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**November 18, 2011**

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

# Yeshivat Keter Torah

**Abraham Sion Mizrachi Elementary School**
**1 Meridian Road**
**Eatontown, NJ 07724**

**Project Number: LGEA97**

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## EXECUTIVE SUMMARY

The Yeshivat Keter Torah Abraham - Sion Mizrachi School is a single-story building with basement comprising a total conditioned floor area of 38,000 square feet. The original structure was built in 1966 and used as a manufacturing facility. It underwent both a rehabilitation and expansion in 1998 when it was converted to a school and the South Wing was constructed. The current owners purchased the building in June 2011 and are continuing to use it as a school. The following chart provides a comparison of the current building energy usage based on the period from June 2010 through May 2011 with the proposed energy usage resulting from the installation of recommended Energy Conservation Measures (ECMs) excluding any renewable energy:

**Table 1: State of Building—Energy Usage**

| | Electric Usage (kWh/yr) | Gas Usage (therms/yr) | Current Annual Cost of Energy ($) | Site Energy Use Intensity (kBtu/sq ft /yr) | Source Energy Use Intensity (kBtu/sq ft /yr) | Joint Energy Consumption (MMBtu/yr) |
|---|---|---|---|---|---|---|
| Current | 266,169 | 12,141 | $59,874 | 55.9 | 4,304,667 | 2,122 |
| Proposed | 229,986 | 12,269 | $52,569 | 52.9 | 3,905,701 | 2,012 |
| Savings | 36,183 | -128 | $7,304* | 2.9 | 398,966 | 111 |
| % Savings | 13.6% | -1.1% | 12.2% | 5.2% | 9.3% | 5.2% |
| Proposed Renewable Energy | 70,800 | 0 | $54,107 | 6.4 | 6.4 | 242 |
| *Includes operation and maintenance savings; **Includes SRECS | | | | | | |

SWA has entered energy information about the school into the U.S. Environmental Protection Agency's (EPA) Energy Star Portfolio Manager Energy Benchmarking system. Under normal conditions, the building will be able to be benchmarked as a K-12 school and a performance rating of 1-100 can be assigned in order to give the building a sense of how well it is performing. Since the building currently has an area of approximately 9,800 sqft that is currently under renovation, a score could not be calculated for this building. The building has a Site Energy Utilization of 56 kBtu/sqft/yr, which is low due to a portion of the building being renovated.

### Recommendations

Based on the current state of the building and its energy use, SWA recommends implementing the following Energy Conservation Measures:

**Table 2: Energy Conservation Measure Recommendations**

| ECMs | First Year Savings ($) | Simple Payback Period | Initial Investment ($) | CO2 Savings (lbs/yr) |
|---|---|---|---|---|
| 0-5 Year | $2,572 | 3.9 | $9,956 | 23,896 |
| 5-10 Year | $4,732 | 7.9 | $37,468 | 39,478 |
| >10 year | N/A | N/A | N/A | N/A |
| Total | $7,304 | 6.5 | $47,424 | 63,374 |
| Proposed Renewable Energy | $54,107 | 4.4 | $240,000 | 126,767 |

In addition to these ECMs, SWA recommends

- Capital Investment opportunities – measures that would contribute to reducing energy usage but require significant capital resources as well as long-term financial planning
    - Install premium motors when replacements are required
    - Insulate original and uninsulated exterior wall sections.
    - Insulate original and uninsulated roof/ceiling sections.
    - Install drip edge detail at window sill.
    - Replace or repair damaged door units Relocate thermostats to the zones that they control and secure with locking guard.

- Operation and Maintenance (O&M) measures that would contribute to reducing energy usage at low cost – not cost
    - Overgrown ground vegetation should be removed to not touch or block exterior wall surfaces from access, ventilation and sunlight.
    - SWA recommends having the structural integrity of the roof evaluated
    - Unclog and maintain all roof drains/scuppers.
    - Clean gutters and downspouts.
    - Maintain/ inspect all roof surfaces on a regular basis.
    - Repair and maintain damaged window units.
    - Repair damaged frames and maintain sealants at all windows for airtight performance.
    - Install and or replace and maintain weather-stripping around all exterior doors and roof hatches.
    - Provide water-efficient fixtures and controls

There may be energy procurement opportunities for the Yeshivat Keter Torah to reduce annual utility costs, which are $5,591 higher, when compared to the average estimated NJ commercial utility rates. SWA recommends further negotiation with energy suppliers, listed in Appendix C.

Based on the historical energy consumption of the Yeshivat Keter Torah Abraham - Sion Mizrachi School is eligible to participate in the New Jersey Clean Energy Pay for Performance Program. However, to reach the 15% goal of the New Jersey Clean Energy Pay for Performance Program, capital investment opportunities will have to be incorporated into the scope of work.

Please see Appendix G for more information on Incentive Programs.

**Environmental Benefits**

SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 7 cars from the roads each year or is equivalent of planting 217 trees to absorb $CO_2$ from the atmosphere.

**Energy Conservation Measure Implementation**

SWA recommends that the Yeshivat Keter Torah implement the following Energy Conservation Measures using an appropriate Incentive Programs for reduced capital cost:

| Recommended ECMs | Incentive Program (Appendix G for details) |
|---|---|
| Install nine (9) new CFL fixtures | N/A |
| Install eight (8) new occupancy sensors | Smart Start |
| Install 60 kW Solar Photovoltaic system | SRECs |

| | |
|---|---|
| Install fifty (50) new T5 fixtures | Smart Start |
| Replace (1) electric DHW heater with an ENERGY STAR® certified natural gas condensing model | Smart Start |
| Replace one (1) older model compact refrigerator and one (1) 18 cu. ft. refrigerator with new ENERGY STAR® refrigerators | N/A |
| Install one hundred and seventy-five (175) new T8 fixtures | Smart Start |
| Replace one (1) DX split system condenser with an ENERGY STAR™ model | Smart Start |
| Install eleven (11) new pulse start metal halide fixtures | Smart Start |

Appendix H contains an Energy Conservation Measures table which ranks ECMs by Simple Payback.

## INTRODUCTION

Launched in 2008, the Local Government Energy Audit (LGEA) Program provides subsidized energy audits for municipal and local government-owned facilities, including offices, courtrooms, town halls, police and fire stations, sanitation buildings, transportation structures, schools and community centers. The Program will subsidize up to 100% of the cost of the audit. The Board of Public Utilities (BPUs) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

Steven Winter Associates, Inc. (SWA) is a 38-year-old architectural/engineering research and consulting firm, with specialized expertise in green technologies and procedures that improve the safety, performance, and cost effectiveness of buildings. SWA has a long-standing commitment to creating energy-efficient, cost-saving and resource-conserving buildings. As consultants on the built environment, SWA works closely with architects, developers, builders, and local, state, and federal agencies to develop and apply sustainable, 'whole building' strategies in a wide variety of building types: commercial, residential, educational and institutional.

SWA performed an energy audit and assessment for the Abraham Sion Mizrachi Elementary School at 1 Meridian Road Eatontown, NJ. The process of the audit included facility visits on September 20th, 2011, benchmarking and energy bills analysis, assessment of existing conditions, energy modeling, energy conservation measures and other recommendations for improvements. The scope of work includes providing a summary of current building conditions, current operating costs, potential savings, and investment costs to achieve these savings. The facility description includes energy usage, occupancy profiles and current building systems along with a detailed inventory of building energy systems, recommendations for improvement and recommendations for energy purchasing and procurement strategies.

The goal of this Local Government Energy Audit is to provide sufficient information to the Yeshivat Keter Torah to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures for the Abraham Sion Mizrachi Elementary School.

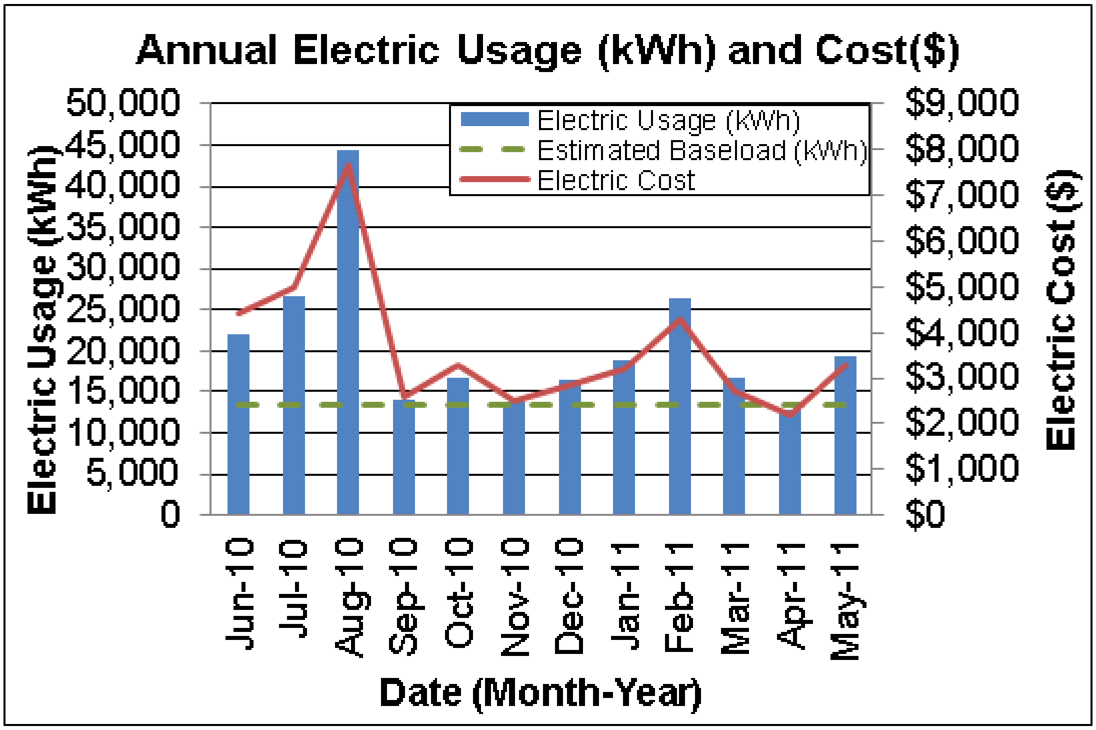
## HISTORICAL ENERGY CONSUMPTION

### Energy usage, load profile and cost analysis

SWA reviewed utility bills from March 2010 through August 2011 that were received from the utility companies supplying the Abraham Sion Mizrachi Elementary School with electricity and natural gas. A 12 month period of analysis from June 2010 through May 2011 was used for all calculations and for purposes of benchmarking the building.

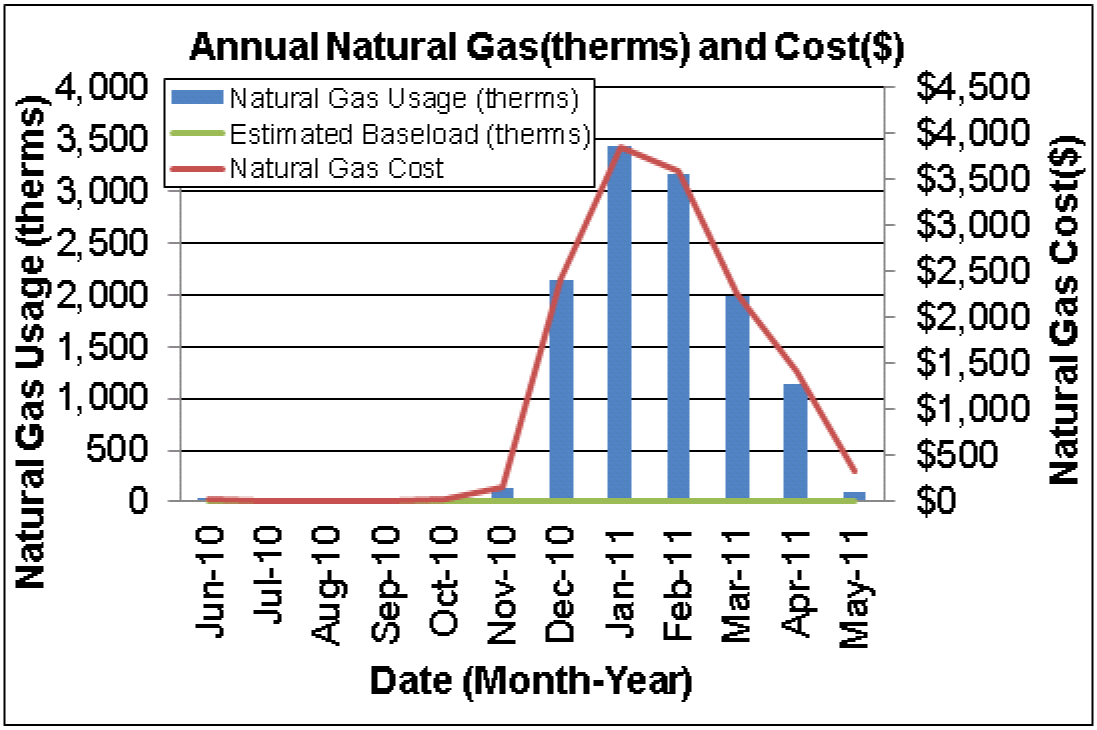
Electricity - The building is currently served by one electric meter. The school currently buys electricity from JCP&L at **an average aggregated rate of $0.171/kWh** and consumed **approximately 266,169 kWh, or $45,516 worth of electricity,** in the previous year. The average monthly demand was 93.0 kW and the annual peak demand was 170.1 kW.

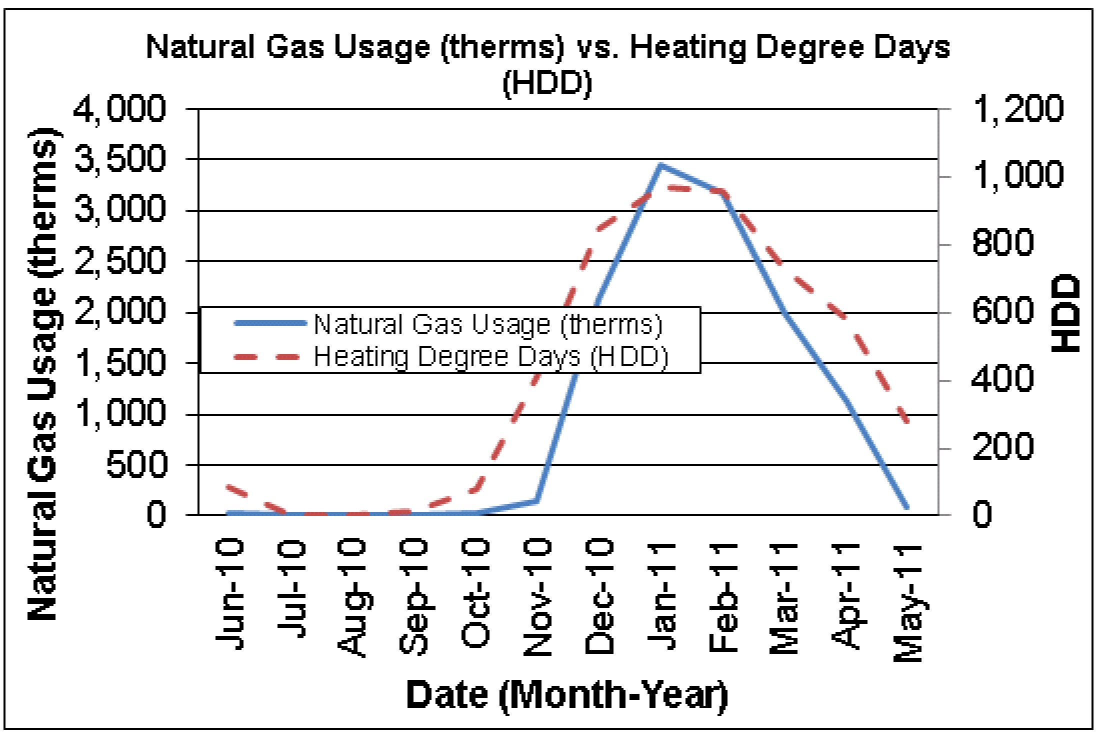
The chart below shows the monthly electric usage and costs. The dashed green line represents the approximate baseload or minimum electric usage required to operate the school. As expected there is a large peak in the summer when the cooling equipment is in operation.




Natural gas - The building is currently served by one meter for natural gas. The school currently buys natural gas from New Jersey Natural Gas at **an average aggregated rate of $1.183/therm** and consumed **approximately 12,141 therms, or $14,358 worth of natural gas,** in the previous year.

The chart below shows the monthly natural gas usage and costs. The green line represents the approximate baseload or minimum natural gas usage required to operate the school. As expected there is a large peak in the winter when the heating equipment is in operation.

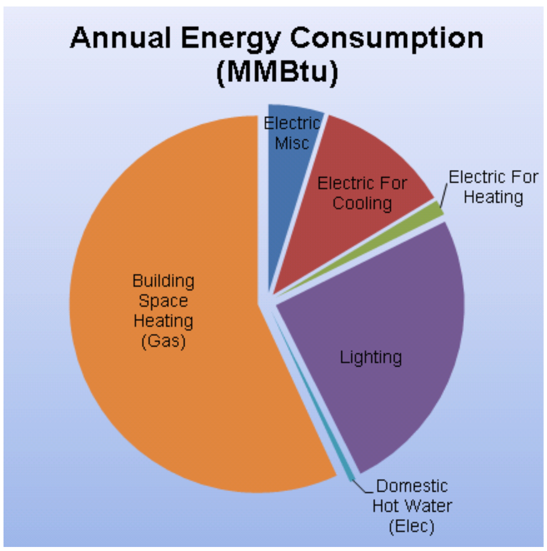


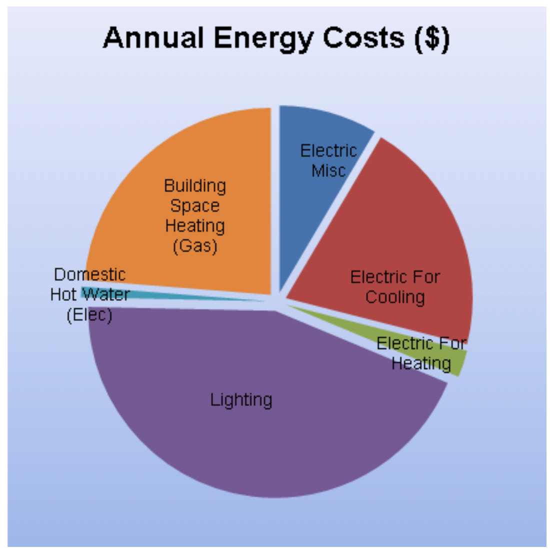




The chart above shows the monthly natural gas usage along with the heating degree days or HDD. Heating degree days is the difference of the average daily temperature and a base temperature, on a particular day. The heating degree days are zero for the days when the average temperature exceeds the base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

The following graphs, pie charts, and table show energy use for the school based on utility bills for the 12 month period. Note: electrical cost at $50/MMBtu of energy is more than four times as expensive as natural gas at $12/MMBtu

| Annual Energy Consumption / Costs | | | | | |
|---|---|---|---|---|---|
| | MMBtu | % MMBtu | $ | % $ | $/MMBtu |
| Electric Misc | 101 | 5% | $5,077 | 9% | 50 |
| Electric For Cooling | 244 | 12% | $12,215 | 20% | 50 |
| Electric For Heating | 28 | 1% | $1,390 | 2% | 50 |
| Lighting | 525 | 25% | $26,289 | 44% | 50 |
| Domestic Hot Water (Elec) | 11 | 1% | $545 | 1% | 50 |
| Building Space Heating (Gas) | 1,199 | 57% | $14,174 | 24% | 12 |
| Totals | 2,107 | 100% | $59,690 | 100% | |
| | | | | | |
| Total Electric Usage | 908 | 43% | $45,516 | 76% | 50 |
| Total Gas Usage | 1,214 | 57% | $14,358 | 24% | 12 |
| Totals | 2,122 | 100% | $59,874 | 100% | |



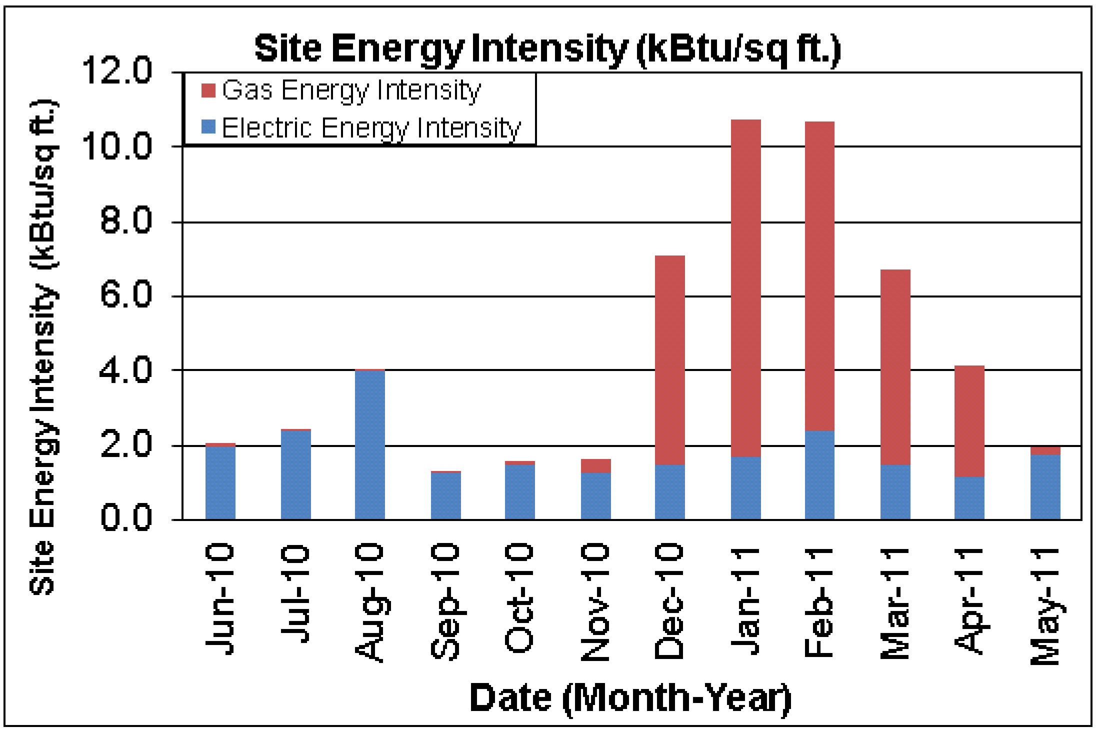




## Energy benchmarking

SWA has entered energy information about the Abraham Sion Mizrachi Elementary School in the U.S. Environmental Protection Agency's (EPA) ENERGY STAR® Portfolio Manager Energy benchmarking system. Under normal conditions, the building will be able to be benchmarked as a K-12 school and a performance rating of 1-100 can be assigned in order to give the building a sense of how well it is performing. Since the building currently has an area of approximately 9,800 sqft that is currently under renovation, a score could not be calculated for this building. SWA benchmarked the 38,000 sqft building as containing 28,200 sqft of K-12 school and 9,800 sqft of "Other" space type to account for the portion of the building that is being renovated. Without accounting for a portion of the building being renovated, Portfolio Manager would give a false performance score higher than expected. SWA recommends that building staff update the Portfolio Manager account to include all 38,000 sqft as soon as renovation is complete. Once the school is fully functioning, a proper benchmark score can be assessed.

The ENERGY STAR® Portfolio Manager uses a national survey conducted by the U.S. Energy Information Administration (EIA). This national survey, known as the Commercial Building Energy Consumption Survey (CBECS), is conducted every four years, and gathers data on building characteristics and energy use from thousands of buildings across the United States. The Portfolio Manager software uses this data to create a database by building type. By entering the building parameters and utility data into the software, Portfolio Manager is able to generate a performance scale from 1-100 by comparing it to similar office buildings. This 100 point scale determines how well the building performs relative to other buildings across the country, regardless of climate and other differentiating factors.

The building has a Site Energy Utilization of 56 kBtu/sqft/yr, which is low and expected to increase once renovations are complete. This Site Energy Use Intensity can be attributed to the fact that the school is still undergoing renovations and is not at full occupancy yet and is not an accurate reflection on the performance of the existing HVAC equipment and building envelope.




Per the LGEA program requirements, SWA has assisted the Yeshivat Keter Torah to create an ENERGY STAR® Portfolio Manager account and share the Abraham Sion Mizrachi Elementary School facilities information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager account information with the Yeshivat Keter Torah (user name of “YeshivatKeterTorah” with a password of “yeshivatketertorah”) and TRC Energy Services (user name of “TRC-LGEA”).

**Tariff analysis**

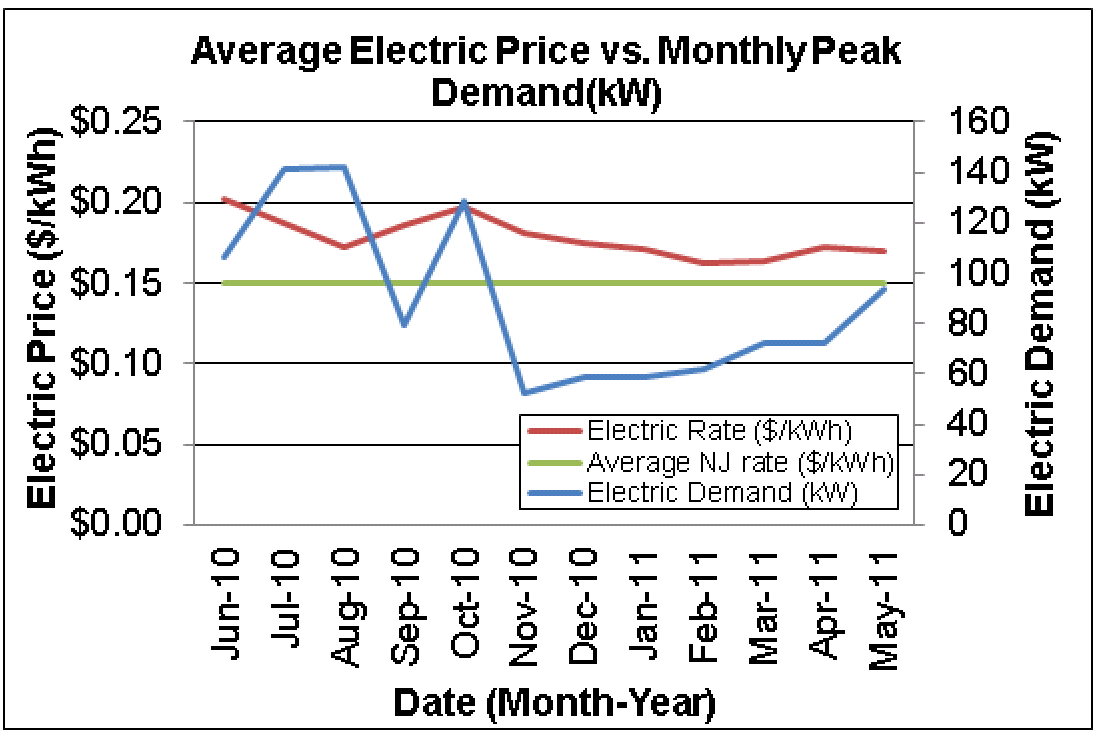
Tariff analysis can help determine if the municipality is paying the lowest rate possible for electric and gas service. Tariffs are typically assigned to buildings based on size and building type. Rate fluctuations are expected during periods of peak usage. Natural gas prices often increase during winter months since large volumes of natural gas is needed for heating equipment. Similarly, electricity prices often increase during the summer months when additional electricity is needed for cooling equipment.

As part of the utility bill analysis, SWA evaluated the current utility rates and tariffs for the Yeshivat Keter Torah. The Abraham Sion Mizrachi Elementary School is currently paying a general service rate for natural gas including fixed costs such as meter reading charges. The electric use for the building is direct-metered and purchased at a general service rate with an additional charge for electrical demand factored into each monthly bill. The general service rate is a market-rate based on electric usage and electric demand. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year.

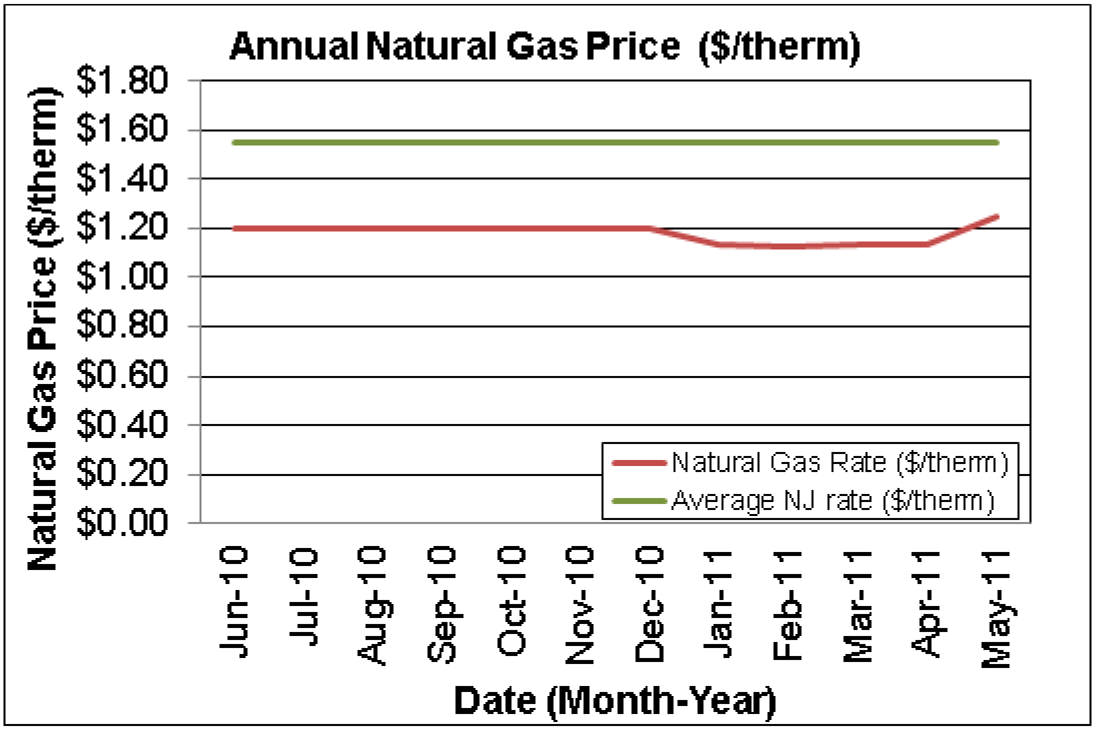
**Energy Procurement strategies**

Billing analysis was conducted using an average aggregated rate which is estimated based on the total cost divided by the total energy usage for each utility over a 12 month period. Average aggregated rates do not separate demand charges from usage, and instead provide a metric of inclusive cost per unit of energy. Average aggregated rates are used in order to equitably compare building utility rates to average utility rates throughout the state of New Jersey.

The average estimated NJ commercial utility rates for electric are $0.150/kWh, while Abraham Sion Mizrachi Elementary School pays a rate of $0.171/kWh. The school's annual electric utility costs are $5,591 higher, when compared to the average estimated NJ commercial utility rates. Electric bill analysis shows fluctuations up to 18% over the most recent 12 month period. As expected the electric rate peaks in the summer but peaks a second time in the fall due to the high demand. Additionally there is some fluctuation in the late summer due to occupancy fluctuations as a result of the ownership transition.



The average estimated NJ commercial utility rates for gas are $1.550/therm, while Abraham Sion Mizrachi Elementary School pays a rate of $1.183/therm. Natural gas bill analysis shows fluctuations up to 10% over the most recent 12 month period.




The lack of utility rate fluctuations between June to November are caused by the combination of low to no usage over these months and their combination into one bill by the utility company. The building pays below the average rate for natural gas in NJ based on the previous annual consumption.

SWA recommends that the Abraham Sion Mizrachi Elementary School further explore opportunities of purchasing electricity from third-party suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the school. Appendix C contains a complete list of third-party energy suppliers for the Yeshivat Keter Torah service area.

## EXISTING FACILITY AND SYSTEMS DESCRIPTION

This section gives an overview of the current state of the facility and systems. Please refer to the Proposed Further Recommendations section for recommendations for improvement.

Based on visits from SWA on Tuesday, September 20, 2011, the following data was collected and analyzed.

### Building Characteristics

The single story including a partial basement, 38,000 square feet Abraham Sion Mizrachi Elementary School was originally constructed in 1966 as a manufacturing facility. It underwent both a rehabilitation and expansion in 1998 when it was converted to a school and the South Wing was constructed. The current owners purchased the building in June 2011 and are continuing to use it as a school. It houses classrooms, gymnasiums, administrative offices, and multi-purpose meeting rooms. The basement is currently unoccupied and undergoing renovation.

*Partial East Façade*

*Partial West Façade*

*Partial North Façade*


*Partial South Façade*

### Building Occupancy Profiles

The building's occupancy is approximately 200 students, 50 faculty members and administrative employees and 2 building maintenance personnel from 8:30 AM to 5:00 PM on Monday through Thursday and from 8:30 AM to 1:00 PM on Friday and Sunday.

## Building Envelope

Due to unfavorable weather conditions, no exterior envelope infrared (IR) images were taken during the field audit.

*General Note:* All findings and recommendations on the exterior envelope (base, walls, roofs, doors and windows) are based on the energy auditors' experience and expertise, on construction document reviews (if available) and on detailed visual analysis, as far as accessibility and weather conditions allowed at the time of the field audit.

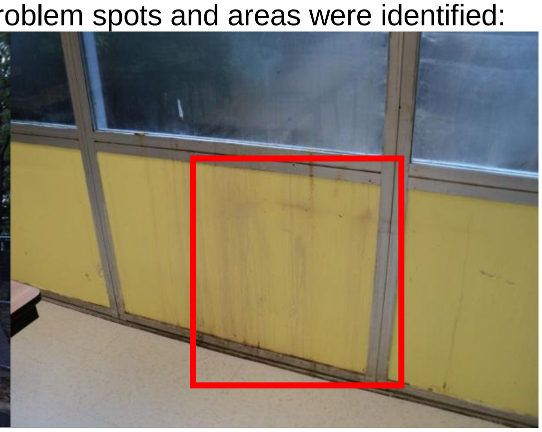
### Exterior Walls

The exterior wall envelope is mostly constructed of aluminum panels over steel framing with no detectable insulation. Other areas are constructed of a stucco finish over steel framing with 0 inches of detectable insulation or exposed cast-in-place concrete over concrete block with 0 inches of detectable insulation. The interior is mostly painted gypsum wallboard, and painted concrete block.

*Note:* Wall insulation levels could visually be verified in the field by non-destructive methods.

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall poor condition with numerous signs of uncontrolled moisture, air-leakage and other energy-compromising issues detected on all facades.

The following specific exterior wall problem spots and areas were identified:

*Damaged exterior wall finishes, overgrown ground vegetation blocking exterior wall surfaces and signs of water damage and mold at perimeter walls.*

**Roof**

The building's roof is predominantly a flat, no parapet type over steel decking, with a dark-colored EPDM single membrane finish. This roof was installed in 1998. Three and a half inches of fiberglass batt attic insulation, and no detectable roof insulation were recorded. This roof is split into two sections with a larger main section and smaller sub-section.

Note: Roof insulation levels could visually be verified in the field by non-destructive methods.

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall acceptable condition, with some signs of uncontrolled moisture, air-leakage and other energy-compromising issues detected on all roof areas. Additionally, the current roof condition leads SWA to recommend that a structural inspection be undertaken especially in light of current plans to install solar PV panels on the roof.

The following specific roof problem spots were identified:




*Signs of standing water and pooling, uncontrolled roof water run-off due to defective/clogged gutters and downspouts, cracking and bubbling of the membrane surface and the presence of loose sharp objects on the roof surface.*

### Base

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

Slab/perimeter insulation levels could not be verified in the field or on construction plans, and are based upon similar wall types and time of construction.

The building's base and its perimeter were inspected for signs of uncontrolled moisture or water presence and other energy-compromising issues. Overall the base was reported to be in good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues neither visible on the interior nor exterior.

### Windows

The building contains several different types of windows:

1. Unit (fixed and hopper) type windows with a non-insulated aluminum frame, clear double glazing and interior roller shades. The windows are located in the South Wing only.

2. Double-hung type windows with a non-insulated aluminum frame clear double glazing and interior mini blinds. The windows are located throughout the building.

3. Fixed type windows with a non-insulated aluminum frame, clear double glazing and interior mini blinds. The windows are located throughout the building.

4. Side-light and transom type windows with a non-insulated aluminum frame, clear double glazing and no interior or exterior shading devices. The windows are located at the glass entryways only.

Windows, shading devices, sills, related flashing and caulking were inspected as far as accessibility allowed for signs of moisture, air-leakage and other energy compromising issues. Overall, the windows were found to be in good condition with only a few signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific window problem spots were identified:

*Damaged window frames, missing window sill and drip-edge details, signs of both exterior and interior mold and water damage around windows*

### Exterior doors

The building contains several different types of exterior doors:

1. Glass with aluminum frame type exterior doors. They are located throughout the building.

2. Solid metal type exterior doors. They are located throughout the building.

3. Solid metal with glass panel type exterior doors. They are located throughout the building.

4. Overhead metal type exterior door. It is located on the basement floor and was installed in 1998.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, the doors were found to be in good/ age appropriate condition with some signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific door problem spots were identified:

Signs of a damaged solid metal with glass panel door and a damaged and warped overhead door frame. SWA also observed that un-insulated doors were installed between different conditioned spaces and missing and worn weather-stripping

### Building air-tightness

Overall the field auditors found the building to be not adequately air-tight with numerous areas of suggested improvements, as described in more detail earlier in this chapter.

The air tightness of buildings helps maximize all other implemented energy measures and investments, and minimizes potentially costly long-term maintenance, repair and replacement expenses.

## Mechanical Systems

### Heating Ventilation Air Conditioning

The Abraham Sion Mizrachi Elementary School has heating, cooling and ventilation for all occupied spaces. During the field visit the same major comfort issue was reported regarding infiltration and convective heat loss across the aluminum panel walls.

### Equipment

The Abraham Sion Mizrachi Elementary School is heated/cooled by a combination of seven rooftop packaged units, five floor mounted packaged units, three through-the-window air conditioning units, two direct expansion (DX) split systems, a natural gas-fired unit heater, electric unit heater and electric perimeter baseboards. A comprehensive Equipment List can be found in Appendix A.

Conditioned air is provided to the building by the packaged rooftop and floor mounted units and the through-the-window air conditioners.

*Gas-Fired Packaged Unit Description*
Packaged rooftop units (RTU) and packaged ground mounted units are installed outside the building and contain a burner which provides heat to intake air through the combustion of natural gas. RTU's also contain a direct expansion (DX) system for cooling, made up of an evaporator, condenser and refrigerant loop; the refrigerant absorbs heat from intake air at the evaporator coil and transfers the heat to the atmosphere in the condenser. The various spaces of the building are provided ventilation by the louvered ducted outside air intakes of the packaged units. The outside air louvers are motorized to allow for economizer operation when the outside air conditions are favorable. The RTUs have 27% - 53% remaining operating life and appear in good condition.

*RTU # 2:*
RTU # 2 serves lobby, library, the Northeast portion of the hallways and several small offices. It is mounted on a platform on the main section of the roof. This Trane Voyager unit has a cooling capacity of 15 tons. It is also equipped with a natural gas-fired forced air furnace section with a maximum input of 350 MBTU, maximum output of 284 MBTU and thermal efficiency of 81.1%. This unit was installed in 2003 and appears to be in good condition.

*RTU #2*

*RTU # 3*

RTU # 3 serves the administrative offices, classrooms in the Northeast portion of the building by the South yard, and bathrooms. It is mounted on a platform on the main section of the roof. The unit is manufactured by International Comfort Products and has a cooling capacity of 10 tons. It is also equipped with a natural gas-fired forced air furnace section with a maximum input of 240 MBTU, output of 192 MBTU and thermal efficiency of 80%. This unit was installed in 2003 and appears to be in good condition.

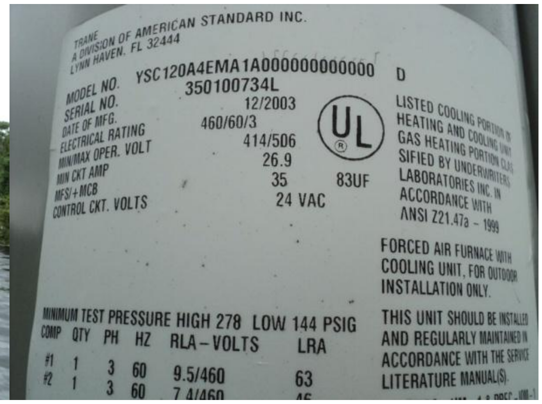

*RTU # 3*

*RTU's # 4, 11, and 13*

RTU # 4 serves the classrooms by the North exit, multipurpose meeting rooms in the Northern portion of the building and the Building Administrator's offices in the Northeast corner. RTU # 11 serves the classrooms and offices directly to the South of the main gymnasium between the two hallways that lead to the Southern exits. RTU # 13 serves the main gymnasium and its adjacent storage rooms.

RTU's # 4, 11, and 13 are all mounted on a platform on the main section of the roof.

They are all manufactured by Trane and have a cooling capacity of 10 tons. All are equipped with natural gas-fired forced air furnace sections with maximum inputs of 200 MBTU, maximum outputs of 160 MBTU and a thermal efficiency of 80%. RTU # 11 was installed in 2003, while RTU's 4 and 13 were installed in 2004. All of the units appear to be in good condition.

*RTU # 4 (L.) and nameplate (R.)*



*RTU # 11 (L.) and RTU # 13 (R.)*

*<u>RTU # 5</u>*
RTU # 5 serves the secondary gymnasium. It is mounted on a platform on the main section of the roof. The unit is manufactured by American Standard and has a cooling capacity of 5 tons. It is also equipped with a natural gas-fired forced air furnace section with a maximum input of 130 MBTU, maximum output of 108 MBTU and thermal efficiency of 83.1%. This unit was installed in 2004 and appears to be in good condition.

*RTU # 5*

*<u>Unit # 6</u>*
RTU # 6 serves the northwest sector of the hallway, bathrooms, kitchen and the classroom adjacent to the kitchen. The unit is floor mounted in a fenced in area of the West yard. The unit is manufactured by Trane and has a cooling capacity of 7.5 tons. It is also equipped

with a natural gas-fired forced air furnace section with a maximum input of 200 MBTU, maximum output of 160 MBTU and thermal efficiency of 80%. This unit was installed in 2008 and appears to be in good condition.

*RTU # 6*

*Unit # 7*

RTU # 7 serves the five classrooms located around the perimeter of the Northwest portion of the building. The unit is ground mounted in a fenced in area of the West yard. This Trane Voyager unit has a cooling capacity of 15 tons. It is also equipped with a natural gas-fired forced air furnace section with a maximum input of 350 MBTU, maximum output of 284 MBTU and thermal efficiency of 81.1%. This unit was installed in 2005 and appears to be in good condition.

*RTU # 7*

*Unit # 8*

RTU # 8 serves the cafeteria, pantry, several offices, and a small classroom. The unit is ground mounted in a fenced in area of the West yard. This Snyder General Climate Control unit has a cooling capacity of 7.5 tons. It is also equipped with a natural gas-fired forced air furnace section with a maximum input of 210 MBTU, maximum output of 166 MBTU and thermal efficiency of 79%. This unit appears to be in good condition.

*RTU # 8*

<u>*Units # 9 and 10*</u>
RTU # 9 serves classrooms by the South yard, sprinkler control room, and bathrooms. RTU # 10 serves the remaining perimeter classrooms by the South yard. Both units are ground mounted in a fenced in area of the South yard. These Rheem Ruud B-series units each have a cooling capacity of 7.5 tons. They are also both equipped with natural gas-fired forced air furnace sections with a maximum input of 112.5 MBTU, maximum output of 182.25 MBTU and thermal efficiency of 81%. RTU # 9 was installed in 2001 and RTU # 10 was installed in 2000. Both units appear to be in good condition.

*RTU's # 9 and 10 (L.) and RTU # 9*

<u>*RTU # 12*</u>
RTU # 12 serves the Southwest perimeter classrooms. It is mounted on a platform on the main section of the roof. This Trane Voyager unit has a cooling capacity of 12.5 tons. It is also equipped with a natural gas-fired forced air furnace section with a maximum input of 250 MBTU, maximum output of 203 MBTU and thermal efficiency of 81.2%. This unit was installed in 2004 and appears to be in good condition.

*RTU # 12*

*DX Split Systems*

The school’s library is cooled by a DX split system with a rooftop condenser unit and wall mounted evaporator unit. It has a cooling capacity of 18,000 BTUH, a SEER of 13 and operates on R-22 refrigerant. There is also another DX split system which serves the administrative office area. It has a cooling capacity of 42,000 BTUH and operates on R-22 refrigerant.

*Comfort Star DX split system serving the library (above) and Zone # 1 condenser*

*Heating Equipment*

The basement is heated by a forced air natural gas-fired unit heater. It is currently disconnected but will be reconnected when the renovations to the basement are complete. It is manufactured by Reznor, has a maximum input of 200 MBTU, maximum output of 154 and thermal efficiency of 77%.

*Basement Unit Heater*

Heating in the entrance vestibule is provided by a 2.0 kW recessed electric unit heater and some of the administrative offices are heated by perimeter electric baseboards.


*Electric heating equipment*

*Ventilation*
There are also exhaust fans located on the roof, which serve the bathrooms, the kitchen and general exhaust. In general, the building exhaust fans have an estimated 35% useful operating life left and appear in good operating condition. None of the fans are equipped with timers. All of the bathrooms are equipped with their own switch activated exhaust fans.

*Typical roof mounted exhaust fans*

*Typical bathroom*

### Distribution Systems

The Abraham Sion Mizrachi Elementary School has a constant volume air system with manual volume dampers.

The piping in the mechanical room was properly insulated. Insulation on hot or cold water piping is a code requirement for safety from scalding as well as thermal energy savings.

### Controls

Each packaged rooftop and ground mounted unit and the DX split system units are all controlled by digital programmable thermostats. There is no centralized control system installed for the building. All of the thermostats are equipped with $6^{o}$F – $7^{o}$F setbacks between occupied and unoccupied mode for both heating and cooling; however, some of the units that serve the gymnasiums and meeting rooms, are currently programmed with $13^{o}$F – $20^{o}$F setbacks between occupied and unoccupied mode for heating during the weekend. Many of the thermostats are located outside of the zone that they control and are instead located in offices alongside other thermostats. SWA recommends that all thermostats be relocated to the zone that they control to ensure accurate temperature readings of the existing conditions and that they are placed inside locking thermostat guards to prevent unauthorized access.

*Typical digital programmable thermostats*

### Domestic Hot Water

The domestic hot water (DHW) for the Abraham Sion Mizrachi Elementary School is provided by an electric storage heater with two 4,500 W elements, a maximum heating input of 4,500 W and 66 gallons of storage capacity. It is manufactured by A.O. Smith, and was installed in 2000. The heater has 27% estimated useful operating life remaining and appears in good condition.


*Electric DHW heater*

## Electrical systems

### Lighting

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

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

Interior Lighting - The Abraham Sion Mizrachi Elementary School currently contains mostly electronically ballasted T8 lamped fixtures; however, there are still some magnetically ballasted T12 lamped fixtures installed. Also installed are self-ballasted compact fluorescent lamped fixtures and metal halide lamped fixtures. Based on measurements of lighting levels for each space, there are no vastly over-illuminated areas; however, the main gymnasium is under lit.

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

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be a mix of mercury vapor, metal halide and incandescent lamped fixtures. Exterior lighting is controlled by a combination of photocells and switches.

### Appliances and process

SWA has conducted a general survey of larger, installed equipment. Appliances and other miscellaneous equipment account for a significant portion of electrical usage within the building. Typically, appliances are referred to as “plug-load” equipment, since they are not inherent to the building’s systems, but rather plug into an electrical outlet. Equipment such as process motors, computers, computer servers, radio and dispatch equipment, refrigerators, vending machines and printers all create an electrical load on the building that is hard to separate out from the rest of the building’s energy usage based on utility analysis.

Installed in the school are two newer model efficient compact refrigerators, one older model compact refrigerator, one larger residential style 18 cu. ft. refrigerator, and commercial style kitchen equipment including freezers and refrigerators.

### Elevators

The Abraham Sion Mizrachi Elementary School does not have an installed elevator.

### Other electrical systems

There are not currently any other significant energy-impacting electrical systems installed at the school other than two electrical transformers sized for 112.5 kVa a third transformer sized for 30 kVa

## RENEWABLE AND DISTRIBUTED ENERGY MEASURES

Renewable energy is defined as any power source generated from sources which are naturally replenished, such as sunlight, wind and geothermal. Technology for renewable energy is improving and the cost of installation is decreasing due to both demand and the availability of government-sponsored funding. Renewable energy reduces the need for using either electricity or fossil fuel, therefore lowering costs by reducing the amount of energy purchased from the utility company. Solar photovoltaic panels and wind turbines use natural resources to generate electricity. Geothermal systems offset the thermal loads in a building by using water stored in the ground as either a heat sink or heat source. Cogeneration or Combined Heat and Power (CHP) allows for heat recovery during electricity generation.

### Existing systems

Currently there are no renewable energy systems installed in the building.

### Evaluated Systems

### Solar Photovoltaic

Photovoltaic panels convert light energy received from the sun into a usable form of electricity. Panels can be connected into arrays and mounted directly onto building roofs, as well as installed onto built canopies over areas such as parking lots, building roofs or other open areas. Electricity generated from photovoltaic panels is generally sold back to the utility company through a net meter. Net-metering allows the utility to record the amount of electricity generated in order to pay credits to the consumer that can offset usage and demand costs on the electric bill. In addition to generation credits, there are incentives available called Solar Renewable Energy Credits (SRECs) that are subsidized by the state government. Specifically, the New Jersey State government pays a market-rate SREC to facilities that generate electricity in an effort to meet state-wide renewable energy requirements.

The school is already in possession of a 60 kW solar panel system; however, they have not installed this system yet. SWA recommends that the building complete a structural inspection of the roof before installing the solar panel system. Please see ECM # 5 for more details.

### Solar Thermal Collectors

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

### Wind

The Abraham Sion Mizrachi Elementary School is not a good candidate for wind power generation due to insufficient wind conditions at the location in its current region of New Jersey.

### Geothermal

The Abraham Sion Mizrachi Elementary School is not a good candidate for geothermal installation since it would require replacement of the entire existing HVAC system, of which major components still have between 27% and 53% remaining useful life.

### Combined Heat and Power

The Abraham Sion Mizrachi Elementary School is not a good candidate for CHP installation and would not be cost-effective due to the size and operations of the building. Typically, CHP is best suited for buildings with a high electrical baseload to accommodate the electricity generated, as well as a means for using waste heat generated. Typical applications include buildings with an absorption chiller, where waste heat would be used efficiently.

## PROPOSED ENERGY CONSERVATION MEASURES

Energy Conservation Measures (ECMs) are recommendations determined for the building based on improvements over current building conditions. ECMs have been determined for the building based on installed cost, as well as energy and cost-savings opportunities.

### Recommendations: Energy Conservation Measures

| ECM# | Description of Highly Recommended 0-5 Year Payback ECMs |
|---|---|
| 1 | Install nine (9) new CFL fixtures |
| 2 | Install eight (8) new occupancy sensors |
| 4 | Install fifty (50) new T5 fixtures |
| 5 | Replace (1) Electric DHW Heater with Energy Star Natural Gas Condensing Model |
| | **Description of Recommended 5-10 Year Payback ECMs** |
| 6 | Replace one (1) older model compact refrigerator and one (1) 18 cu. ft. refrigerator with new ENERGY STAR® refrigerators |
| 7 | Install one hundred and seventy-five (175) new T8 fixtures |
| 8 | Replace one (1) DX split system condenser with an ENERGY STAR™ model |
| 9 | Install eleven (11) new pulse start metal halide fixtures |
| | **Description of Recommended >10 Year Payback ECMs** |
| 3 | Install 60 kW Solar Photovoltaic system |

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

## ECM#1: Install nine (9) new CFL fixtures

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

### Installation cost:

Estimated installed cost: $92 (includes $45 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

### Economics:

| est. installed cost, $ | est. incentives, $ | net est. ECM cost with incentives, $ | kWh, 1st yr savings | kW, demand reduction/mo | therms, 1st yr savings | kBtu/sq ft, 1st yr savings | est. operating cost, 1st yr savings, $ | total 1st yr savings, $ | life of measure, yrs | est. lifetime 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 92 | 0 | 92 | 553 | 0 | 0 | 0.2 | 24 | 119 | 5 | 595 | 0.8 | 545 | 109 | 127 | 435 | 991 |

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

### Rebates/financial incentives:

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

Please see Appendix G for more information on Incentive Programs.

## ECM#2: Install eight (8) new occupancy sensors

On the days of the site visits, SWA completed a lighting inventory of the Abraham Sion Mizrachi Elementary School (see Appendix B). The building contains eight areas that could benefit from the installation of occupancy sensors. These areas consisted of various meeting rooms and offices that are used sporadically throughout the day and could show energy savings by having the lights turn off after a period of no occupancy. Typically, occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion is detected within a set time period. Advanced micro-phonic lighting sensors include sound detection as a means to controlling lighting operation.

### Installation cost:

Estimated installed cost: $1,600 (includes $640 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

### Economics:

| ECM description | est. installed cost, $ | est. incentives, $ | net est. ECM cost with incentives, $ | kWh, 1st yr savings | kW, demand reduction/mo | therms, 1st yr savings | kBtu/sq ft, 1st yr savings | est. operating cost, 1st yr savings, $ | total 1st yr savings, $ | life of measure, yrs | est. lifetime cost savings, $ | simple payback, yrs | lifetime return on investment, % | annual return on investment, % | internal rate of return, % | net present value, $ | $CO_2$ reduced, lbs/yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Install eight (8) new occupancy sensors | 1,760 | 160 | 1,600 | 4,378 | 1 | 0 | 1.5 | 0 | 749 | 15 | 11,229 | 2.1 | 602 | 40 | 47 | 6,985 | 7,838 |

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

### Rebates/financial incentives:

- NJ Clean Energy – SmartStart – Wall-mounted Occupancy Sensors ($20 per control)
    - Maximum Incentive Amount: $160.

Please see Appendix G for more information on Incentive Programs.

## ECM#3: Install 60 kW Photovoltaic System

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

The size of the system was determined based on the capacity of the previously purchased equipment that has yet to be installed while also considering the available roof surface area, without compromising service space for roof equipment and safety, as well as the facilities' annual base load and mode of operation.

The building is already in possession of panels with 14.2 square feet of surface area and 175 W of power per panel (providing 12.32 watts per square foot). A 60 kW system needs approximately 343 panels which would take up 4,870 square feet.

SWA also recommends that the building complete a structural inspection of the roof before installing the solar panel system due to concerns about the condition of the current roof.

The reduced installation cost is due to the fact that the panels have already been purchased and reflect the need to purchase other related electrical components such as inverters and installation costs such as labor, design, and permitting to complete the system installation.

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

**Installation cost:**

Net estimated installed cost: $240,000 (includes $216,000 of labor)

Source of cost estimate: RS Means; Published and established costs; Similar projects

**Economics:**

| ECM description | est. installed cost, $ | est. incentives, $ | net est. ECM cost with incentives, $ | kWh, 1st yr savings | kW, demand reduction/mo | therms, 1st yr savings | kBtu/sq ft, 1st yr savings | est. operating cost, 1st yr savings, $ | total 1st yr savings, $ | life of measure, yrs | est. lifetime cost savings, $ | simple payback, yrs | lifetime return on investment, % | annual return on investment, % | internal rate of return, % | net present value, $ | $CO_2$ reduced, lbs/yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Install 60 kW Solar Photovoltaic system | 240,000 | 0 | 240,000 | 70,800 | 60 | 0 | 6.4 | 0 | 54,107 | 25 | 1,352,677 | 4.4 | 464 | 19 | 22 | 446,140 | 126,767 |

**Annual Solar PV Cost Savings Breakdown**

| Rated Capacity (kW) | 60.0 | | | |
|---|---|---|---|---|
| Rated Capacity (kWh) | 70,800 | | | |
| Annual Capacity Loss | 0% | | | |
| Year | kWh Capacity | Installed Cost | Incentives | Electric Savings ($) |
| 0 | | $240,000 | $0 | |
| 1 | 70,800 | | $42,000 | $12,107 |
| 2 | 70,800 | | $42,000 | $12,107 |
| 3 | 70,800 | | $42,000 | $12,107 |
| 4 | 70,800 | | $42,000 | $12,107 |
| 5 | 70,800 | | $42,000 | $12,107 |
| 6 | 70,800 | | $42,000 | $12,107 |
| 7 | 70,800 | | $42,000 | $12,107 |
| 8 | 70,800 | | $42,000 | $12,107 |
| 9 | 70,800 | | $42,000 | $12,107 |
| 10 | 70,800 | | $42,000 | $12,107 |
| 11 | 70,800 | | $42,000 | $12,107 |
| 12 | 70,800 | | $42,000 | $12,107 |
| 13 | 70,800 | | $42,000 | $12,107 |
| 14 | 70,800 | | $42,000 | $12,107 |
| 15 | 70,800 | | $42,000 | $12,107 |
| 16 | 70,800 | | $0 | $12,107 |
| 17 | 70,800 | | $0 | $12,107 |
| 18 | 70,800 | | $0 | $12,107 |
| 19 | 70,800 | | $0 | $12,107 |
| 20 | 70,800 | | $0 | $12,107 |
| 21 | 70,800 | | $0 | $12,107 |
| 22 | 70,800 | | $0 | $12,107 |
| 23 | 70,800 | | $0 | $12,107 |
| 24 | 70,800 | | $0 | $12,107 |
| 25 | 70,800 | | $0 | $12,107 |
| | kWh | Cost | Saving | |
| **Lifetime Total** | **1,770,000** | **($240,000)** | **$630,000** | **$302,677** |

Rebates/financial incentives:

- NJ Clean Energy - Solar Renewable Energy Certificate Program. Each time a solar electric system generates 1,000kWh (1MWh) of electricity, a SREC is issued which can then be sold or traded separately from the power. The buildings must also become net-metered in order to earn SRECs as well as sell power back to the electric grid. A total of $42,000/year, based on $600/SREC, has been incorporated in the above costs for a period of 15 years; however it requires proof of performance, application approval and negotiations with the utility.

Please see Appendix G for more information on Incentive Programs.

## ECM#4: Install fifty (50) new T5 fixtures

On the day of the site visit, SWA completed a lighting inventory of the Abraham Sion Mizrachi Elementary School (see Appendix B). The existing lighting inventory consists of 20 standard probe start Metal Halide (MH) lamps. SWA recommends replacing the interior higher wattage MH fixtures with T5 lamps and electronic ballasts which offer the advantages of standard probe start MH lamps, but minimize the disadvantages. They operate more efficiently, produce whiter light, and turn on and re-strike faster. SWA recommends a two-to-one substitution to provide spaces with the same amount of illumination. Due to concerns about the main gymnasium being under lit, SWA is recommending a three to one substitution for this space. In total SWA recommends installing fifty T5 fixtures. The labor for the recommended installations is evaluated using prevailing electrical contractor wages. The building owner may decide to perform this work with in-house resources on a scheduled, longer timeline than otherwise performed by a contractor.

### Installation cost:

Estimated installed cost: $8,264 (includes $4,750 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

### Economics:

| ECM # | ECM description | est. installed cost, $ | est. incentives, $ | net est. ECM cost with incentives, $ | kWh, 1st yr savings | kW, demand reduction/mo | therms, 1st yr savings | kBtu/sq ft, 1st yr savings | est. operating cost, 1st yr savings, $ | total 1st yr savings, $ | life of measure, yrs | est. lifetime cost savings, $ | simple payback, yrs | lifetime return on investment, % | annual return on investment, % | internal rate of return, % | net present value, $ | $CO_2$ reduced, lbs/yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Install fifty (50) new T5 fixtures | 8,764 | 500 | 8,264 | 8,415 | 2 | 0 | 2.9 | 266 | 1,705 | 15 | 25,574 | 4.8 | 209 | 14 | 19 | 11,432 | 15,068 |

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

### Rebates/financial incentives:

- NJ Clean Energy - Smart Start - T8 fixtures with electronic ballasts ($10 per fixture)
    - Maximum Incentive Amount - $500

Please see Appendix G for more information on Incentive Programs.

## ECM#5: Replace (1) electric DHW heater with an ENERGY STAR® certified natural gas condensing model

On the day of the site visit, SWA completed a mechanical inventory of the Abraham Sion Mizrachi Elementary School (see Appendix A). SWA observed that domestic hot water was being generated by an electric heated domestic hot water storage type hot water heater with two 4,500 W heating elements.

The most efficient DHW systems available are generally gas-fired. Even though electric models have a higher energy factor than fuel-burning models, electric resistance is a very expensive way to generate heat. It does not have great environmental benefits either, since electricity is only as clean and efficient as the fuel (often coal) that generates it. Before ruling out electricity, though, check if the utility company offer special off-peak rates or options for purchasing renewable power that may make electricity a more attractive option.

The capacity of a water heater is an important consideration. The water heater should provide enough hot water at the busiest time of the day. For a storage water heater, this capacity is indicated by its "first hour rating" (found on Energy Guide label alongside efficiency rating) which accounts for the effects of tank size and the speed by which cold water is heated.

DHW heaters range in size from 20 to 80 gallons (or larger) and fueled by electricity, natural gas, propane, or oil, storage water heaters transfer heat from a burner or coil to water in an insulated tank. Because heat is lost through the flue (except in electric models) and through the walls of the storage tank, energy is consumed even when no hot water is being used.

New energy-efficient gas-fired storage water heaters are a good, cost-effective replacement option for old water heaters if a gas line is in your building. They have higher levels of insulation around the tank and one-way valves where pipes connect to the tank, substantially reducing standby heat loss. Newer super-efficient "condensing" and "near-condensing" gas water heaters save much more energy compared to traditional models. For safety as well as energy efficiency, fuel-burning water heaters should be installed with sealed combustion ("direct-vented" or "power-vented). Sealed combustion means that outside air is brought in directly to the water heater and exhaust gases are vented directly outside, keeping combustion totally separate from the house air.

Accordingly, SWA recommends replacing the existing 66 gallon electric DHW heater with an ENERGY STAR® certified natural gas condensing model.

### Installation cost:

Estimated installed cost: $2,274 (includes $535 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

### Economics:

| ECM description | est. installed cost, $ | est. incentives, $ | net est. ECM cost with incentives, $ | kWh, 1st yr savings | kW, demand reduction/mo | therms, 1st yr savings | kBtu/sq ft, 1st yr savings | est. operating cost, 1st yr savings, $ | total 1st yr savings, $ | life of measure, yrs | est. lifetime cost savings, $ | simple payback, yrs | lifetime return on investment, % | annual return on investment, % | internal rate of return, % | net present value, $ | $CO_2$ reduced, lbs/yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Replace (1) electric DHW heater with an ENERGY STAR® certified natural gas condensing model | 2,349 | 75 | 2,274 | 3,190 | 0 | -128 | -0.1 | 0 | 394 | 13 | 5,123 | 5.8 | 125 | 10 | 14 | 1,806 | 4,300 |

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

**Rebates/financial incentives:**

- NJ Clean Energy –- SmartStart – Gas Water Heaters $1 per therm
  - Maximum incentive amount is $75

Please see Appendix G for more information on Incentive Programs.

## ECM#6: Replace one (1) older model compact refrigerator and one (1) 18 cu. ft. refrigerator with new ENERGY STAR® refrigerators

On the day of the site visit, SWA observed that there were was one older, 18 cu. ft. refrigerator model and one older 2.7 cu. ft. model refrigerator in the building which were not Energy Star rated (using approximately 254 or 380 kWh/year). Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. SWA recommends the replacement of the existing refrigerators with 2.7 or 18 cu. ft. ENERGY STAR® refrigerator. Besides saving energy, the replacement will also keep their surroundings cooler. When compared to the average electrical consumption of older equipment, Energy Star equipment results in large savings. Look for the Energy Star label when replacing appliances and equipment, including: window air conditioners, refrigerators, printers, computers, copy machines, etc. More information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov.

**Installation cost:**

Estimated installed cost: $865 (Includes $125 in labor cost)
Source of cost estimate: Manufacturer and Store established costs

**Economics:**

| ECM description | est. installed cost, $ | est. incentives, $ | net est. ECM cost with incentives, $ | kWh, 1st yr savings | kW, demand reduction/mo | therms, 1st yr savings | kBtu/sq ft, 1st yr savings | est. operating cost, 1st yr savings, $ | total 1st yr savings, $ | life of measure, yrs | est. lifetime cost savings, $ | simple payback, yrs | lifetime return on investment, % | annual return on investment, % | internal rate of return, % | net present value, $ | $CO_2$ reduced, lbs/yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Replace one (1) older model compact refrigerator and one (1) 18 cu. ft. refrigerator with new ENERGY STAR® refrigerators | 865 | 0 | 865 | 435 | 0 | 0 | 0.0 | 50 | 124 | 12 | 1,493 | 7.0 | 73 | 6 | 10 | 347 | 779 |

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

**Rebates/financial incentives:**

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

Please see Appendix G for more information on Incentive Programs.

## ECM#7: Install one hundred and seventy-five (175) new T8 fixtures

On the day of the site visit, SWA completed a lighting inventory of the Abraham Sion Mizrachi Elementary School (see Appendix B). The existing lighting inventory contains one hundred and seventy-five inefficient T12 fluorescent fixtures with magnetic ballasts. SWA recommends replacing each existing fixture with more efficient T8 fluorescent fixtures with electronic ballasts. T8 fixtures with electronic ballasts provide equivalent or better light output while reducing energy consumption by 30% when compared to a T12 fixture with magnetic ballast.

### Installation cost:

Estimated installed cost: $23,451 (includes $16,625 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

### Economics:

| ECM description | est. installed cost, $ | est. incentives, $ | net est. ECM cost with incentives, $ | kWh, 1st yr savings | kW, demand reduction/mo | therms, 1st yr savings | kBtu/sq ft, 1st yr savings | est. operating cost, 1st yr savings, $ | total 1st yr savings, $ | life of measure, yrs | est. lifetime cost savings, $ | simple payback, yrs | lifetime return on investment, % | annual return on investment, % | internal rate of return, % | net present value, $ | $CO_2$ reduced, lbs/yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Install one hundred and seventy-five (175) new T8 fixtures | 25,201 | 1,750 | 23,451 | 15,177 | 3 | 0 | 5.2 | 469 | 3,064 | 15 | 45,960 | 7.7 | 96 | 6 | 10 | 12,213 | 27,175 |

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

### Rebates/financial incentives:

- NJ Clean Energy - Smart Start - T8 fixtures with electronic ballasts ($10 per fixture)
    - Maximum Incentive Amount - $1,750

Please see Appendix G for more information on Incentive Programs.

## ECM#8: Replace one (1) DX split system condenser with an ENERGY STAR™ model

On the day of the site visit, SWA completed a mechanical inventory of the Abraham Sion Mizrachi Elementary School (see Appendix A). During the field audit, SWA observed the installation of an old 3.5 ton DX split system condenser unit which was not Energy Star rated. SWA recommends the replacement of this existing old and inefficient AC condenser with an ENERGY STAR™ model

In a split-system central air conditioner, an outdoor metal cabinet contains the condenser and compressor, and an indoor cabinet contains the evaporator. Central air conditioners are more efficient than room air conditioners. In addition, they are out of the way, quiet, and convenient to operate. For an older central air conditioner, consider replacing the outdoor compressor with a modern, high-efficiency unit. Today's best air conditioners use 30%–50% less energy to produce the same amount of cooling as air conditioners made twenty years ago. Even if the air conditioner is only 10 years old, savings may be 20%–40% of the cooling energy costs by replacing it with a newer, more efficient model. Proper sizing and installation are key elements in determining air conditioner efficiency. Too large a unit will not adequately remove humidity. Too small a unit will not be able to attain a comfortable temperature on the hottest days. Improper unit location, lack of insulation, and improper duct installation can greatly diminish efficiency.

When buying an air conditioner, look for a model with a high efficiency. Central air conditioners are rated according to their seasonal energy efficiency ratio (SEER). SEER (Btu/Watt-hr) indicates the relative amount of energy needed to provide a specific cooling output. Many older systems have SEER ratings of 6 or less (excluding the years of equipment degradation). The minimum SEER allowed today is 13. Look for the ENERGY STAR® label for central air conditioners with SEER ratings of 13 or greater, but consider using air conditioning equipment with higher SEER ratings for greater savings. SEER 13 is 30% more efficient than the previous minimum SEER of 10. The "lifespan" of a central air conditioner is about 15 to 20 years. More information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov.

### Installation cost:

Estimated installed cost: $3,178 (includes $1,050 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

### Economics:

| ECM description | est. installed cost, $ | est. incentives, $ | net est. ECM cost with incentives, $ | kWh, 1st yr savings | kW, demand reduction/mo | therms, 1st yr savings | kBtu/sq ft, 1st yr savings | est. operating cost, 1st yr savings, $ | total 1st yr savings, $ | life of measure, yrs | est. lifetime cost savings, $ | simple payback, yrs | lifetime return on investment, % | annual return on investment, % | internal rate of return, % | net present value, $ | $CO_2$ reduced, lbs/yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Replace one (1) DX split system condenser with an ENERGY STAR™ model | 3,574 | 322 | 3,178 | 1,433 | 0 | 0 | 0.3 | 105 | 350 | 15 | 5,250 | 9.1 | 65 | 4 | 7 | 911 | 2,565 |

**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 2.5 hr/yr to replace aging burnt out lamps vs. newly installed.

**Rebates/financial incentives:**

- NJ Clean Energy - Smart Start - Unitary HVAC / Split System, <5.4 tons ($92 per ton)
    - Maximum Incentive Amount: $322

Please see Appendix G for more information on Incentive Programs.

## ECM#9: Install eleven (11) new pulse start metal halide fixtures

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

### Installation cost:

Estimated installed cost: $7,700 (includes $2,010 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

### Economics:

| ECM description | est. installed cost, $ | est. incentives, $ | net est. ECM cost with incentives, $ | kWh, 1st yr savings | kW, demand reduction/mo | therms, 1st yr savings | kBtu/sq ft, 1st yr savings | est. operating cost, 1st yr savings, $ | total 1st yr savings, $ | life of measure, yrs | est. lifetime cost savings, $ | simple payback, yrs | lifetime return on investment, % | annual return on investment, % | internal rate of return, % | net present value, $ | $CO_2$ reduced, lbs/yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Install eleven (11) new pulse start metal halide fixtures | 7,975 | 275 | 7,700 | 2,602 | 1 | 0 | 0.9 | 355 | 799 | 15 | 11,992 | 9.6 | 56 | 4 | 6 | 1,654 | 4,658 |

**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 2.5 hr/yr to replace aging burnt out lamps vs. newly installed.

### Rebates/financial incentives:

- NJ Clean Energy - Smart Start - Pulse Start Metal Halide Fixtures ($25 per fixture)
    - Maximum Incentive Amount: $275

Please see Appendix G for more information on Incentive Programs.

## PROPOSED FURTHER RECOMMENDATIONS

### Capital Improvements

Capital Improvements are recommendations for the building that may not be cost-effective at the current time, but that could yield a significant long-term payback. These recommendations should typically be considered as part of a long-term capital improvement plan. Capital improvements should be considered if additional funds are made available, or if the installed costs can be shared with other improvements, such as major building renovations. SWA recommends the following capital improvements for the Abraham Sion Mizrachi Elementary School:

- Install premium motors when replacements are required - Select NEMA Premium motors when replacing motors that have reached the end of their useful operating lives.
- Insulate original and uninsulated exterior wall sections. SWA suggests applying 2" XPS rigid foam boards to the interior and covering it with gypsum wallboard or other preferred interior finish.
- Insulate original and uninsulated roof/ceiling sections. SWA suggests applying spray-foam and/or rigid foam board insulation (R-30 min.) under and/or on top of the metal decking surface.
- Install drip edge detail at window sill.
- Replace or repair damaged door units including the overhead door which does not properly align with the basement wall or the damaged solid metal doors with glass panels.
- Relocate thermostats to the zones that they control and secure with locking guard - SWA recommends that all thermostats be relocated to the zone that they control to ensure accurate temperature readings of the existing conditions and that they are placed inside locking thermostat guards to prevent unauthorized access.

### Operations and Maintenance

Operations and Maintenance measures consist of low/no cost measures that are within the capability of the current building staff to handle. These measures typically require little investment, and they yield a short payback period. These measures may address equipment settings or staff operations that, when addressed will reduce energy consumption or costs.

- Overgrown ground vegetation should be removed to not touch or block exterior wall surfaces from access, ventilation and sunlight.
- SWA recommends having the structural integrity of the roof evaluated
- Unclog and maintain all roof drains/scuppers.
- Clean gutters and downspouts.
- Maintain/ inspect all roof surfaces on a regular basis.

- Repair and maintain damaged window units.
- Repair damaged frames and maintain sealants at all windows for airtight performance.
- Install and or replace and maintain weather-stripping around all exterior doors and roof hatches.
- Provide water-efficient fixtures and controls - Adding controlled on/off timers on all lavatory faucets is a cost-effective way to reduce domestic hot water demand and save water. Building staff can also easily install faucet aerators and/or low-flow fixtures to reduce water consumption. There are many retrofit options, which can be installed now or incorporated as equipment is replaced. Routine maintenance practices that identify and quickly address water leaks are a low-cost way to save water and energy. Retrofitting with more efficient water-consumption fixtures/appliances will reduce energy consumption for water heating, while also decreasing water/sewer bills.
- SWA recommends that the building considers purchasing the most energy-efficient equipment, including ENERGY STAR® labeled appliances, when equipment is installed or replaced. More information can be found in the "Products" section of the ENERGY STAR® website at: http://www.energystar.gov.
- Use smart power electric strips - in conjunction with occupancy sensors to power down computer equipment when left unattended for extended periods of time.
- Create an energy educational program - that teaches how to minimize energy use. The U.S. Department of Energy offers free information for hosting energy efficiency educational programs and plans. For more information please visit: http://www1.eere.energy.gov/education/.

## APPENDIX A: EQUIPMENT LIST

### Inventory

| Building System | Description | Model # | Fuel | Location | Space Served | Year Installed | Estimated Remaining Useful Life % |
|---|---|---|---|---|---|---|---|
| Heating / Cooling | RTU2 – Heat: 250 MBH min. input, 350 MBH max. input, 284 MBH max. output, 81.1% thermal eff., 15 tons cooling | Trane YCH180B4H0HB S/N 344100645D | Natural Gas/Electric | Rooftop | lobby, library, NE hallways, small offices | 2003 | 47% |
| Heating / Cooling | RTU3 – Heat: 160 MBH min. input, 240 MBH max. input, 125 MBH min. output, 192 MBH max. output, 80% thermal eff., 10 tons cooling | International Comfort Products PGD120L240A S/N L011664939 | Natural Gas/Electric | Rooftop | Admin. offices, NE classrooms bathrooms | 2003 | 47% |
| Heating / Cooling | RTU4 – Heat: 140 MBH min. input, 200 MBH max. input, 160 MBH max. output, 80% thermal eff., 10 tons cooling | Trane YSC120A4EMA1A S/N 350100734L | Natural Gas/Electric | Rooftop | Classrooms, multipurpose meeting rooms, admin. offices NE corner. | 2004 | 53% |
| Heating / Cooling | RTU5 – Heat: 130 MBH max. input, 108 MBH max. output, 83.1% thermal eff., 5 tons cooling | American Standard YSC060A4EHA1C S/N 410102204L | Natural Gas/Electric | Rooftop | Secondary gymnasium | 2004 | 53% |
| Heating / Cooling | RTU11 – Heat: 140 MBH min. input, 200 MBH max. input, 160 MBH max. output, 80% thermal eff., 10 tons cooling | Trane YSC120A4EMA16 S/N 338100509L | Natural Gas/Electric | Rooftop | Classrooms, offices south of the main gymnasium | 2003 | 47% |
| Heating / Cooling | RTU12 – Heat: 175 MBH min. input, 250 MBH max. input, 203 MBH max. output, 81.2% thermal eff., 12.5 tons cooling | Trane YCH150D4H0BB S/N 448100352D | Natural Gas/Electric | Rooftop | SW perimeter classrooms | 2004 | 53% |
| Heating / Cooling | RTU13 – Heat: 140 MBH min. | Trane YSC120A4EMA1N | Natural Gas/Electric | Rooftop | Main gymnasium | 2004 | 53% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | input, 200 MBH max. input, 160 MBH max. output, 80% thermal eff., 10 tons cooling | S/N 429100533L | | | | | |
| Heating / Cooling | HVAC6 – Heat: 140 MBH min. input, 200 MBH max. input, 160 MBH max. output, 80% thermal eff., 7.5 tons cooling | Trane YSC090A4EHA3A S/N 828102184L | Natural Gas/Electric | West yard | NW sector hallway, bathrooms, kitchen and classroom adjacent to the kitchen. | 2008 | 80% |
| Heating / Cooling | HVAC7 – Heat: 250 MBH min. input, 350 MBH max. input, 284 MBH max. output, 81.1% thermal eff., 15 tons cooling | Trane YCH180B4H0HB S/N 543100572D | Natural Gas/Electric | West yard | five classrooms NW perimeter | 2005 | 80% |
| Heating / Cooling | HVAC8 – Heat: 128 MBH min. input, 210 MBH max. input, 166 MBH max. output, 79% thermal eff., 7.5 tons cooling | Snyder General Climate Control CUR075FN21 S/N 5VD84130-00 | Natural Gas/Electric | West yard | cafeteria, pantry, several offices, small classroom | 2001 | 33% |
| Heating / Cooling | HVAC9 – Heat: 112.5 MBH min. input, 225 MBH max. input, 182.25 MBH max. output, 81% thermal eff., 7.5 tons cooling | Rheem RKKB-A090DL22E S/N 2D6330ADAAF150 112978 | Natural Gas/Electric | South yard | classrooms south yard, sprinkler control room, bathrooms. | 2001 | 33% |
| Heating / Cooling | HVAC10 – Heat: 112.5 MBH min. input, 225 MBH max. input, 182.25 MBH max. output, 81% thermal eff., 7.5 tons cooling | Rheem RKKB-A090DL22E S/N 1Z6330ADAAF150 016018 | Natural Gas/Electric | South yard | perimeter classrooms by the south yard | 2010 | 86% |
| Cooling | AC-1, DX split system evaporator unit, wall mounted, 470 CFM | Comfort Star, CCH018CD-A S/N 040750 | Electric | Library | Library | 2001 | 33% |
| Cooling | ACC-1, DX split system condenser unit, R-22, 18,000 BTUH Cooling, 13 SEER | Comfort Star, CCH018CD-A S/N 0407091 | Electric | Rooftop | Library | 2001 | 33% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Cooling | ACC-2, DX split system condenser unit, R-22, 42,000 BTUH Cooling, 11 SEER | Fraser-Johnston | Electric | Rooftop | Library | 1996 | 7% |
| Heating | HV1 – 100 MBH min. input, 200 MBH max. input, 154 MBH max. output, 77% thermal eff. | Reznor XL200-3 S/N AHB31B5N719 | Natural Gas | Basement | Basement | 1996 | 7% |
| Domestic Hot Water | DHW heater - 66 gal storage, 2 coils, 4,500 Watt upper and 4,500 Watt lower | AO Smith EES-66 S/N MB00-0033657-917 | Electric | Basement | Entire Building | 2000 | 15% |
| Electric | T1 – transformer 112.5 kVa | GE 9T23A3875 | Electric | Basement | Entire Building | 1996 | 20% |
| Electric | T2 – transformer 112.5 kVa | GE 9T23A3875 | Electric | Basement | Entire Building | 1996 | 20% |
| Electric | T3 – transformer 30 kVa | GE 9T23B3872 | Electric | Gym | Entire Building | 1996 | 20% |
| Lighting | See details - Appendix B | - | Electric | See details - Appendix B | Entire Building | 1996-2008 | 7-80% |

**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.

# Appendix B: Lighting Study

| Location | | | Existing Fixture Information | | | | | | | | | | | | Retrofit Information | | | | | | | | | | | | | Annual Savings | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Marker | Floor | Room Identification | Fixture Type | Ballast | Lamp Type | # of Fixtures | # of Lamps per Fixture | Watts per Lamp | Controls | Operational Hours per Day | Operational Days per Year | Ballast Wattage | Total Watts | Energy Use kWh/year | Category | Fixture Type | Lamp Type | Ballast | Controls | # of Fixtures | # of Lamps per Fixture | Watts per Lamp | Operational Hours per Day | Operational Days per Year | Ballast Watts | Total Watts | Energy Use kWh/year | Fixture Savings (kWh) | Controls Savings (kWh) | Total Savings (kWh) |
| 1 | 1 | Meeting Room | Recessed Parabolic | M | 4'T12 | 4 | 4 | 40 | Sw | 7 | 313 | 48 | 832 | 1,823 | T8 | Recessed Parabolic | 4'T8 | E | OS | 4 | 4 | 32 | 5 | 313 | 20 | 592 | 973 | 526 | 324 | 850 |
| 2 | 1 | Meeting Room | Exit Sign | S | LED | 1 | 1 | 5 | N | 24 | 365 | 1 | 6 | 48 | N/A | Exit Sign | LED | S | N | 1 | 1 | 5 | 24 | 365 | 1 | 6 | 48 | 0 | 0 | 0 |
| 3 | 1 | Vestibule | Recessed | M | 2'T12 | 3 | 4 | 20 | Sw | 7 | 313 | 24 | 312 | 684 | T8 | Recessed | 2'T8 | E | Sw | 3 | 4 | 17 | 7 | 313 | 8 | 228 | 500 | 184 | 0 | 184 |
| 4 | 1 | Vestibule | Exit Sign | S | LED | 1 | 1 | 5 | N | 24 | 365 | 1 | 6 | 48 | N/A | Exit Sign | LED | S | N | 1 | 1 | 5 | 24 | 365 | 1 | 6 | 48 | 0 | 0 | 0 |
| 5 | 1 | Office | Recessed | M | 4'T12 | 2 | 4 | 40 | Sw | 7 | 313 | 48 | 416 | 911 | T8 | Recessed | 4'T8 | E | Sw | 2 | 4 | 32 | 7 | 313 | 20 | 296 | 649 | 263 | 0 | 263 |
| 6 | 1 | Office | Recessed | M | 2'T12 | 4 | 4 | 20 | Sw | 7 | 313 | 24 | 416 | 911 | T8 | Recessed | 2'T8 | E | Sw | 4 | 4 | 17 | 7 | 313 | 8 | 304 | 666 | 245 | 0 | 245 |
| 7 | 1 | Bathroom | Wall Mounted | M | 2'T12 | 1 | 2 | 20 | Sw | 4 | 313 | 12 | 52 | 65 | T8 | Wall Mounted | 2'T8 | E | Sw | 1 | 2 | 17 | 4 | 313 | 4 | 38 | 48 | 18 | 0 | 18 |
| 8 | 1 | Bathroom | Recessed | M | 2'T12 | 1 | 2 | 20 | Sw | 4 | 313 | 12 | 52 | 65 | T8 | Recessed | 2'T8 | E | Sw | 1 | 2 | 17 | 4 | 313 | 4 | 38 | 48 | 18 | 0 | 18 |
| 9 | 1 | Storage Closet | Recessed | E | 4'T8 | 1 | 3 | 32 | Sw | 2 | 313 | 15 | 111 | 69 | N/A | Recessed | 4'T8 | E | Sw | 1 | 3 | 32 | 2 | 313 | 15 | 111 | 69 | 0 | 0 | 0 |
| 10 | 1 | Lobby | Recessed | M | 4'T12 | 18 | 4 | 40 | Sw | 7 | 313 | 48 | 3,744 | 8,203 | T8 | Recessed | 4'T8 | E | Sw | 18 | 4 | 32 | 7 | 313 | 20 | 2664 | 5837 | 2366 | 0 | 2366 |
| 11 | 1 | Lobby | Exit Sign | S | LED | 1 | 1 | 5 | N | 24 | 365 | 1 | 6 | 48 | N/A | Exit Sign | LED | S | N | 1 | 1 | 5 | 24 | 365 | 1 | 6 | 48 | 0 | 0 | 0 |
| 12 | 1 | Hallway | Recessed | E | 4'T8 | 3 | 4 | 32 | Sw | 7 | 313 | 20 | 444 | 973 | N/A | Recessed | 4'T8 | E | Sw | 3 | 4 | 32 | 7 | 313 | 20 | 444 | 973 | 0 | 0 | 0 |
| 13 | 1 | Office | Recessed | M | 4'T12 | 6 | 4 | 40 | Sw | 7 | 313 | 48 | 1,248 | 2,734 | T8 | Recessed | 4'T8 | E | OS | 6 | 4 | 32 | 5 | 313 | 20 | 888 | 1459 | 789 | 486 | 1275 |
| 14 | 1 | Office | Recessed | M | 4'T12 | 6 | 4 | 40 | Sw | 7 | 313 | 48 | 1,248 | 2,734 | T8 | Recessed | 4'T8 | E | OS | 6 | 4 | 32 | 5 | 313 | 20 | 888 | 1459 | 789 | 486 | 1275 |
| 15 | 1 | Office | Recessed | M | 4'T12 | 6 | 4 | 40 | Sw | 7 | 313 | 48 | 1,248 | 2,734 | T8 | Recessed | 4'T8 | E | OS | 6 | 4 | 32 | 5 | 313 | 20 | 888 | 1459 | 789 | 486 | 1275 |
| 16 | 1 | Meeting Room | Recessed | E | 4'T8 | 14 | 4 | 32 | Sw | 7 | 313 | 20 | 2,072 | 4,540 | C | Recessed | 4'T8 | E | OS | 14 | 4 | 32 | 5 | 313 | 20 | 2072 | 3405 | 0 | 1135 | 1135 |
| 17 | 1 | Meeting Room | Recessed | M | 4'T12 | 6 | 4 | 40 | Sw | 7 | 313 | 48 | 1,248 | 2,734 | T8 | Recessed | 4'T8 | E | OS | 6 | 4 | 32 | 5 | 313 | 20 | 888 | 1459 | 789 | 486 | 1275 |
| 18 | 1 | Library | Recessed | M | 4'T12 | 5 | 4 | 40 | Sw | 7 | 313 | 48 | 1,040 | 2,279 | T8 | Recessed | 4'T8 | E | Sw | 5 | 4 | 32 | 7 | 313 | 20 | 740 | 1621 | 657 | 0 | 657 |
| 19 | 1 | Library | Recessed | E | 4'T8 | 5 | 4 | 32 | Sw | 7 | 313 | 20 | 740 | 1,621 | N/A | Recessed | 4'T8 | E | Sw | 5 | 4 | 32 | 7 | 313 | 20 | 740 | 1621 | 0 | 0 | 0 |
| 20 | 1 | Server Room Unoccupied | Recessed | M | 4'T12 | 2 | 4 | 40 | Sw | 2 | 313 | 48 | 416 | 260 | T8 | Recessed | 4'T8 | E | Sw | 2 | 4 | 32 | 2 | 313 | 20 | 296 | 185 | 75 | 0 | 75 |
| 21 | 1 | Office Area | Recessed | M | 4'T12 | 1 | 4 | 40 | Sw | 7 | 313 | 48 | 208 | 456 | T8 | Recessed | 4'T8 | E | Sw | 1 | 4 | 32 | 7 | 313 | 20 | 148 | 324 | 131 | 0 | 131 |
| 22 | 1 | Hallway | Recessed | M | 4'T12 | 3 | 4 | 40 | Sw | 7 | 313 | 48 | 624 | 1,367 | T8 | Recessed | 4'T8 | E | Sw | 3 | 4 | 32 | 7 | 313 | 20 | 444 | 973 | 394 | 0 | 394 |
| 23 | 1 | Hallway | Recessed | E | 4'T8 | 4 | 4 | 32 | Sw | 7 | 313 | 20 | 592 | 1,297 | N/A | Recessed | 4'T8 | E | Sw | 4 | 4 | 32 | 7 | 313 | 20 | 592 | 1297 | 0 | 0 | 0 |
| 24 | 1 | Hallway | Exit Sign | S | LED | 1 | 2 | 5 | N | 24 | 365 | 1 | 11 | 96 | N/A | Exit Sign | LED | S | N | 1 | 2 | 5 | 24 | 365 | 1 | 11 | 96 | 0 | 0 | 0 |
| 25 | 1 | Classroom (Z101) | Recessed | E | 4'T8 | 4 | 2 | 32 | Sw | 7 | 313 | 10 | 296 | 649 | N/A | Recessed | 4'T8 | E | Sw | 4 | 2 | 32 | 7 | 313 | 10 | 296 | 649 | 0 | 0 | 0 |
| 26 | 1 | Hallway | Recessed | M | 4'T12 | 3 | 4 | 40 | Sw | 7 | 313 | 48 | 624 | 1,367 | T8 | Recessed | 4'T8 | E | Sw | 3 | 4 | 32 | 7 | 313 | 20 | 444 | 973 | 394 | 0 | 394 |
| 27 | 1 | Hallway (Z102) | Recessed | M | 4'T12 | 5 | 4 | 40 | Sw | 7 | 313 | 48 | 1,040 | 2,279 | T8 | Recessed | 4'T8 | E | Sw | 5 | 4 | 32 | 7 | 313 | 20 | 740 | 1621 | 657 | 0 | 657 |
| 28 | 1 | Hallway (Z102) | Recessed | E | 4'T8 | 4 | 4 | 32 | Sw | 7 | 313 | 20 | 592 | 1,297 | N/A | Recessed | 4'T8 | E | Sw | 4 | 4 | 32 | 7 | 313 | 20 | 592 | 1297 | 0 | 0 | 0 |
| 29 | 1 | Classroom (Z103) | Recessed | E | 4'T8 | 3 | 4 | 32 | Sw | 7 | 313 | 20 | 444 | 973 | N/A | Recessed | 4'T8 | E | Sw | 3 | 4 | 32 | 7 | 313 | 20 | 444 | 973 | 0 | 0 | 0 |
| 30 | 1 | Classroom (Z103) | Recessed | M | 4'T12 | 6 | 4 | 40 | Sw | 7 | 313 | 48 | 1,248 | 2,734 | T8 | Recessed | 4'T8 | E | Sw | 6 | 4 | 32 | 7 | 313 | 20 | 888 | 1946 | 789 | 0 | 789 |
| 31 | 1 | Janitor's Closet | Recessed | E | 4'T8 U-Shaped | 1 | 2 | 32 | Sw | 2 | 313 | 10 | 74 | 46 | N/A | Recessed | 4'T8 U-Shaped | E | Sw | 1 | 2 | 32 | 2 | 313 | 10 | 74 | 46 | 0 | 0 | 0 |
| 32 | 1 | Bathroom Women | Wall Mounted | M | 2'T12 | 2 | 2 | 20 | Sw | 4 | 313 | 12 | 104 | 130 | T8 | Wall Mounted | 2'T8 | E | Sw | 2 | 2 | 17 | 4 | 313 | 4 | 76 | 95 | 35 | 0 | 35 |
| 33 | 1 | Bathroom Women | Recessed | M | 2'T12 | 1 | 2 | 20 | Sw | 4 | 313 | 12 | 52 | 65 | T8 | Recessed | 2'T8 | E | Sw | 1 | 2 | 17 | 4 | 313 | 4 | 38 | 48 | 18 | 0 | 18 |
| 34 | 1 | Bathroom Women | Recessed | M | 4'T12 | 2 | 2 | 40 | Sw | 4 | 313 | 24 | 208 | 260 | T8 | Recessed | 4'T8 | E | Sw | 2 | 2 | 32 | 4 | 313 | 10 | 148 | 185 | 75 | 0 | 75 |
| 35 | 1 | Bathroom Women | Recessed | M | 4'T12 | 2 | 4 | 40 | Sw | 4 | 313 | 48 | 416 | 521 | T8 | Recessed | 4'T8 | E | Sw | 2 | 4 | 32 | 4 | 313 | 20 | 296 | 371 | 150 | 0 | 150 |
| 36 | 1 | Staircase | Recessed | M | 4'T12 | 2 | 4 | 40 | Sw | 7 | 313 | 48 | 416 | 911 | T8 | Recessed | 4'T8 | E | Sw | 2 | 4 | 32 | 7 | 313 | 20 | 296 | 649 | 263 | 0 | 263 |
| 37 | 1 | Classroom (401) | Recessed | M | 4'T12 | 6 | 4 | 40 | Sw | 7 | 313 | 48 | 1,248 | 2,734 | T8 | Recessed | 4'T8 | E | Sw | 6 | 4 | 32 | 7 | 313 | 20 | 888 | 1946 | 789 | 0 | 789 |
| 38 | 1 | Hallway | Recessed | E | 4'T8 | 6 | 3 | 32 | Sw | 7 | 313 | 15 | 666 | 1,459 | N/A | Recessed | 4'T8 | E | Sw | 6 | 3 | 32 | 7 | 313 | 15 | 666 | 1459 | 0 | 0 | 0 |
| 39 | 1 | Hallway | Exit Sign | S | LED | 2 | 1 | 5 | N | 24 | 365 | 1 | 11 | 96 | N/A | Exit Sign | LED | S | N | 2 | 1 | 5 | 24 | 365 | 1 | 11 | 96 | 0 | 0 | 0 |
| 40 | 1 | Jungle Gymnasium | Low Bay | S | MH | 10 | 1 | 400 | Sw | 7 | 313 | 112 | 5,120 | 11,218 | T5 | Low Bay | 4'T5 | E | Sw | 20 | 4 | 28 | 7 | 313 | 16 | 2560 | 5608 | 5610 | 0 | 5610 |
| 41 | 1 | Jungle Gymnasium | Wall Mounted | M | 4'T12 | 1 | 2 | 40 | Sw | 7 | 313 | 24 | 104 | 228 | T8 | Wall Mounted | 4'T8 | E | Sw | 1 | 2 | 32 | 7 | 313 | 10 | 74 | 162 | 66 | 0 | 66 |
| 42 | 1 | Jungle Gymnasium Storage | Wall Mounted | S | CFL | 1 | 1 | 13 | Sw | 7 | 313 | 0 | 13 | 28 | N/A | Wall Mounted | CFL | S | Sw | 1 | 1 | 13 | 7 | 313 | 0 | 13 | 28 | 0 | 0 | 0 |
| 43 | 1 | Jungle Gymnasium Storage | Wall Mounted | S | Inc | 4 | 1 | 60 | Sw | 7 | 313 | 0 | 240 | 526 | CFL | Wall Mounted | CFL | S | Sw | 4 | 1 | 20 | 7 | 313 | 0 | 80 | 175 | 351 | 0 | 351 |
| 44 | 1 | Hallway | Recessed | E | 4'T8 | 11 | 3 | 32 | Sw | 7 | 313 | 15 | 1,221 | 2,675 | N/A | Recessed | 4'T8 | E | Sw | 11 | 3 | 32 | 7 | 313 | 15 | 1221 | 2675 | 0 | 0 | 0 |
| 45 | 1 | Bathroom Women | Recessed | E | 4'T8 | 4 | 3 | 32 | Sw | 4 | 313 | 15 | 444 | 556 | N/A | Recessed | 4'T8 | E | Sw | 4 | 3 | 32 | 4 | 313 | 15 | 444 | 556 | 0 | 0 | 0 |
| 46 | 1 | Bathroom Women | Exit Sign | S | LED | 1 | 1 | 5 | N | 24 | 365 | 1 | 6 | 48 | N/A | Exit Sign | LED | S | N | 1 | 1 | 5 | 24 | 365 | 1 | 6 | 48 | 0 | 0 | 0 |
| 47 | 1 | Bathroom | Recessed | E | 4'T8 | 1 | 3 | 32 | Sw | 4 | 313 | 15 | 111 | 139 | N/A | Recessed | 4'T8 | E | Sw | 1 | 3 | 32 | 4 | 313 | 15 | 111 | 139 | 0 | 0 | 0 |
| 48 | 1 | Mechanical Room | Recessed | E | 4'T8 | 3 | 3 | 32 | Sw | 2 | 313 | 15 | 333 | 208 | N/A | Recessed | 4'T8 | E | Sw | 3 | 3 | 32 | 2 | 313 | 15 | 333 | 208 | 0 | 0 | 0 |
| 49 | 1 | Classroom | Recessed | E | 4'T8 | 12 | 3 | 32 | Sw | 7 | 313 | 15 | 1,332 | 2,918 | N/A | Recessed | 4'T8 | E | Sw | 12 | 3 | 32 | 7 | 313 | 15 | 1332 | 2918 | 0 | 0 | 0 |
| 50 | 1 | Storage Room | Recessed | M | 4'T12 | 3 | 4 | 40 | Sw | 2 | 313 | 48 | 624 | 391 | T8 | Recessed | 4'T8 | E | Sw | 3 | 4 | 32 | 2 | 313 | 20 | 444 | 278 | 113 | 0 | 113 |
| 51 | 1 | Storage Room | Recessed | E | 4'T8 | 2 | 3 | 32 | Sw | 2 | 313 | 15 | 222 | 139 | N/A | Recessed | 4'T8 | E | Sw | 2 | 3 | 32 | 2 | 313 | 15 | 222 | 139 | 0 | 0 | 0 |
| 52 | 1 | Classroom | Recessed | E | 4'T8 | 12 | 3 | 32 | Sw | 7 | 313 | 15 | 1,332 | 2,918 | N/A | Recessed | 4'T8 | E | Sw | 12 | 3 | 32 | 7 | 313 | 15 | 1332 | 2918 | 0 | 0 | 0 |
| 53 | 1 | Classroom | Exit Sign | S | LED | 1 | 1 | 5 | N | 24 | 365 | 1 | 6 | 48 | N/A | Exit Sign | LED | S | N | 1 | 1 | 5 | 24 | 365 | 1 | 6 | 48 | 0 | 0 | 0 |
| 54 | 1 | Classroom | Recessed | E | 4'T8 | 3 | 3 | 32 | Sw | 7 | 313 | 15 | 333 | 730 | N/A | Recessed | 4'T8 | E | Sw | 3 | 3 | 32 | 7 | 313 | 15 | 333 | 730 | 0 | 0 | 0 |
| 55 | 1 | Classroom | Exit Sign | S | LED | 1 | 1 | 5 | N | 24 | 365 | 1 | 6 | 48 | N/A | Exit Sign | LED | S | N | 1 | 1 | 5 | 24 | 365 | 1 | 6 | 48 | 0 | 0 | 0 |
| 56 | 1 | Office | Recessed | E | 4'T8 | 8 | 3 | 32 | Sw | 7 | 313 | 15 | 888 | 1,946 | C | Recessed | 4'T8 | E | OS | 8 | 3 | 32 | 5 | 313 | 15 | 888 | 1459 | 0 | 486 | 486 |
| 57 | 1 | Hallway | Exit Sign | S | LED | 1 | 1 | 5 | N | 24 | 365 | 1 | 6 | 48 | N/A | Exit Sign | LED | S | N | 1 | 1 | 5 | 24 | 365 | 1 | 6 | 48 | 0 | 0 | 0 |
| 58 | 1 | Classroom | Recessed | E | 4'T8 | 9 | 3 | 32 | Sw | 7 | 313 | 15 | 999 | 2,189 | N/A | Recessed | 4'T8 | E | Sw | 9 | 3 | 32 | 7 | 313 | 15 | 999 | 2189 | 0 | 0 | 0 |
| 59 | 1 | Gymnasium | Recessed | S | MH | 10 | 1 | 400 | Sw | 7 | 313 | 112 | 5,120 | 11,218 | T5 | Recessed | 4'T5 | E | Sw | 30 | 4 | 28 | 7 | 313 | 16 | 3839 | 8412 | 2806 | 0 | 2806 |
| 60 | 1 | Gymnasium | Exit Sign | S | LED | 4 | 1 | 5 | N | 24 | 365 | 1 | 22 | 193 | N/A | Exit Sign | LED | S | N | 4 | 1 | 5 | 24 | 365 | 1 | 22 | 193 | 0 | 0 | 0 |
| 61 | 1 | Storage Room | Recessed | M | 4'T12 | 1 | 4 | 40 | Sw | 2 | 313 | 48 | 208 | 130 | T8 | Recessed | 4'T8 | E | Sw | 1 | 4 | 32 | 2 | 313 | 20 | 148 | 93 | 38 | 0 | 38 |
| 62 | 1 | Storage Room | Recessed | M | 4'T12 | 1 | 4 | 40 | Sw | 2 | 313 | 48 | 208 | 130 | T8 | Recessed | 4'T8 | E | Sw | 1 | 4 | 32 | 2 | 313 | 20 | 148 | 93 | 38 | 0 | 38 |
| 63 | 1 | Gymnasium | Recessed | E | 4'T8 | 7 | 1 | 32 | Sw | 7 | 313 | 5 | 259 | 567 | N/A | Recessed | 4'T8 | E | Sw | 7 | 1 | 32 | 7 | 313 | 5 | 259 | 567 | 0 | 0 | 0 |
| 64 | 1 | Hallway | Recessed | E | 4'T8 | 5 | 3 | 32 | Sw | 7 | 313 | 15 | 555 | 1,216 | N/A | Recessed | 4'T8 | E | Sw | 5 | 3 | 32 | 7 | 313 | 15 | 555 | 1216 | 0 | 0 | 0 |
| 65 | 1 | Hallway | Exit Sign | S | LED | 2 | 1 | 5 | N | 24 | 365 | 1 | 11 | 96 | N/A | Exit Sign | LED | S | N | 2 | 1 | 5 | 24 | 365 | 1 | 11 | 96 | 0 | 0 | 0 |
| 66 | 1 | Office | Recessed | E | 4'T8 | 4 | 3 | 32 | Sw | 7 | 313 | 15 | 444 | 973 | N/A | Recessed | 4'T8 | E | Sw | 4 | 3 | 32 | 7 | 313 | 15 | 444 | 973 | 0 | 0 | 0 |
| 67 | 1 | Classroom | Recessed | E | 4'T8 | 12 | 3 | 32 | Sw | 7 | 313 | 15 | 1,332 | 2,918 | N/A | Recessed | 4'T8 | E | Sw | 12 | 3 | 32 | 7 | 313 | 15 | 1332 | 2918 | 0 | 0 | 0 |
| 68 | 1 | Office Area | Recessed | E | 4'T8 | 8 | 3 | 32 | Sw | 7 | 313 | 15 | 888 | 1,946 | C | Recessed | 4'T8 | E | OS | 8 | 3 | 32 | 5 | 313 | 15 | 888 | 1459 | 0 | 486 | 486 |
| 69 | 1 | Classroom | Recessed | E | 4'T8 | 4 | 3 | 32 | Sw | 7 | 313 | 15 | 444 | 973 | N/A | Recessed | 4'T8 | E | Sw | 4 | 3 | 32 | 7 | 313 | 15 | 444 | 973 | 0 | 0 | 0 |
| 70 | 1 | Hallway | Recessed | E | 4'T8 | 11 | 3 | 32 | Sw | 7 | 313 | 15 | 1,221 | 2,675 | N/A | Recessed | 4'T8 | E | Sw | 11 | 3 | 32 | 7 | 313 | 15 | 1221 | 2675 | 0 | 0 | 0 |
| 71 | 1 | Classroom (701) | Recessed | E | 4'T8 | 8 | 3 | 32 | Sw | 7 | 313 | 15 | 888 | 1,946 | N/A | Recessed | 4'T8 | E | Sw | 8 | 3 | 32 | 7 | 313 | 15 | 888 | 1946 | 0 | 0 | 0 |
| 72 | 1 | Classroom (601) | Recessed | E | 4'T8 | 9 | 3 | 32 | Sw | 7 | 313 | 15 | 999 | 2,189 | N/A | Recessed | 4'T8 | E | Sw | 9 | 3 | 32 | 7 | 313 | 15 | 999 | 2189 | 0 | 0 | 0 |
| 73 | 1 | Hallway | Exit Sign | S | LED | 3 | 1 | 5 | N | 24 | 365 | 1 | 17 | 145 | N/A | Exit Sign | LED | S | N | 3 | 1 | 5 | 24 | 365 | 1 | 17 | 145 | 0 | 0 | 0 |
| 74 | 1 | Classroom (901) | Recessed | E | 4'T8 | 9 | 1 | 32 | Sw | 7 | 313 | 5 | 333 | 730 | N/A | Recessed | 4'T8 | E | Sw | 9 | 1 | 32 | 7 | 313 | 5 | 333 | 730 | 0 | 0 | 0 |
| 75 | 1 | Classroom | Recessed | E | 4'T8 | 4 | 3 | 32 | Sw | 7 | 313 | 15 | 444 | 973 | N/A | Recessed | 4'T8 | E | Sw | 4 | 3 | 32 | 7 | 313 | 15 | 444 | 973 | 0 | 0 | 0 |
| 76 | 1 | Storage Room | Recessed | E | 4'T8 | 4 | 3 | 32 | Sw | 2 | 313 | 15 | 444 | 278 | N/A | Recessed | 4'T8 | E | Sw | 4 | 3 | 32 | 2 | 313 | 15 | 444 | 278 | 0 | 0 | 0 |
| 77 | 1 | Classroom | Recessed | E | 4'T8 | 9 | 3 | 32 | Sw | 7 | 313 | 15 | 999 | 2,189 | N/A | Recessed | 4'T8 | E | Sw | 9 | 3 | 32 | 7 | 313 | 15 | 999 | 2189 | 0 | 0 | 0 |
| 78 | 1 | Classroom | Recessed | E | 4'T8 | 12 | 3 | 32 | Sw | 7 | 313 | 15 | 1,332 | 2,918 | N/A | Recessed | 4'T8 | E | Sw | 12 | 3 | 32 | 7 | 313 | 15 | 1332 | 2918 | 0 | 0 | 0 |
| 79 | 1 | Janitor's Closet | Recessed | E | 4'T8 | 1 | 3 | 32 | Sw | 2 | 313 | 15 | 111 | 69 | N/A | Recessed | 4'T8 | E | Sw | 1 | 3 | 32 | 2 | 313 | 15 | 111 | 69 | 0 | 0 | 0 |
| 80 | 1 | Bathroom Men | Recessed | E | 4'T8 | 1 | 3 | 32 | Sw | 4 | 313 | 15 | 111 | 139 | N/A | Recessed | 4'T8 | E | Sw | 1 | 3 | 32 | 4 | 313 | 15 | 111 | 139 | 0 | 0 | 0 |
| 81 | 1 | Bathroom Women | Recessed | E | 4'T8 | 1 | 3 | 32 | Sw | 4 | 313 | 15 | 111 | 139 | N/A | Recessed | 4'T8 | E | Sw | 1 | 3 | 32 | 4 | 313 | 15 | 111 | 139 | 0 | 0 | 0 |
| 82 | 1 | Bathroom Women | Exit Sign | S | LED | 1 | 1 | 5 | N | 24 | 365 | 1 | 6 | 48 | N/A | Exit Sign | LED | S | N | 1 | 1 | 5 | 24 | 365 | 1 | 6 | 48 | 0 | 0 | 0 |
| 83 | 1 | Hallway | Recessed | E | 4'T8 | 2 | 3 | 32 | Sw | 7 | 313 | 15 | 222 | 486 | N/A | Recessed | 4'T8 | E | Sw | 2 | 3 | 32 | 7 | 313 | 15 | 222 | 486 | 0 | 0 | 0 |
| 84 | 1 | Hallway | Exit Sign | S | LED | 1 | 1 | 5 | N | 24 | 365 | 1 | 6 | 48 | N/A | Exit Sign | LED | S | N | 1 | 1 | 5 | 24 | 365 | 1 | 6 | 48 | 0 | 0 | 0 |

| Location | | | Existing Fixture Information | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |
| 85 | 1 | Nurse's Station | Recessed | E | 4'T8 | 4 | 3 | 32 | Sw | 7 | 313 | 15 | 444 | 973 |
| 86 | 1 | Classroom | Recessed | E | 4'T8 | 8 | 3 | 32 | Sw | 7 | 313 | 15 | 888 | 1,946 |
| 87 | 1 | Classroom | Exit Sign | S | LED | 1 | 1 | 5 | N | 24 | 365 | 1 | 6 | 48 |
| 88 | 1 | Hallway | Recessed | E | 4'T8 | 2 | 3 | 32 | Sw | 7 | 313 | 15 | 222 | 486 |
| 89 | 1 | Office Area | Recessed | E | 4'T8 | 2 | 3 | 32 | Sw | 2 | 313 | 15 | 222 | 139 |
| 90 | 1 | Storage Room | Recessed | M | 4'T12 | 2 | 4 | 40 | Sw | 7 | 313 | 48 | 416 | 911 |
| 91 | 1 | Cafeteria | Exit Sign | S | LED | 2 | 1 | 5 | N | 24 | 365 | 1 | 11 | 96 |
| 92 | 1 | Cafeteria | Recessed | M | 4'T12 | 16 | 4 | 40 | Sw | 4 | 313 | 48 | 3,328 | 4,167 |
| 93 | 1 | Cafeteria - Sink Area | Recessed | M | 4'T12 | 1 | 4 | 40 | Sw | 4 | 313 | 48 | 208 | 260 |
| 94 | 1 | Kitchen | Recessed | M | 4'T12 | 4 | 4 | 40 | Sw | 4 | 313 | 48 | 832 | 1,042 |
| 95 | 1 | Kitchen | Recessed | E | 2'T8 | 1 | 2 | 17 | Sw | 4 | 313 | 4 | 38 | 48 |
| 96 | 1 | Meeting Room | Recessed | E | 4'T8 | 3 | 3 | 32 | Sw | 7 | 313 | 15 | 333 | 730 |
| 97 | 1 | Bathroom | Recessed | E | 4'T8 U-Shaped | 1 | 2 | 32 | Sw | 7 | 313 | 10 | 74 | 162 |
| 98 | 1 | Classroom (6) | Recessed | E | 4'T8 | 8 | 3 | 32 | Sw | 7 | 313 | 15 | 888 | 1,946 |
| 99 | 1 | Classroom (7) | Recessed | E | 4'T8 | 8 | 3 | 32 | Sw | 7 | 313 | 15 | 888 | 1,946 |
| 100 | 1 | Classroom (5) | Recessed | E | 4'T8 | 6 | 3 | 32 | Sw | 7 | 313 | 15 | 666 | 1,459 |
| 101 | 1 | Hallway | Recessed | E | 4'T8 | 13 | 2 | 32 | Sw | 7 | 313 | 10 | 962 | 2,108 |
| 102 | 1 | Hallway | Exit Sign | S | LED | 3 | 1 | 5 | N | 24 | 365 | 1 | 17 | 145 |
| 103 | 1 | Bathroom | Recessed | M | 4'T12 | 2 | 2 | 40 | Sw | 4 | 313 | 24 | 208 | 260 |
| 104 | 1 | Bathroom | Recessed | M | 4'T12 | 2 | 2 | 40 | Sw | 4 | 313 | 24 | 208 | 260 |
| 105 | 1 | Classroom (4) | Recessed | E | 4'T8 | 6 | 4 | 32 | Sw | 7 | 313 | 20 | 888 | 1,946 |
| 106 | 1 | Classroom (3) | Recessed | E | 4'T8 | 6 | 4 | 32 | Sw | 7 | 313 | 20 | 888 | 1,946 |
| 107 | 1 | Bathroom Men | Recessed | E | 4'T8 U-Shaped | 1 | 2 | 32 | Sw | 4 | 313 | 10 | 74 | 93 |
| 108 | 1 | Bathroom Women | Recessed | E | 4'T8 U-Shaped | 1 | 2 | 32 | Sw | 4 | 313 | 10 | 74 | 93 |
| 109 | 1 | Office | Recessed | E | 4'T8 | 2 | 4 | 32 | Sw | 7 | 313 | 20 | 296 | 649 |
| 110 | 1 | Classroom (2) | Recessed | E | 4'T8 | 6 | 4 | 32 | Sw | 7 | 313 | 20 | 888 | 1,946 |
| 111 | 1 | Office | Recessed | E | 4'T8 | 3 | 4 | 32 | Sw | 7 | 313 | 20 | 444 | 973 |
| 112 | 1 | Classroom (1) | Recessed | E | 4'T8 | 6 | 4 | 32 | Sw | 7 | 313 | 20 | 888 | 1,946 |
| 113 | 1 | Storage Room | Recessed | M | 4'T12 | 1 | 4 | 40 | Sw | 2 | 313 | 48 | 208 | 130 |
| 114 | 1 | Bathroom Women | Recessed | E | 4'T8 | 4 | 4 | 32 | Sw | 4 | 313 | 20 | 592 | 741 |
| 115 | 1 | Classroom | Recessed | E | 4'T8 | 11 | 4 | 32 | Sw | 7 | 313 | 20 | 1,628 | 3,567 |
| 116 | 1 | Classroom | Recessed | M | 2'T12 | 1 | 2 | 20 | Sw | 7 | 313 | 12 | 52 | 114 |
| 117 | 1 | Staircase | Recessed | E | 4'T8 | 1 | 3 | 32 | Sw | 7 | 313 | 15 | 111 | 243 |
| 118 | 1 | Staircase | Recessed | M | 4'T12 | 1 | 2 | 40 | Sw | 7 | 313 | 24 | 104 | 228 |
| 119 | Bsmt | Mechanical Room | Ceiling Mounted | M | 8'T12 | 30 | 2 | 80 | Sw | 2 | 313 | 40 | 6,000 | 3,756 |
| 120 | Bsmt | Mechanical Room | Ceiling Mounted | M | 4'T12 | 10 | 2 | 40 | Sw | 2 | 313 | 24 | 1,040 | 651 |
| 121 | Bsmt | Staircase | Wall Mounted | M | 4'T12 | 2 | 2 | 40 | Sw | 7 | 313 | 24 | 208 | 456 |
| 122 | Ext | Exterior | Wall Mounted | E | Inc | 5 | 1 | 100 | Sw | 12 | 52 | 0 | 500 | 312 |
| 123 | Ext | Exterior | Flood | E | MV | 11 | 1 | 150 | PC | 12 | 365 | 24 | 1,914 | 8,383 |
| 124 | Park | Exterior | Pole Mounted | S | MH | 4 | 2 | 400 | Sw | 12 | 52 | 224 | 4,096 | 2,556 |
| Totals: | | | | | | 571 | 343 | 5,013 | | | | 2,906 | 86,352 | 164,418 |

| | Retrofit Information | | | | | | | | | | | | | | Annual Savings | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Marker | 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) |
| 85 | N/A | Recessed | 4'T8 | E | Sw | 4 | 3 | 32 | 7 | 313 | 15 | 444 | 973 | 0 | 0 | 0 |
| 86 | N/A | Recessed | 4'T8 | E | Sw | 8 | 3 | 32 | 7 | 313 | 15 | 888 | 1946 | 0 | 0 | 0 |
| 87 | N/A | Exit Sign | LED | S | N | 1 | 1 | 5 | 24 | 365 | 1 | 6 | 48 | 0 | 0 | 0 |
| 88 | N/A | Recessed | 4'T8 | E | Sw | 2 | 3 | 32 | 7 | 313 | 15 | 222 | 486 | 0 | 0 | 0 |
| 89 | N/A | Recessed | 4'T8 | E | Sw | 2 | 3 | 32 | 2 | 313 | 15 | 222 | 139 | 0 | 0 | 0 |
| 90 | T8 | Recessed | 4'T8 | E | Sw | 2 | 4 | 32 | 7 | 313 | 20 | 296 | 649 | 263 | 0 | 263 |
| 91 | N/A | Exit Sign | LED | S | N | 2 | 1 | 5 | 24 | 365 | 1 | 11 | 96 | 0 | 0 | 0 |
| 92 | T8 | Recessed | 4'T8 | E | Sw | 16 | 4 | 32 | 4 | 313 | 20 | 2368 | 2965 | 1202 | 0 | 1202 |
| 93 | T8 | Recessed | 4'T8 | E | Sw | 1 | 4 | 32 | 4 | 313 | 20 | 148 | 185 | 75 | 0 | 75 |
| 94 | T8 | Recessed | 4'T8 | E | Sw | 4 | 4 | 32 | 4 | 313 | 20 | 592 | 741 | 300 | 0 | 300 |
| 95 | N/A | Recessed | 2'T8 | E | Sw | 1 | 2 | 17 | 4 | 313 | 4 | 38 | 48 | 0 | 0 | 0 |
| 96 | N/A | Recessed | 4'T8 | E | Sw | 3 | 3 | 32 | 7 | 313 | 15 | 333 | 730 | 0 | 0 | 0 |
| 97 | N/A | Recessed | 4'T8 U-Shaped | E | Sw | 1 | 2 | 32 | 7 | 313 | 10 | 74 | 162 | 0 | 0 | 0 |
| 98 | N/A | Recessed | 4'T8 | E | Sw | 8 | 3 | 32 | 7 | 313 | 15 | 888 | 1946 | 0 | 0 | 0 |
| 99 | N/A | Recessed | 4'T8 | E | Sw | 8 | 3 | 32 | 7 | 313 | 15 | 888 | 1946 | 0 | 0 | 0 |
| 100 | N/A | Recessed | 4'T8 | E | Sw | 6 | 3 | 32 | 7 | 313 | 15 | 666 | 1459 | 0 | 0 | 0 |
| 101 | N/A | Recessed | 4'T8 | E | Sw | 13 | 2 | 32 | 7 | 313 | 10 | 962 | 2108 | 0 | 0 | 0 |
| 102 | N/A | Exit Sign | LED | S | N | 3 | 1 | 5 | 24 | 365 | 1 | 17 | 145 | 0 | 0 | 0 |
| 103 | T8 | Recessed | 4'T8 | E | Sw | 2 | 2 | 32 | 4 | 313 | 10 | 148 | 185 | 75 | 0 | 75 |
| 104 | T8 | Recessed | 4'T8 | E | Sw | 2 | 2 | 32 | 4 | 313 | 10 | 148 | 185 | 75 | 0 | 75 |
| 105 | N/A | Recessed | 4'T8 | E | Sw | 6 | 4 | 32 | 7 | 313 | 20 | 888 | 1946 | 0 | 0 | 0 |
| 106 | N/A | Recessed | 4'T8 | E | Sw | 6 | 4 | 32 | 7 | 313 | 20 | 888 | 1946 | 0 | 0 | 0 |
| 107 | N/A | Recessed | 4'T8 U-Shaped | E | Sw | 1 | 2 | 32 | 4 | 313 | 10 | 74 | 93 | 0 | 0 | 0 |
| 108 | N/A | Recessed | 4'T8 U-Shaped | E | Sw | 1 | 2 | 32 | 4 | 313 | 10 | 74 | 93 | 0 | 0 | 0 |
| 109 | N/A | Recessed | 4'T8 | E | Sw | 2 | 4 | 32 | 7 | 313 | 20 | 296 | 649 | 0 | 0 | 0 |
| 110 | N/A | Recessed | 4'T8 | E | Sw | 6 | 4 | 32 | 7 | 313 | 20 | 888 | 1946 | 0 | 0 | 0 |
| 111 | N/A | Recessed | 4'T8 | E | Sw | 3 | 4 | 32 | 7 | 313 | 20 | 444 | 973 | 0 | 0 | 0 |
| 112 | N/A | Recessed | 4'T8 | E | Sw | 6 | 4 | 32 | 7 | 313 | 20 | 888 | 1946 | 0 | 0 | 0 |
| 113 | T8 | Recessed | 4'T8 | E | Sw | 1 | 4 | 32 | 2 | 313 | 20 | 148 | 93 | 38 | 0 | 38 |
| 114 | N/A | Recessed | 4'T8 | E | Sw | 4 | 4 | 32 | 4 | 313 | 20 | 592 | 741 | 0 | 0 | 0 |
| 115 | N/A | Recessed | 4'T8 | E | Sw | 11 | 4 | 32 | 7 | 313 | 20 | 1628 | 3567 | 0 | 0 | 0 |
| 116 | T8 | Recessed | 2'T8 | E | Sw | 1 | 2 | 17 | 7 | 313 | 4 | 38 | 83 | 31 | 0 | 31 |
| 117 | N/A | Recessed | 4'T8 | E | Sw | 1 | 3 | 32 | 7 | 313 | 15 | 111 | 243 | 0 | 0 | 0 |
| 118 | T8 | Recessed | 4'T8 | E | Sw | 1 | 2 | 32 | 7 | 313 | 10 | 74 | 162 | 66 | 0 | 66 |
| 119 | T8 | Ceiling Mounted | 8'T8 | E | Sw | 30 | 2 | 59 | 2 | 313 | 14 | 3960 | 2479 | 1277 | 0 | 1277 |
| 120 | T8 | Ceiling Mounted | 4'T8 | E | Sw | 10 | 2 | 32 | 2 | 313 | 10 | 740 | 463 | 188 | 0 | 188 |
| 121 | T8 | Wall Mounted | 4'T8 | E | Sw | 2 | 2 | 32 | 7 | 313 | 10 | 148 | 324 | 131 | 0 | 131 |
| 122 | CFL | Wall Mounted | CFL | E | Sw | 5 | 1 | 35 | 12 | 52 | 0 | 175 | 109 | 203 | 0 | 203 |
| 123 | PSMH | Flood | PSMH | E | PC | 11 | 1 | 100 | 12 | 365 | 20 | 1320 | 5782 | 2602 | 0 | 2602 |
| 124 | N/A | Pole Mounted | MH | S | Sw | 4 | 2 | 400 | 12 | 52 | 224 | 4096 | 2556 | 0 | 0 | 0 |
| Totals: | | | | | | 601 | 349 | 3,816 | | | 1,814 | 71,792 | 133,293 | 26,748 | 4,378 | 31,125 |

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

| Proposed Lighting Summary Table | | | |
|---|---|---|---|
| Total Gross Floor Area (SF) | 38,000 | | |
| Average Power Cost ($/kWh) | 0.1710 | | |
| **Exterior Lighting** | **Existing** | **Proposed** | **Savings** |
| Exterior Annual Consumption (kWh) | 8,695 | 5,891 | **2,805** |
| Exterior Power (watts) | 2,414 | 1,495 | **919** |
| **Total Interior Lighting** | **Existing** | **Proposed** | **Savings** |
| Annual Consumption (kWh) | 155,723 | 127,402 | **28,321** |
| Lighting Power (watts) | 83,938 | 70,297 | **13,641** |
| Lighting Power Density (watts/SF) | 2.21 | 1.85 | **0.36** |
| Estimated Cost of Fixture Replacement ($) | 39,507 | | |
| Estimated Cost of Controls Improvements ($) | 1,600 | | |
| **Total Consumption Cost Savings ($)** | **6,436** | | |

| Legend | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fixture Type** | | **Lamp Type** | | | **Control Type** | **Ballast Type** | **Retrofit Category** |
| Ceiling Suspended | Recessed | CFL | 3'T12 | 8'T5 | Autom. Timer (T) | S (Self) | N/A (None) |
| Exit Sign | Sconce | Inc | 3'T12 U-Shaped | 8'T5 U-Shaped | Bi-Level (BL) | E (Electronic) | T8 (Install new T8) |
| High Bay | Spotlight | LED | 3'T5 | 8'T8 | Contact (Ct) | M (Magnetic) | T5 (Install new T5) |
| Parabolic Ceiling Mounted | Track | HPS | 3'T5 U-Shaped | 8'T8 U-Shaped | Daylight & Motion (M) | | CFL (Install new CFL) |
| Parabolic Ceiling Suspended | Vanity | MH | 3'T8 | Circline - T5 | Daylight & Switch (DLSw) | | LEDex (Install new LED Exit) |
| Pendant | Wall Mounted | MV | 3'T8 U-Shaped | Circline - T8 | Daylight Sensor (DL) | | LED (Install new LED) |
| Recessed Parabolic | Wall Suspended | 1'T12 | 4'T5 | Circline - T12 | Delay Switch (DSw) | | D (Delamping) |
| Ceiling Mounted | Wallpack | 1'T12 U-Shaped | 4'T5 U-Shaped | Fl. | Dimmer (D) | | C (Controls Only) |
| Chandelier | | 1'T5 | 6'T12 | Hal | Motion Sensor (MS) | | PSMH (Install new Pulse-Start Metal Halide) |
| Equipment / Fume Hood | | 1'T5 U-Shaped | 6'T12 U-Shaped | Induction | Motion& Switch (MSw) | | |
| Flood | | 1'T8 | 6'T5 | Infrared | None (N) | | |
| Landscape | | 1'T8 U-Shaped | 6'T5 U-Shaped | LPS | Occupancy Sensor (OS) | | |
| Low Bay | | 2'T12 U-Shaped | 6'T8 | Mixed Vapor | Occupancy Sensor - CM (OSCM) | | |
| Parabolic Wall Mounted | | 2'T5 | 6'T8 U-Shaped | Neon | Photocell (PC) | | |
| Pole Mounted | | 2'T5 U-Shaped | 8'T12 | Quartz Halogen | Switch (Sw) | | |
| Pole Mounted Off Building | | 2'T8 U-Shaped | 8'T12 U-Shaped | | | | |

**APPENDIX C: UPCOMING EQUIPMENT PHASEOUTS**

**LIGHTING:**

- As of **July 1, 2010** magnetic ballasts most commonly used for the operation of T12 lamps will no longer be produced for commercial and industrial applications.

- As of **January 1, 2012** 100 watt incandescent bulbs will be phased out in accordance with the Energy Independence and Security Act of 2007.

- Starting **July 2012** many non energy saver model T12 lamps will be phased out of production.

- As of **January 1, 2013** 75 watt incandescent bulbs will be phased out in accordance with the Energy Independence and Security Act of 2007.

- As of **January 1, 2014** 60 and 40 watt incandescent bulbs will be phased out in accordance with the Energy Independence and Security Act of 2007.

- Energy Independence and Security Act of 2007 incandescent lamp phase-out exclusions:
  1. Appliance lamp (e.g. refrigerator or oven light)
  2. Black light lamp
  3. Bug lamp
  4. Colored lamp
  5. Infrared lamp
  6. Left-hand thread lamp
  7. Marine lamp
  8. Marine signal service lamp
  9. Mine service lamp
  10. Plant light lamp
  11. Reflector lamp
  12. Rough service lamp
  13. Shatter-resistant lamp (including a shatter-proof lamp and a shatter-protected lamp)
  14. Sign service lamp
  15. Silver bowl lamp
  16. Showcase lamp
  17. 3-way incandescent lamp
  18. Traffic signal lamp
  19. Vibration service lamp
  20. Globe shaped “G” lamp (as defined in ANSI C78.20-2003 and C79.1-2002 with a diameter of 5 inches or more
  21. T shape lamp (as defined in ANSI C78.20-2003 and C79.1-2002) and that uses not more than 40 watts or has a length of more than 10 inches
  22. A B, BA, CA, F, G16-1/2, G-25, G30, S, or M-14 lamp (as defined in ANSI C79.1-2002 and ANSI C78.20-2003) of 40 watts or less
  23. Candelabra incandescent and other lights not having a medium Edison screw base.

- When installing compact fluorescent lamps (CFLs), be advised that they contain a very small amount of mercury sealed within the glass tubing and EPA guidelines concerning cleanup and safe disposal of compact fluorescent light bulbs should be followed. Additionally, all lamps to be disposed should be recycled in accordance with EPA guidelines through state or local government collection or exchange programs instead.

**HCFC (Hydrochlorofluorocarbons):**

- As of **January 1, 2010,** no production and no importing of R-142b and R-22, except for use in equipment manufactured before January 1, 2010, in accordance with adherence to the Montreal Protocol.

- As of **January 1, 2015,** No production and no importing of any HCFCs, except for use as refrigerants in equipment manufactured before January 1, 2010.

- As of **January 1, 2020** No production and no importing of R-142b and R-22.

## APPENDIX D: THIRD PARTY ENERGY SUPPLIERS

http://www.state.nj.us/bpu/commercial/shopping.html

| Third Party Electric Suppliers for JCPL Service Territory | Telephone & Web Site |
|---|---|
| **Hess Corporation**<br>1 Hess Plaza<br>Woodbridge, NJ 07095 | (800) 437-7872<br>www.hess.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 |
| **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 |
| **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<br>Moorestown, NJ 08057 | (856) 273-9995<br>www.ugienergyservices.com |

| Third Party Gas Suppliers for NJNG 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 |
| **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 |
| **NJ Gas & Electric**<br>1 Bridge Plaza, Fl. 2<br>Fort Lee, NJ 07024 | (866) 568-0290<br>www.NewJerseyGasElectric.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 |
| **Sprague Energy Corp.**<br>12 Ridge Road<br>Chatham Township, NJ 07928 | (800) 225-1560<br>www.spragueenergy.com |
| **Woodruff Energy**<br>73 Water Street<br>Bridgeton, NJ 08302 | (800) 557-1121<br>www.woodruffenergy.com |

## APPENDIX E: GLOSSARY AND METHOD OF CALCULATIONS

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

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

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

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

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

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

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

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

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

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

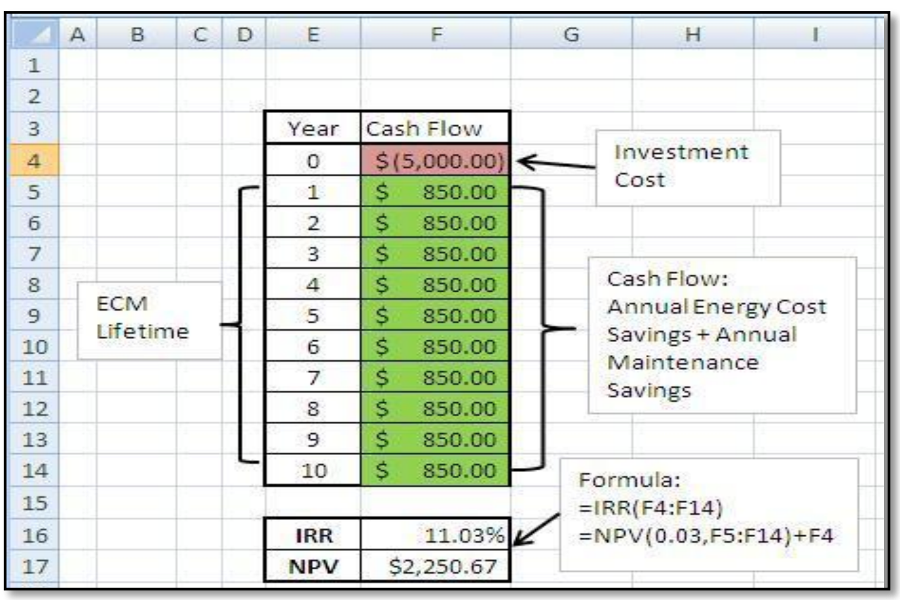
## Calculation References

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

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

### Excel NPV and IRR Calculation

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



## Solar PV ECM Calculation

There are several components to the calculation:

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

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

## ECM and Equipment Lifetimes

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

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

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

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

## New Jersey Clean Energy Program Commercial Equipment Life Span

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

# APPENDIX F: STATEMENT OF ENERGY PERFORMANCE FROM ENERGY STAR®

OMB No. 2060-0347

## STATEMENT OF ENERGY PERFORMANCE
## Yeshivat Keter Torah Abraham Sion Mizrachi Elementray School

**Building ID:** 2877785
**For 12-month Period Ending:** May 31, 2011[1]
**Date SEP becomes ineligible:** N/A

**Date SEP Generated:** October 06, 2011

**Facility**
Yeshivat Keter Torah Abraham Sion
Mizrachi Elementray School
1 Meridian Road
Eatontown, NJ 07724

**Facility Owner**
Yeshivat Keter Torah
1 Meridiain Road
Eatontown, NJ 07724

**Primary Contact for this Facility**
Rabbi Adam Kanefsky
1 Meridian Road
Eatontown, NJ 07724

**Year Built:** 1966
**Gross Floor Area ($ft^2$):** 38,000

**Energy Performance Rating**[2] (1-100) N/A

| **Site Energy Use Summary**[3] | |
|---|---|
| Electricity - Grid Purchase(kBtu) | 908,247 |
| Natural Gas (kBtu)[4] | 1,214,061 |
| Total Energy (kBtu) | 2,122,308 |
| | |
| **Energy Intensity**[5] | |
| Site (kBtu/$ft^2$/yr) | 56 |
| Source (kBtu/$ft^2$/yr) | 113 |
| | |
| **Emissions** (based on site energy use) | |
| Greenhouse Gas Emissions (Mt$CO_2$e/year) | 193 |
| | |
| **Electric Distribution Utility** | |
| Jersey Central Power & Light Co [FirstEnergy Corp] | |
| | |
| **National Average Comparison** | |
| National Average Site EUI | 75 |
| National Average Source EUI | 169 |
| % Difference from National Average Source EUI | -33% |
| Building Type | K-12 School |

Stamp of Certifying Professional

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

**Meets Industry Standards**[5] **for Indoor Environmental Conditions:**

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

**Certifying Professional**
N/A

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Values represent energy intensity, annualized to a 12-month period.
5. 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.

The government estimates the average time needed to fill out this form is 6 hours (includes the time for entering energy data, Licensed Professional facility inspection, and notarizing the SEP) and welcomes suggestions for reducing this level of effort. Send comments (referencing OMB control number) to the Director, Collection Strategies Division, U.S., EPA (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460.

EPA Form 5900-16

## APPENDIX G: INCENTIVE PROGRAMS

### New Jersey Clean Energy Pay for Performance

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

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

CHP Incentive

- **New Jersey Natural Gas** - Provides matching inventive up to $1mm, requires participation in P4P

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

### Direct Install 2011 Program*

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

Eligibility:

- Existing small and mid-sized commercial and industrial facilities with peak electrical demand **below 100 kW** within 12 months of applying (the 100 kW peak demand threshold has been waived for local government entities who receive and utilize their Energy Efficiency and Conservation Block Grant in conjunction with Direct Install)
- Must be located in New Jersey
- Must be served by one of the state's public, regulated or natural gas companies

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

## Smart Start

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

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

Energy Provider Incentives

- **New Jersey Natural Gas** – Will match SSB incentives on gas equipment

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

## Renewable Energy Incentive Program*

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

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

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

## Utility Sponsored Programs

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

## Energy Efficiency and Conservation Block Grant Rebate Program

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

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

## Other Federal and State Sponsored Programs

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

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

## APPENDIX H: ENERGY CONSERVATION MEASURES

| ECM # | ECM description | est. installed cost, $ | est. incentives, $ | net est. ECM cost with incentives, $ | kWh, 1st yr savings | kW, demand reduction/mo | therms, 1st yr savings | kBtu/sq ft, 1st yr savings | est. operating cost, 1st yr savings, $ | total 1st yr savings, $ | life of measure, yrs | est. lifetime cost savings, $ | simple payback, yrs | lifetime return on investment, % | annual return on investment, % | internal rate of return, % | net present value, $ | $CO_2$ reduced, lbs/yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Install nine (9) new CFL fixtures | 92 | 0 | 92 | 553 | 0 | 0 | 0.2 | 24 | 119 | 5 | 595 | 0.8 | 545 | 109 | 127 | 435 | 991 |
| 2 | Install eight (8) new occupancy sensors | 1,760 | 160 | 1,600 | 4,378 | 1 | 0 | 1.5 | 0 | 749 | 15 | 11,229 | 2.1 | 602 | 40 | 47 | 6,985 | 7,838 |
| 3 | Install 60 kW Solar Photovoltaic system | 240,000 | 0 | 240,000 | 70,800 | 60 | 0 | 6.4 | 0 | 54,107 | 25 | 1,352,677 | 4.4 | 464 | 19 | 22 | 446,140 | 126,767 |
| 4 | Install fifty (50) new T5 fixtures | 8,764 | 500 | 8,264 | 8,415 | 2 | 0 | 2.9 | 266 | 1,705 | 15 | 25,574 | 4.8 | 209 | 14 | 19 | 11,432 | 15,068 |
| 5 | Replace (1) electric DHW heater with an ENERGY STAR® certified natural gas condensing model | 2,349 | 75 | 2,274 | 3,190 | 0 | -128 | -0.1 | 0 | 394 | 13 | 5,123 | 5.8 | 125 | 10 | 14 | 1,806 | 4,300 |
| 6 | Replace one (1) older model compact refrigerator and one (1) 18 cu. ft. refrigerator with new ENERGY STAR® refrigerators | 865 | 0 | 865 | 435 | 0 | 0 | 0.0 | 50 | 124 | 12 | 1,493 | 7.0 | 73 | 6 | 10 | 347 | 779 |
| 7 | Install one hundred and seventy-five (175) new T8 fixtures | 25,201 | 1,750 | 23,451 | 15,177 | 3 | 0 | 5.2 | 469 | 3,064 | 15 | 45,960 | 7.7 | 96 | 6 | 10 | 12,213 | 27,175 |
| 8 | Replace one (1) DX split system condenser with an ENERGY STAR™ model | 3,574 | 322 | 3,178 | 1,433 | 0 | 0 | 0.3 | 105 | 350 | 15 | 5,250 | 9.1 | 65 | 4 | 7 | 911 | 2,565 |
| 9 | Install eleven (11) new pulse start metal halide fixtures | 7,975 | 275 | 7,700 | 2,602 | 1 | 0 | 0.9 | 355 | 799 | 15 | 11,992 | 9.6 | 56 | 4 | 6 | 1,654 | 4,658 |
| **Total** | | **290,580** | **3,082** | **287,424** | **106,983** | **67** | **-128** | **17.2** | **1,268** | **61,411** | **130** | **1,459,891** | **51** | **2,234** | **212** | **261** | **481,924** | **190,141** |

**Assumptions:** Discount Rate: 3.2%; Energy Price Escalation Rate: 0%

**Note:** A 0.0 electrical demand reduction/month indicates that it is very low/negligible

# APPENDIX I: METHOD OF ANALYSIS

## Assumptions and tools

| | |
|---|---|
| Energy modeling tool: | Established/standard industry assumptions |
| 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 |

## 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.**