | 9 | 190 | 10 | 1,272 | 2,175 | N/A | Parabolic | 4'T8 | E | S | 12 | 3 | 32 | 9 | 190 | 10 | 1272 | 2175 | 0 | 0 | 0 |
| 170 | 1 | Classroom (7) | Parabolic | E | 4'T8 | 12 | 3 | 32 | S | 9 | 190 | 10 | 1,272 | 2,175 | N/A | Parabolic | 4'T8 | E | S | 12 | 3 | 32 | 9 | 190 | 10 | 1272 | 2175 | 0 | 0 | 0 |
| 171 | 1 | Classroom (8) | Parabolic | E | 4'T8 | 12 | 3 | 32 | S | 9 | 190 | 10 | 1,272 | 2,175 | N/A | Parabolic | 4'T8 | E | S | 12 | 3 | 32 | 9 | 190 | 10 | 1272 | 2175 | 0 | 0 | 0 |
| 172 | 1 | Classroom (9) | Parabolic | E | 4'T8 | 12 | 3 | 32 | S | 9 | 190 | 10 | 1,272 | 2,175 | N/A | Parabolic | 4'T8 | E | S | 12 | 3 | 32 | 9 | 190 | 10 | 1272 | 2175 | 0 | 0 | 0 |
| 173 | 1 | Classroom (10) | Parabolic | E | 4'T8 | 12 | 3 | 32 | S | 9 | 190 | 10 | 1,272 | 2,175 | N/A | Parabolic | 4'T8 | E | S | 12 | 3 | 32 | 9 | 190 | 10 | 1272 | 2175 | 0 | 0 | 0 |
| 174 | 1 | Classroom (11) | Parabolic | E | 4'T8 | 12 | 3 | 32 | S | 9 | 190 | 10 | 1,272 | 2,175 | N/A | Parabolic | 4'T8 | E | S | 12 | 3 | 32 | 9 | 190 | 10 | 1272 | 2175 | 0 | 0 | 0 |
| 175 | 1 | Bathroom Men (1ST GRADE) | Recessed | E | 4'T8 | 2 | 3 | 32 | S | 9 | 190 | 10 | 212 | 363 | C | Recessed | 4'T8 | E | OS | 2 | 3 | 32 | 7 | 190 | 10 | 212 | 272 | 0 | 91 | 91 |
| 176 | 1 | Bathroom Women (1ST GRADE) | Recessed | E | 4'T8 | 2 | 3 | 32 | S | 9 | 190 | 10 | 212 | 363 | C | Recessed | 4'T8 | E | OS | 2 | 3 | 32 | 7 | 190 | 10 | 212 | 272 | 0 | 91 | 91 |
| 177 | 1 | TELE Closet (1ST GRADE) | Recessed | E | 4'T8 | 2 | 3 | 32 | S | 2 | 190 | 10 | 212 | 81 | C | Recessed | 4'T8 | E | OS | 2 | 3 | 32 | 2 | 190 | 10 | 212 | 60 | 0 | 20 | 20 |
| 178 | 1 | Hallway TROPHY (LIBRARY) | Recessed | M | 4'T12 | 14 | 2 | 40 | S | 2 | 190 | 15 | 1,330 | 505 | T8 | Recessed | 4'T8 | E | S | 14 | 2 | 32 | 2 | 190 | 6 | 980 | 372 | 133 | 0 | 133 |
| 179 | 1 | Hallway (LIBRARY) | Recessed | E | 4'T8 | 9 | 2 | 32 | S | 16 | 190 | 6 | 630 | 1,915 | N/A | Recessed | 4'T8 | E | S | 9 | 2 | 32 | 16 | 190 | 6 | 630 | 1915 | 0 | 0 | 0 |
| 180 | 1 | Hallway (LIBRARY) | Exit Sign | E | LED | 2 | 1 | 5 | N | 24 | 365 | 1 | 12 | 105 | N/A | Exit Sign | LED | E | N | 2 | 1 | 5 | 24 | 365 | 1 | 12 | 105 | 0 | 0 | 0 |
| 181 | 1 | LIBRARY (LIBRARY) | Parabolic | E | 4'T5 | 80 | 1 | 28 | S | 9 | 190 | 3 | 2,480 | 4,241 | N/A | Parabolic | 4'T5 | E | S | 80 | 1 | 28 | 9 | 190 | 3 | 2480 | 4241 | 0 | 0 | 0 |
| 182 | 1 | COMPUTER LAB (LIBRARY) | Parabolic | E | 4'T8 | 15 | 3 | 32 | S | 9 | 190 | 10 | 1,590 | 2,719 | C | Parabolic | 4'T8 | E | OS | 15 | 3 | 32 | 7 | 190 | 10 | 1590 | 2039 | 0 | 680 | 680 |
| 183 | 1 | PRINT LAB (LIBRARY) | Parabolic | E | 4'T8 | 6 | 3 | 32 | S | 4 | 190 | 10 | 636 | 483 | C | Parabolic | 4'T8 | E | OS | 6 | 3 | 32 | 3 | 190 | 10 | 636 | 363 | 0 | 121 | 121 |
| 184 | 1 | LIBRARY (LIBRARY) | Exit Sign | E | LED | 2 | 1 | 5 | N | 24 | 365 | 1 | 12 | 105 | C | Exit Sign | LED | E | OS | 2 | 1 | 5 | 18 | 365 | 1 | 12 | 79 | 0 | 26 | 26 |
| 185 | 1 | Hallway (LIBRARY) | Recessed | E | 4'T8 | 4 | 3 | 32 | S | 16 | 190 | 10 | 424 | 1,289 | N/A | Recessed | 4'T8 | E | S | 4 | 3 | 32 | 16 | 190 | 10 | 424 | 1289 | 0 | 0 | 0 |
| 186 | 1 | STAIRWELL (STAIR) | Recessed | E | 4'T8 | 4 | 2 | 32 | S | 16 | 190 | 6 | 280 | 851 | N/A | Recessed | 4'T8 | E | S | 4 | 2 | 32 | 16 | 190 | 6 | 280 | 851 | 0 | 0 | 0 |
| 187 | 2 | HALLWAY (2ND FL) | RECESSED | E | 4'T8 | 9 | 2 | 32 | S | 16 | 190 | 6 | 630 | 1,915 | N/A | Recessed | 4'T8 | E | S | 9 | 2 | 32 | 16 | 190 | 6 | 630 | 1915 | 0 | 0 | 0 |
| 188 | 2 | HALLWAY (2ND FL) | Exit Sign | E | LED | 2 | 1 | 5 | N | 24 | 365 | 1 | 12 | 105 | N/A | Exit Sign | LED | E | N | 2 | 1 | 5 | 24 | 365 | 1 | 12 | 105 | 0 | 0 | 0 |
| 189 | 2 | OFFICE LOBBY (CHILD STUDY) | Recessed | E | 4'T8 | 2 | 3 | 32 | S | 9 | 190 | 10 | 212 | 363 | N/A | Recessed | 4'T8 | E | S | 2 | 3 | 32 | 9 | 190 | 10 | 212 | 363 | 0 | 0 | 0 |
| 190 | 2 | PANTRY (CHILD STUDY) | Recessed | E | 4'T8 | 1 | 3 | 32 | S | 9 | 190 | 10 | 106 | 181 | N/A | Recessed | 4'T8 | E | S | 1 | 3 | 32 | 9 | 190 | 10 | 106 | 181 | 0 | 0 | 0 |
| 191 | 2 | OFFICE (CHILD STUDY) | Recessed | E | 4'T8 | 2 | 3 | 32 | S | 9 | 190 | 10 | 212 | 363 | N/A | Recessed | 4'T8 | E | S | 2 | 3 | 32 | 9 | 190 | 10 | 212 | 363 | 0 | 0 | 0 |
| 192 | 2 | OFFICE (CHILD STUDY) | Recessed | E | 4'T8 | 2 | 3 | 32 | S | 9 | 190 | 10 | 212 | 363 | N/A | Recessed | 4'T8 | E | S | 2 | 3 | 32 | 9 | 190 | 10 | 212 | 363 | 0 | 0 | 0 |
| 193 | 2 | OFFICE (CHILD STUDY) | Recessed | E | 4'T8 | 2 | 3 | 32 | S | 9 | 190 | 10 | 212 | 363 | N/A | Recessed | 4'T8 | E | S | 2 | 3 | 32 | 9 | 190 | 10 | 212 | 363 | 0 | 0 | 0 |
| 194 | 2 | LOBBY (DISTRICT) | Parabolic | E | 4'T8 | 7 | 3 | 32 | S | 9 | 190 | 10 | 742 | 1,269 | N/A | Parabolic | 4'T8 | E | S | 7 | 3 | 32 | 9 | 190 | 10 | 742 | 1269 | 0 | 0 | 0 |
| 195 | 2 | OFFICE 1 (DISTRICT) | Screw-in | E | CFL | 2 | 2 | 26 | S | 9 | 190 | 0 | 104 | 178 | N/A | Screw-in | CFL | E | S | 2 | 2 | 26 | 9 | 190 | 0 | 104 | 178 | 0 | 0 | 0 |
| 196 | 2 | OFFICE 2 (DISTRICT) | Parabolic | E | 4'T8 | 3 | 3 | 32 | S | 9 | 190 | 10 | 318 | 544 | N/A | Parabolic | 4'T8 | E | S | 3 | 3 | 32 | 9 | 190 | 10 | 318 | 544 | 0 | 0 | 0 |
| 197 | 2 | OFFICE 2 (DISTRICT) | Screw-in | E | CFL | 2 | 2 | 26 | S | 9 | 190 | 0 | 104 | 178 | N/A | Screw-in | CFL | E | S | 2 | 2 | 26 | 9 | 190 | 0 | 104 | 178 | 0 | 0 | 0 |
| 198 | 2 | FILE RM (DISTRICT) | Parabolic | E | 4'T8 | 3 | 3 | 32 | S | 5 | 190 | 10 | 318 | 302 | N/A | Parabolic | 4'T8 | E | S | 3 | 3 | 32 | 5 | 190 | 10 | 318 | 302 | 0 | 0 | 0 |
| 199 | 2 | SUPER (DISTRICT) | Parabolic | E | 4'T8 | 2 | 3 | 32 | S | 2 | 190 | 10 | 212 | 81 | N/A | Parabolic | 4'T8 | E | S | 2 | 3 | 32 | 2 | 190 | 10 | 212 | 81 | 0 | 0 | 0 |
| 200 | 2 | SUPER (DISTRICT) | Screw-in | E | CFL | 4 | 2 | 26 | S | 2 | 190 | 0 | 208 | 79 | N/A | Screw-in | CFL | E | S | 4 | 2 | 26 | 2 | 190 | 0 | 208 | 79 | 0 | 0 | 0 |

| Location | | | Existing Fixture Information | | | | | | | | | | | | Retrofit Information | | | | | | | | | | | | | Annual Savings | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Marker | Floor | Room Identification | Fixture Type | Ballast | Lamp Type | # of Fixtures | # of Lamps per Fixture | Watts per Lamp | Controls | Operational Hours per Day | Operational Days per Year | Ballast Wattage | Total Watts | Energy Use kWh/year | Category | Fixture Type | Lamp Type | Ballast | Controls | # of Fixtures | # of Lamps per Fixture | Watts per Lamp | Operational Hours per Day | Operational Days per Year | Ballast Watts | Total Watts | Energy Use kWh/year | Fixture Savings (kWh) | Controls Savings (kWh) | Total Savings (kWh) |
| 201 | 2 | CONFERENCE (DISTRICT) | Parabolic | E | 4'T8 | 5 | 3 | 32 | S | 9 | 190 | 10 | 530 | 906 | C | Parabolic | 4'T8 | E | OS | 5 | 3 | 32 | 7 | 190 | 10 | 530 | 680 | 0 | 227 | 227 |
| 202 | 2 | PANTRY (DISTRICT) | Parabolic | E | 4'T8 | 3 | 3 | 32 | S | 9 | 190 | 10 | 318 | 544 | N/A | Parabolic | 4'T8 | E | S | 3 | 3 | 32 | 9 | 190 | 10 | 318 | 544 | 0 | 0 | 0 |
| 203 | 2 | OFFICE (CURRICULM) | Parabolic | E | 4'T8 | 2 | 3 | 32 | S | 9 | 190 | 10 | 212 | 363 | N/A | Parabolic | 4'T8 | E | S | 2 | 3 | 32 | 9 | 190 | 10 | 212 | 363 | 0 | 0 | 0 |
| 204 | 2 | LOBBY (CURRICULM) | Parabolic | E | 4'T8 | 6 | 3 | 32 | S | 9 | 190 | 10 | 636 | 1,088 | N/A | Parabolic | 4'T8 | E | S | 6 | 3 | 32 | 9 | 190 | 10 | 636 | 1088 | 0 | 0 | 0 |
| 205 | 2 | Bathroom Women (Bathroom) | RECESSED | E | 4'T8 | 1 | 2 | 32 | S | 9 | 190 | 6 | 70 | 120 | C | Recessed | 4'T8 | E | OS | 1 | 2 | 32 | 7 | 190 | 6 | 70 | 90 | 0 | 30 | 30 |
| 206 | 2 | Bathroom Men (Bathroom) | RECESSED | E | 4'T8 | 1 | 2 | 32 | S | 9 | 190 | 6 | 70 | 120 | C | Recessed | 4'T8 | E | OS | 1 | 2 | 32 | 7 | 190 | 6 | 70 | 90 | 0 | 30 | 30 |
| 207 | 2 | HALLWAY (2ND FL) | Screw-in | E | CFL | 2 | 2 | 26 | S | 16 | 190 | 0 | 104 | 316 | N/A | Screw-in | CFL | E | S | 2 | 2 | 26 | 16 | 190 | 0 | 104 | 316 | 0 | 0 | 0 |
| 208 | 2 | Closet (ELEC RM) | RECESSED | E | 4'T8 | 1 | 2 | 32 | S | 2 | 190 | 6 | 70 | 27 | N/A | Recessed | 4'T8 | E | S | 1 | 2 | 32 | 2 | 190 | 6 | 70 | 27 | 0 | 0 | 0 |
| 209 | 2 | MECH RM (2ND FL) | RECESSED | E | 4'T8 | 1 | 3 | 32 | S | 2 | 190 | 10 | 106 | 40 | N/A | Recessed | 4'T8 | E | S | 1 | 3 | 32 | 2 | 190 | 10 | 106 | 40 | 0 | 0 | 0 |
| 210 | 2 | ELEV RM (2ND FL) | RECESSED | E | 4'T8 | 1 | 2 | 32 | S | 2 | 190 | 6 | 70 | 27 | N/A | Recessed | 4'T8 | E | S | 1 | 2 | 32 | 2 | 190 | 6 | 70 | 27 | 0 | 0 | 0 |
| 211 | 2 | MEETING RM (2ND FL) | RECESSED | E | 4'T8 | 7 | 3 | 32 | S | 2 | 190 | 10 | 742 | 282 | C | Recessed | 4'T8 | E | OS | 7 | 3 | 32 | 2 | 190 | 10 | 742 | 211 | 0 | 70 | 70 |
| 212 | 2 | Elevator (ELEVATOR ) | Recessed | M | 4'T12 | 1 | 2 | 40 | S | 16 | 190 | 15 | 95 | 289 | T8 | Recessed | 4'T8 | E | S | 1 | 2 | 32 | 16 | 190 | 6 | 70 | 213 | 76 | 0 | 76 |
| 213 | 1 | Lobby (Entrance) | Screw-in | N | CFL | 4 | 2 | 26 | S | 16 | 190 | 0 | 208 | 632 | N/A | Screw-in | CFL | N | S | 4 | 2 | 26 | 16 | 190 | 0 | 208 | 632 | 0 | 0 | 0 |
| 214 | 2 | Office (Records) | Recessed | E | 4'T8 | 2 | 2 | 32 | S | 4 | 190 | 6 | 140 | 106 | N/A | Recessed | 4'T8 | E | S | 2 | 2 | 32 | 4 | 190 | 6 | 140 | 106 | 0 | 0 | 0 |
| 215 | Ext | Exterior (Exterior) | Screw-in | E | CFL | 45 | 2 | 26 | PC | 12 | 190 | 0 | 2,340 | 5,335 | N/A | Screw-in | CFL | E | PC | 45 | 2 | 26 | 12 | 190 | 0 | 2340 | 5335 | 0 | 0 | 0 |
| **Totals:** | | | | | | | | | | | | **1,201** | **126,316** | **220,133** | | | | | | | | | | | **1,183** | **125,741** | **216,603** | **285** | **3,245** | **3,530** |
| **Rows Highlighed Yellow Indicate an Energy Conservation Measure is recommended for that space** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Proposed Lighting Summary Table | | | |
|---|---|---|---|
| Total Surface Area (SF) | 128,789 | | |
| Average Power Cost ($/kWh) | 0.1480 | | |
| **Exterior Lighting** | **Existing** | **Proposed** | **Savings** |
| Exterior Annual Consumption (kWh) | 5,335 | 5,335 | **0** |
| Exterior Power (watts) | 2,340 | 2,340 | **0** |
| **Total Lighting** | **Existing** | **Proposed** | **Savings** |
| Annual Consumption (kWh) | 214,798 | 211,268 | **3,530** |
| Lighting Power (watts) | 123,976 | 123,401 | **575** |
| Lighting Power Density (watts/SF) | 0.963 | 0.958 | **0.004** |
| | | | |
| Estimated Cost of Fixture Replacement ($) | 3,435 | | |
| Estimated Cost of Controls Improvements ($) | 7,700 | | |
| **Total Consumption Cost Savings ($)** | **435** | | |

**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**

| South Jersey Gas Service Territory | Telephone & Web Site |
|---|---|
| **Cooperative Industries**<br>412-420 Washington Avenue<br>Belleville, NJ 07109 | (800) 628-9427<br>www.cooperativenet.com |
| **Direct Energy Services, LLC**<br>120 Wood Avenue, Suite 611<br>Iselin, NJ 08830 | (866) 547-2722<br>www.directenergy.com |
| **Gateway Energy Services Corp.**<br>44 Whispering Pines Lane<br>Lakewood, NJ 08701 | (800) 805-8586<br>www.gesc.com |
| **UGI Energy Services, Inc.**<br>704 East Main Street, Suite 1<br>Moorestown, NJ 08057 | (856) 273-9995<br>www.ugienergyservices.com |
| **Great Eastern Energy**<br>116 Village Riva, Suite 200<br>Princeton, NJ 08540 | (888) 651-4121<br>www.greateastern.com |
| **Hess Corporation**<br>1 Hess Plaza<br>Woodbridge, NJ 07095 | (800) 437-7872<br>www.hess.com |
| **Intelligent Energy**<br>2050 Center Avenue, Suite 500<br>Fort Lee, NJ 07024 | (800) 724-1880<br>www.intelligentenergy.org |
| **Metromedia Energy, Inc.**<br>6 Industrial Way<br>Eatontown, NJ 07724 | (877) 750-7046<br>www.metromediaenergy.com |
| **MxEnergy, Inc.**<br>510 Thornall Street, Suite 270<br>Edison, NJ 08837 | (800) 375-1277<br>www.mxenergy.com |
| **NATGASCO (Mitchell Supreme)**<br>532 Freeman Street<br>Orange, NJ 07050 | (800) 840-4427<br>www.natgasco.com |
| **Pepco Energy Services, Inc.**<br>112 Main Street<br>Lebanon, NJ 08833 | (800) 363-7499<br>www.pepco-services.com |
| **PPL EnergyPlus, LLC**<br>811 Church Road<br>Cherry Hill, NJ 08002 | (800) 281-2000<br>www.pplenergyplus.com |
| **South Jersey Energy Company**<br>One South Jersey Plaza, Route 54<br>Folsom, NJ 08037 | (800) 756-3749<br>www.southjerseyenergy.com |
| **Woodruff Energy**<br>73 Water Street<br>Bridgeton, NJ 08302 | (800) 557-1121<br>www.woodruffenergy.com |

| Atlantic City Electric Service Territory | Telephone & Web Site |
|---|---|
| **Hess Corporation**<br>1 Hess Plaza Woodbridge, NJ 07095 | (800) 437-7872<br>www.hess.com |
| **American Powernet Management, LP**<br>437 North Grove St.<br>Berlin, NJ 08009 | (877) 977-2636<br>www.americanpowernet.com |
| **BOC Energy Services, Inc.**<br>575 Mountain Avenue<br>Murray Hill, NJ 07974 | (800) 247-2644<br>www.boc.com |
| **Commerce Energy, Inc.**<br>4400 Route 9 South, Suite 100<br>Freehold, NJ 07728 | (800) 556-8457<br>www.commerceenergy.com |
| **ConEdison Solutions**<br>535 State Highway 38<br>Cherry Hill, NJ 08002 | (888) 665-0955<br>www.conedsolutions.com |
| **Constellation NewEnergy, Inc.**<br>900A Lake Street, Suite 2<br>Ramsey, NJ 07446 | (888) 635-0827<br>www.newenergy.com |
| **Direct Energy Services, LLC**<br>120 Wood Avenue, Suite 611<br>Iselin, NJ 08830 | (866) 547-2722<br>www.directenergy.com |
| **FirstEnergy Solutions**<br>300 Madison Avenue<br>Morristown, NJ 07926 | (800) 977-0500<br>www.fes.com |
| **Glacial Energy of New Jersey, Inc.**<br>207 LaRoche Avenue<br>Harrington Park, NJ 07640 | (877) 569-2841<br>www.glacialenergy.com |
| **Integrys Energy Services, Inc.**<br>99 Wood Ave, South, Suite 802<br>Iselin, NJ 08830 | (877) 763-9977<br>www.integrysenergy.com |
| **Liberty Power Delaware, LLC**<br>Park 80 West Plaza II, Suite 200<br>Saddle Brook, NJ 07663 | (866) 769-3799<br>www.libertypowercorp.com |
| **Liberty Power Holdings, LLC**<br>Park 80 West Plaza II, Suite 200<br>Saddle Brook, NJ 07663 | (800) 363-7499<br>www.libertypowercorp.com |
| **Pepco Energy Services, Inc.**<br>112 Main St.<br>Lebanon, NJ 08833 | (800) 363-7499<br>www.pepco-services.com |
| **PPL EnergyPlus, LLC**<br>811 Church Road<br>Cherry Hill, NJ 08002 | (800) 281-2000<br>www.pplenergyplus.com |
| **Sempra Energy Solutions**<br>581 Main Street, 8th Floor<br>Woodbridge, NJ 07095 | (877) 273-6772<br>www.semprasolutions.com |
| **South Jersey Energy Company**<br>One South Jersey Plaza, Route 54<br>Folsom, NJ 08037 | (800) 756-3749<br>www.southjerseyenergy.com |
| **Strategic Energy, LLC**<br>55 Madison Avenue, Suite 400<br>Morristown, NJ 07960 | (888) 925-9115<br>www.sel.com |
| **Suez Energy Resources NA, Inc.**<br>333 Thornall Street, 6th Floor<br>Edison, NJ 08837 | (888) 644-1014<br>www.suezenergyresources.com |
| **UGI Energy Services, Inc.**<br>704 East Main Street, Suite 1 Moorestown, NJ 08057 | (856) 273-9995<br>www.ugienergyservices.com |

## Appendix C: Glossary and Method of Calculations & Glossary of ECM Terms

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

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

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

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

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

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

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

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

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

## Calculation References

ECM = Energy Conservation Measure
AOCS = Annual Operating Cost Savings
AECS = Annual Energy Cost Savings
LOCS = Lifetime Operating Cost Savings
LECS = Lifetime Energy Cost Savings
LCS = Lifetime Cost Savings

NPV = Net Present Value
IRR = Internal Rate of Return
DR = Discount Rate

Net ECM Cost = Total ECM Cost – Incentive
LECS = AECS X ECM Lifetime
AOCS = LOCS / ECM Lifetime
LCS = LOCS+LECS

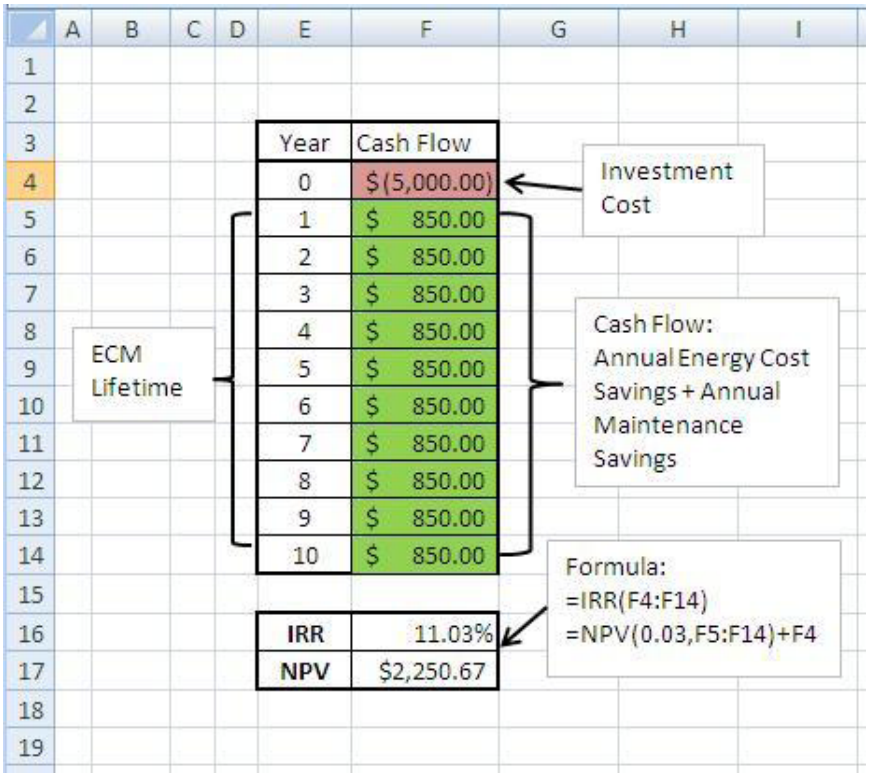
Note: The lifetime operating cost savings are all avoided operating, maintenance, and / or component replacement costs over the lifetime of the ECM. This can be the sum of any annual operating savings, recurring or bulk (i.e. one-time repairs) maintenance savings, or the savings that comes from avoiding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

Simple Payback = Net ECM Cost / (AECS + AOCS)
Lifetime ROI = (LECS + LOCS – Net ECM Cost) / Net ECM Cost
Annual ROI = (Lifetime ROI / Lifetime) = (AECS + OCS) / Net ECM Cost – 1 / Lifetime

It is easiest to calculate the NPV and IRR using a spreadsheet program like Excel.

## Excel NPV and IRR Calculation

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




**ECM and Equipment Lifetimes**

Determining a lifetime for equipment and ECM's can sometimes be difficult. The following table contains a list of lifetimes that the NJCEP uses in its commercial and industrial programs. Other valid sources are also used to determine lifetimes, such as the DOE, ASHRAE, or the manufacturer's warranty.
Lighting is typically the most difficult lifetime to calculate because the fixture, ballast, and bulb can all have different lifetimes. Essentially the ECM analysis will have different operating cost savings (avoided equipment replacement) depending on which lifetime is used.

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

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

**NJCEP C & I Lifetimes**

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