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*November 8, 2010*

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

# *City of Orange Township*

***593 Lincoln Ave Building***
***593 Lincoln Ave***
***Orange, NJ 07050***

***Project Number: LGEA68***

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## EXECUTIVE SUMMARY

The City of Orange Township 593 Lincoln Ave Building is a two-story building with full basement comprising a total conditioned floor area of 13,428 square feet. The original structure was built in 1890 and there was interior renovations completed over 5 years ago. The following chart provides an overview of current energy usage in the building based on the analysis period of March 2009 through February 2010:

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

| | Electric Usage, kWh/yr | Gas Usage, therms/yr | Other fuel usage, gal/yr | Current Annual Cost of Energy, $ | Site Energy Use Intensity, kBtu/sq ft yr | Joint Energy Consumption, MMBtu/yr |
|---|---|---|---|---|---|---|
| Current | 139,190 | 13,413 | NA | $38,953 | 135.3 | 1,816 |
| Proposed | 124,384 | 13,413 | NA | $34,141 | 131.6 | 1,766 |
| Savings | 14,806 | 0 | NA | $4,812 | 3.7 | 51 |
| % Savings | 12% | 0% | NA | 14% | 3% | 3% |

There may be energy procurement opportunities for the City of Orange Township 593 Lincoln Ave Building to reduce annual electric costs, which are $2,645 higher, when compared to the average estimated NJ commercial utility rates.

SWA has also entered energy information about the 593 Lincoln Ave Building in the U.S. Environmental Protection Agency's (EPA) *ENERGY STAR® Portfolio Manager* energy benchmarking system. The former police department facility is comprised of non-eligible ("Other") space type. The resulting score is 132.0 kBtu/sqft-yr, which is worse than the average comparable building by 27%.

Based on the current state of the building and its energy use, SWA recommends implementing various energy conservation measures from the savings detailed in Table 1. The measures are categorized by payback period in Table 2 below:

**Table 2: Energy Conservation Measure Recommendations**

| ECMs | First Year Savings ($) | Simple Payback Period (years) | Initial Investment, $ | CO2 Savings, lbs/yr |
|---|---|---|---|---|
| 0-5 Year | $2,095 | 1.4 | $2,861 | 8718 |
| 5-10 Year | $2,717 | 6.1 | $16,544 | 17792 |
| >10 year | $0 | - | $0 | 0 |
| Total | $4,812 | 4.0 | $19,405 | 26510 |

SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 2 cars from the roads each year or avoiding the need of 65 trees to absorb the annual $CO_2$ generated.

Other recommendations to increase building efficiency pertaining to operations and maintenance and capital improvements are listed below:

**Further Recommendations:**

SWA recommends that the 593 Lincoln Ave Building further explore the following:

- Capital Improvements
    - Install premium motors when replacements are required
    - Re-point deteriorated mortar joints
    - Replace Air Handling Unit with new premium efficiency type
    - Replace Air Compressor with new using premium efficiency motor
    - Replace all steam water piping and insulate as per code requirements
    - Insulate original and un-insulated roof/ceiling sections.
    - Due to significant base deterioration in the interior, SWA recommends abandoning the building until further action (repair/rebuilding) has been evaluated
    - Replace all original, single-glazed windows and frames with historically and architecturally accurate low-E, double glazed type
- Operations and Maintenance
    - Remove overgrown ground vegetation
    - Repair and maintain gutters, downspouts and downspout deflectors
    - Maintain / inspect all roof surfaces on a regular basis
    - Install/replace and maintain weather-stripping around all exterior doors and roof hatches
    - SWA recommends that the building considers purchasing the most energy-efficient equipment, including ENERGY STAR® labeled appliances

The recommended ECMs and the list above are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for City of Orange Township. Based on the requirements of the LGEA program, City of Orange Township must commit to implementing some of these measures, and must submit paperwork to the Local Government Energy Audit program within one year of this report's approval to demonstrate that they have spent, net of other NJCEP incentives, at least 25% of the cost of the audit (per building). The minimum amount to be spent, net of other NJCEP incentives, is $926.50.

**Financial Incentives and Other Program Opportunities**

The table below summarizes the recommended next steps that City of Orange Township can take to achieve greater energy efficiency and reduce operating expenses. It includes the amount in dollars that City of Orange Township is required to spend per building according to the LGEA program guidelines. It is important to note that the required 25% expenditure is per building and after the other implementation incentive amounts.

**Table 3: Next Steps for the 593 Lincoln Ave Building**

| Recommended ECMs | Incentive Program (Please refer to Appendix F for details) |
|---|---|
| Lighting Upgrades: T12 to T8 | Direct Install OR NJ Clean Energy |
| Lighting Upgrades: Inc to CFL | Direct Install |
| Lighting Upgrades: PSMH to MH | Direct Install OR NJ Clean Energy |

There are various incentive programs that the City of Orange Township could apply for that could help lower the cost of installing the ECMs. For the 593 Lincoln Ave Building, and contingent upon available funding, SWA recommends the following incentive program:

Since the 593 Lincoln building is currently unoccupied and there is no plan for occupancy in the near future, the first step is to ensure that all energy consuming systems are shut down at the main panels and are disabled to avoid wasted energy. As a plan for the building develops, a thorough investigation of the base conditions in the basement would be required prior to occupancy. The current heating and air delivery systems are beyond their useful life and will have to be redesigned to accommodate the future use of the building.

**Direct Install 2010 Program**: Commercial buildings with peak electric demand below 200kW can receive up to 60% of installed cost of energy saving upgrades.

**Smart Start**: Majority of energy saving equipment and design measures have moderate incentives under this program.

Please refer to Appendix F for further details.

## 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 593 Lincoln Ave Building at 593 Lincoln Ave, Orange, NJ. The process of the audit included facility visits on March 19, 2010 and April 22, 2010, 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 City of Orange Township to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures for the 593 Lincoln Ave Building.

## HISTORICAL ENERGY CONSUMPTION

### Energy usage, load profile and cost analysis

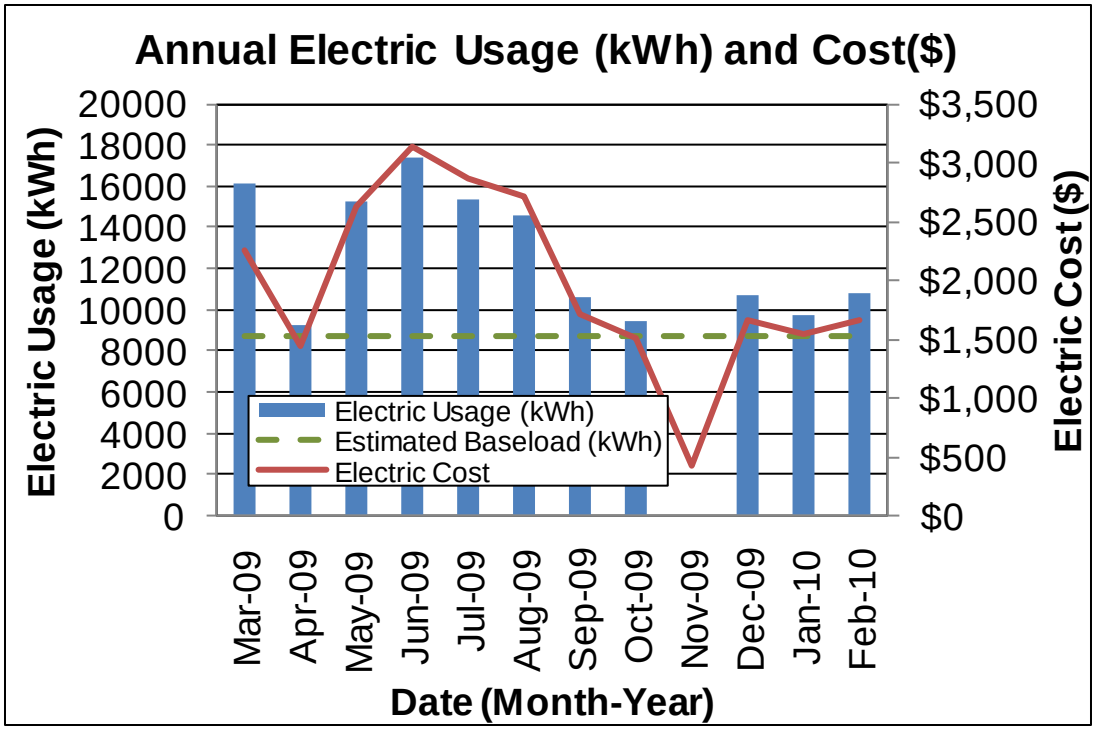
SWA reviewed utility bills from March 2008 through February 2010 that were received from the utility companies supplying the 593 Lincoln Ave Building with electric and natural gas. A 12 month period of analysis from March 2009 through February 2010 was used for all calculations and for purposes of benchmarking the building.

It should be noted that according to Orange building staff, the building has been unoccupied since March 2009. The hot water system was completely drained during the field visit, and appeared to be inoperable without significant upgrade. The utility bills however reflect usage that would be expected during full occupancy. The City of Orange Township should investigate possible ties to other facilities which are in full occupancy. There was $35,000 in utility charges for 539 Lincoln between March 2009 and February 2010. Based on the observations during the field visit, it seems impossible for the building to be using this much energy since the boiler is completely drained and appears to be damaged beyond repair and at least 50% of the lighting fixtures are not powered.

For the purposes of this study, it will be assumed that the equipment is operating as installed, and that all lighting fixtures are powered. The bills provided will be used in the analysis for this building; however SWA strongly suggests investigating the source of these bills before making any more payments to PSE&G.

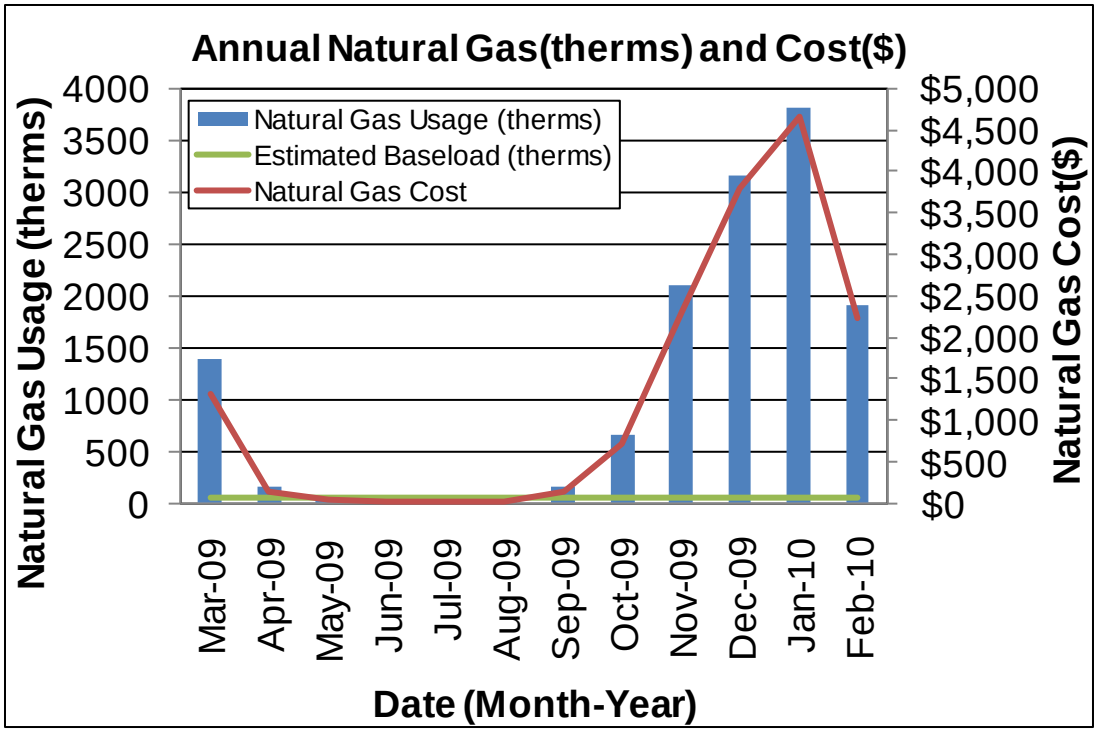
Electricity - The 593 Lincoln Ave Building is currently served by one electric meter. The 593 Lincoln Ave Building currently buys electricity from PSE&G at **an average aggregated rate of $0.169/kWh**. The 593 Lincoln Ave Building purchased **approximately 139,190 kWh, or $23,519 worth of electricity,** in the previous year. The average monthly demand was 30.5 kW and the annual peak demand was 30.5 kW.

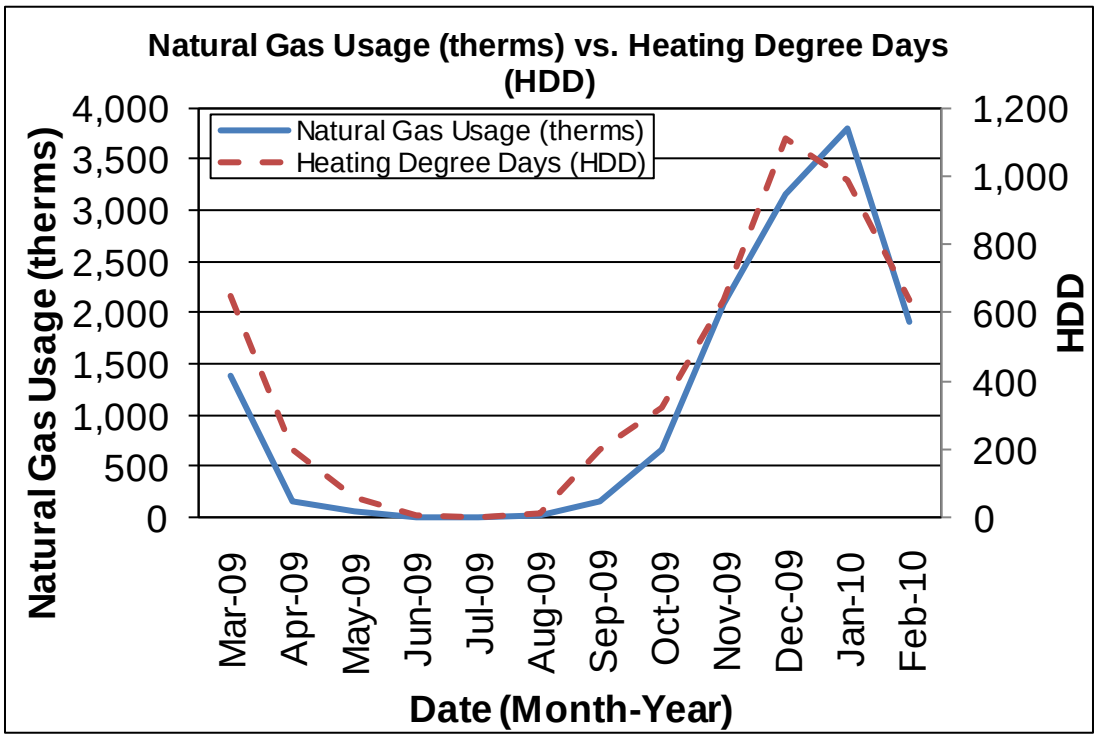
The chart below shows the monthly electric usage and costs. The dashed green line represents the approximate baseload or minimum electric usage required to operate the 593 Lincoln Ave Building.




Natural gas - The 593 Lincoln Ave Building is currently served by one meter for natural gas. The 593 Lincoln Ave Building currently buys natural gas from PSE&G at **an average aggregated rate of $1.151/therm**. The 593 Lincoln Ave Building purchased **approximately 13,413 therms, or $15,434 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 593 Lincoln Ave Building.

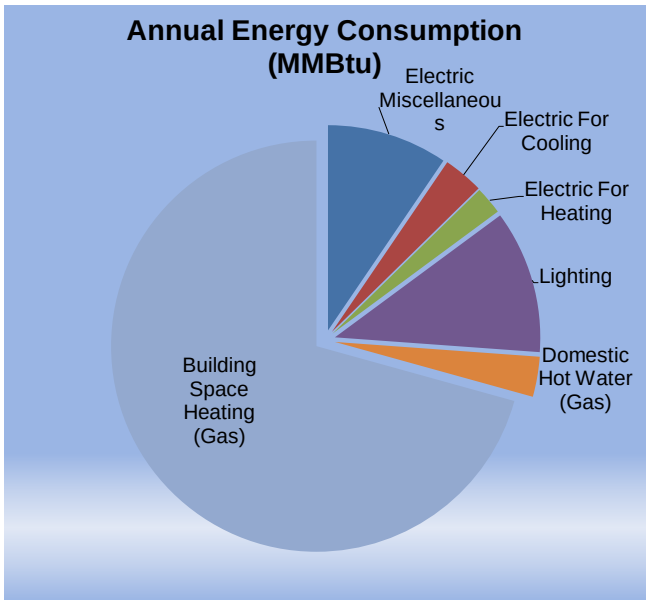


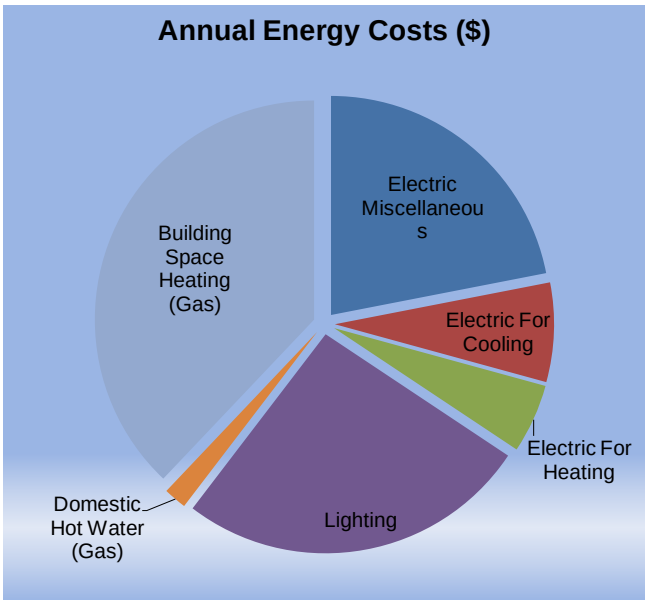




The chart above shows the monthly natural gas usage along with the heating degree days or HDD. Heating degree days is the difference of the average daily temperature and a base temperature, on a particular day. The heating degree days are zero for the days when the average temperature exceeds the base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

The following graphs, pie charts, and table show energy use for the building based on utility bills for the 12 month period. Note: electrical cost at $50/MMBtu of energy is almost 5 times as expensive as natural gas at $12/MMBtu.

| Annual Energy Consumption / Costs | | | | | |
|---|---|---|---|---|---|
| | MMBtu | % MMBtu | $ | % $ | $/MMBtu |
| Electric Miscellaneous | 173 | 10% | $8,545 | 22% | 50 |
| Electric For Cooling | 58 | 3% | $2,852 | 7% | 50 |
| Electric For Heating | 40 | 2% | $1,983 | 5% | 50 |
| Lighting | 205 | 11% | $10,140 | 26% | 50 |
| Domestic Hot Water (Elec) | | | | | |
| Domestic Hot Water (Gas) | 57 | 3% | $659 | 2% | 12 |
| Building Space Heating | 1,284 | 71% | $14,774 | 38% | 12 |
| Totals | 1,816 | 100% | $38,953 | 100% | |
| | | | | | |
| Total Electric Usage | 475 | 26% | $23,520 | 60% | 50 |
| Total Gas Usage | 1,341 | 74% | $15,434 | 40% | 12 |
| Totals | 1,816 | 100% | $38,953 | 100% | |

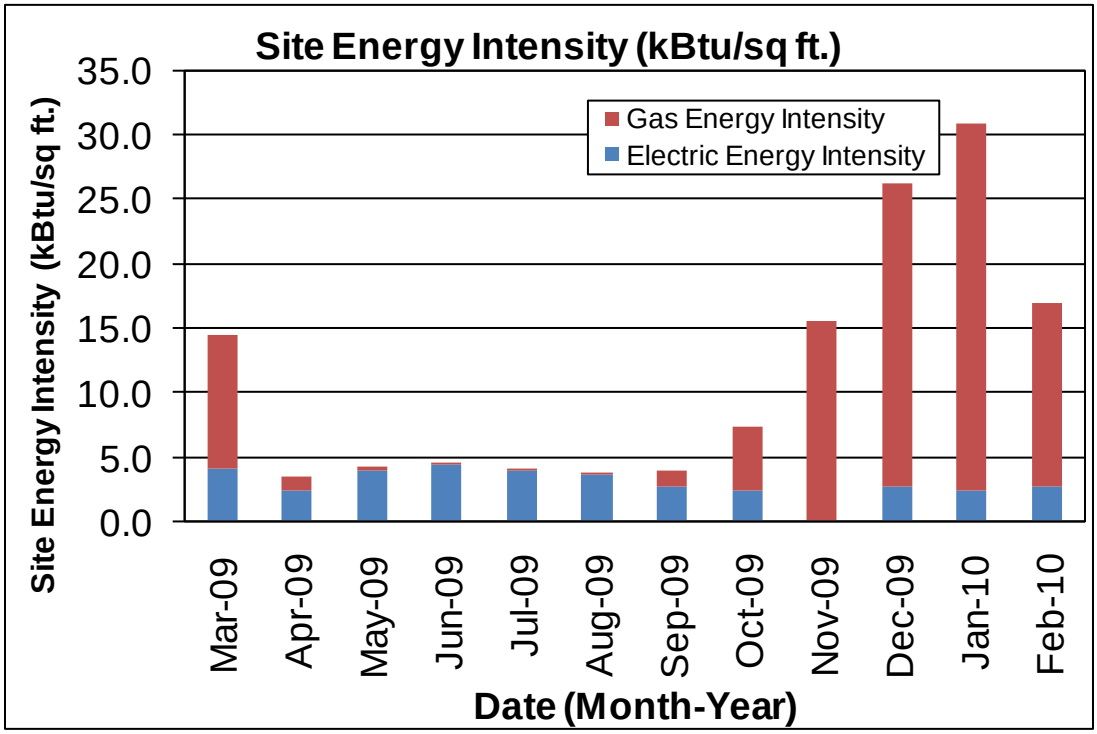


**Energy benchmarking**

SWA has entered energy information about the 593 Lincoln Ave Building in the U.S. Environmental Protection Agency's (EPA) *ENERGY STAR® Portfolio Manager* energy benchmarking system. This old police facility is categorized as a non-eligible ("Other") space type. Because it is an "Other" space type, there is no rating available. Consequently, the 593 Lincoln Ave Building is not eligible to receive a national energy performance rating at this time. The Site Energy Use Intensity is 132.0 kBtu/ft$^2$-yr compared to the national average of an old police building consuming 104.0 kBtu/ft$^2$-yr. See ECM section for guidance on how to improve the building's rating.

Due to the nature of its calculation based upon a survey of existing buildings of varying usage, the national average for "Other" space types is very subjective, and is not an absolute bellwether for gauging performance. Additionally, should the City of Orange Township desire to reach this average there are other large scale and financially less advantageous improvements that can be made, such as envelope window, door and insulation upgrades that would help the building reach this goal.




Per the LGEA program requirements, SWA has assisted the City of Orange Township to create an *ENERGY STAR® Portfolio Manager* account and share the 593 Lincoln Ave Building 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 City of Orange Township [redacted]

## Tariff analysis

As part of the utility bill analysis, SWA evaluated the current utility rates and tariffs. Tariffs are typically assigned to buildings based on size and building type.

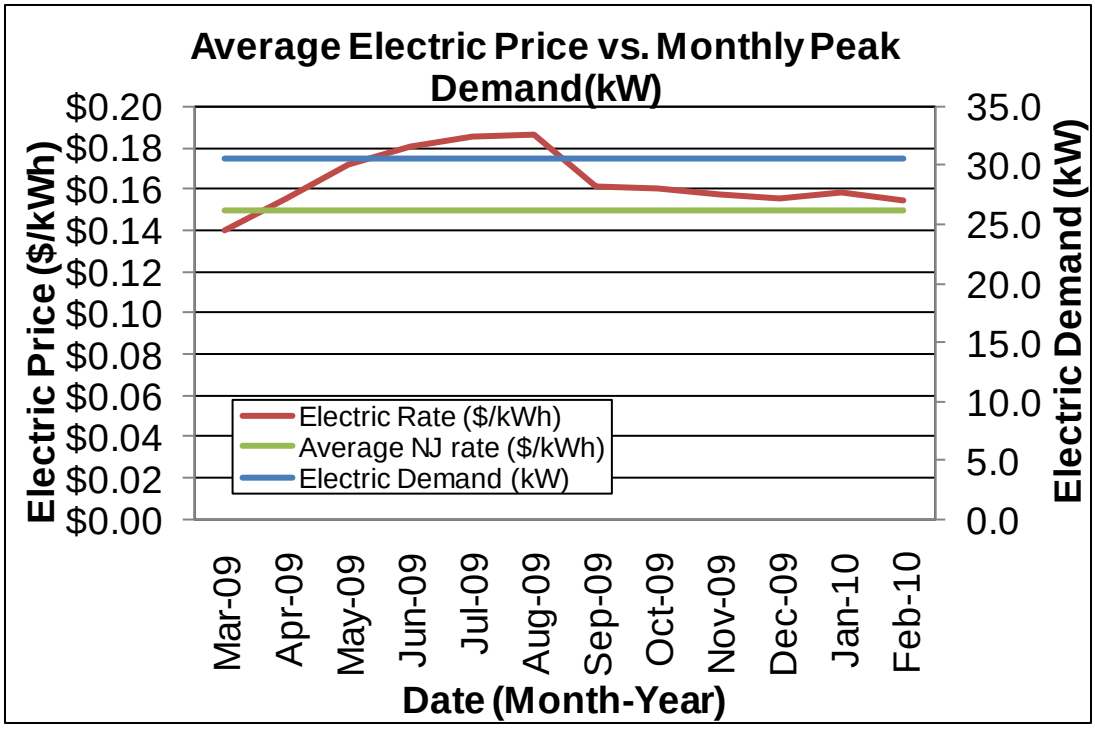
Tariff analysis is performed to determine if the rate that a City of Orange Township is contracted to pay with each utility provider is the best rate possible resulting in the lowest costs for electric and gas provision. Typically, the natural gas prices increase during the heating months when natural gas is used by the hot water boiler units. Some high gas price per therm fluctuations in the summer may be due to high energy costs that recently occurred and low use caps for the non-heating months. Typically, electricity prices also increase during the cooling months when electricity is used by the HVAC condensing units and air handlers.

The supplier charges a market-rate price based on use, and the billing does not break down demand costs for all periods because usage and demand are included in the rate. Currently, the City of Orange Township is paying a general service rate for natural gas. Demand is not broken out in the bill. Thus the building pays for fixed costs such as meter reading charges during the summer months. The building is direct metered and currently purchases electricity at a general service rate for usage with an additional charge for electrical demand factored into each monthly bill. The general service rate for electric charges is market-rate based on usage and demand. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year.

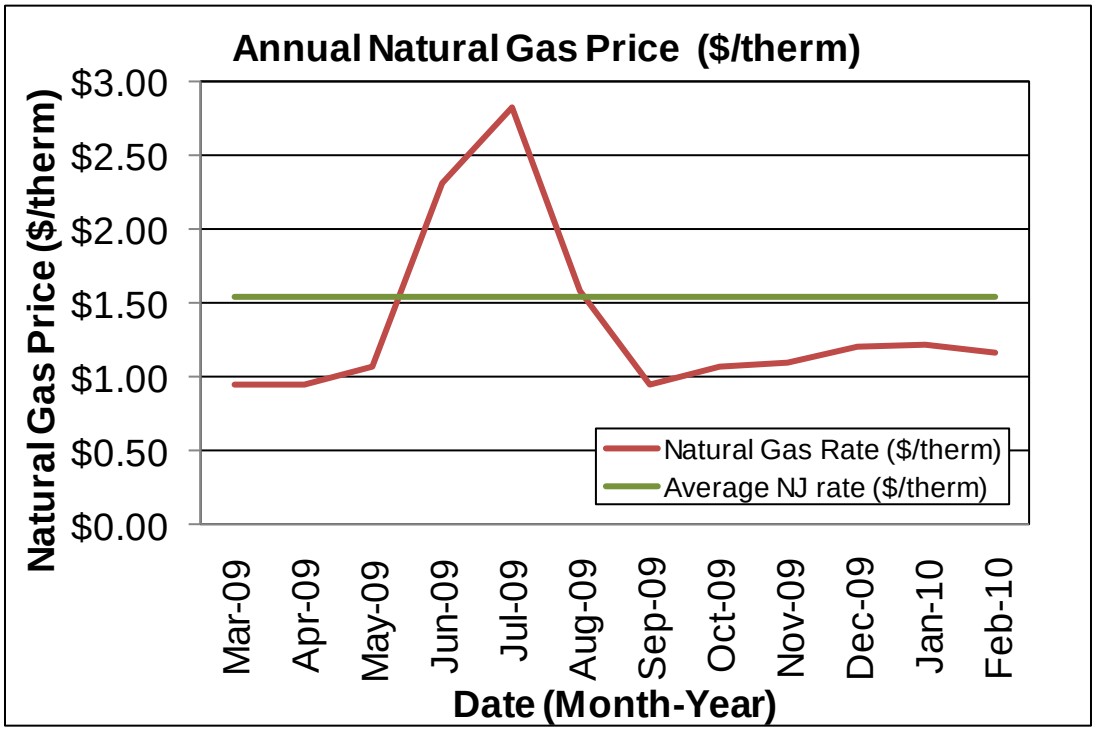
## Energy Procurement strategies

Billing analysis is conducted using an average aggregated rate that is estimated based on the total cost divided by the total energy usage per utility per 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 593 Lincoln Ave Building pays a rate of $0.169/kWh. The 593 Lincoln Ave Building annual electric utility costs are $2,645 higher, when compared to the average estimated NJ commercial utility rates. Electric bill analysis shows fluctuations up to 25% over the most recent 12 month period.




The average estimated NJ commercial utility rates for gas are $1.550/therm, while 593 Lincoln Ave Building pays a rate of $1.151/therm. Natural gas bill analysis shows fluctuations up to 74% over the most recent 12 month period.




Utility rate fluctuations may have been caused by adjustments between estimated and actual meter readings; others may be due to unusual high and recent escalating energy costs.

SWA recommends that the 593 Lincoln Ave Building further explore opportunities of purchasing both natural gas and electricity from third-party suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the 593 Lincoln Ave Building. Appendix C contains a complete list of third-party energy suppliers for the City of Orange Township 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 April 22, 2010, the following data was collected and analyzed.

### Building Characteristics

The two-story, (including a full basement), 13,428 square feet 593 Lincoln Ave Building was originally constructed in 1890 with additions/alterations completed over 5 years ago. It was originally a school then a police station and now is a vacant facility with storage and office spaces.

Front Façade

Rear Façade

Left Side Façade

Right Side Façade

### Building Occupancy Profiles

The facility is currently unoccupied and there are no conclusive plans for future occupancy.

## Building Envelope

Due to unfavorable weather conditions (min. 18 deg. F delta-T in/outside and no/low wind), no exterior envelope infrared (IR) images were taken during the field audit.

### Exterior Walls

The exterior wall envelope is mostly constructed of solid brick and some natural stone veneer accents, with no of detectable insulation. The interior is mostly painted gypsum wallboard.

*Note:* Wall insulation levels could not be verified in the field or on construction plans, and are based upon similar wall types and time of construction.

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:

Signs of water damage and mold growth at perimeter walls due to missing/ineffective site drainage

Cracked/deteriorated bricks and mortar joints

Cracked/deteriorated bricks and mortar joints

Overgrown ground vegetation blocking exterior wall surfaces

## Roof

The building's roof is predominantly hipped over a wood structure, with an asphalt shingle finish. It was replaced over 15 years ago. Zero inches of detectable attic insulation, and zero inches of detectable roof insulation were recorded.

Note: Roof insulation levels could only partially be verified in the field and are based upon similar wall types and time of construction.

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall acceptable condition, with only a few signs of uncontrolled moisture, air-leakage or other energy-compromising issues.

The following specific roof problem spots were identified:

Delaminating roof membrane/patches

No attic insulation found

## Base

The building's base is composed of a below grade slab floor with a perimeter foundation and no detectable 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 acceptable condition with only a few signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues detected in some areas inside.

The following specific base problem spots were identified:

Structural cracks detected in the slab with vegetation growth

Water/moisture seepage through cracks detected in the slab

**Windows**

The building contains several different types of windows:

1. Approximate 56 double-hung type windows with a non-insulated aluminum frame, clear double glazing and interior roller blinds. The windows are located throughout the building and were replaced over 10 years ago

2. Approximate 9 double-hung type windows with a non-insulated aluminum frame, clear single glazing and interior roller blinds. The windows are located throughout the building and are original.

3. Approximate16 fixed type windows with a wood frame, clear single glazing and no interior or exterior shading devices. The windows are located at ground level and are original.

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 poor condition with numerous signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific window problem spots were identified:

Cracked or aged caulk around frame/sill on the exterior

Damaged/aged window frame

Missing/aged sealants

Single-glazed window with ineffective frame

Damaged window frame

**Exterior doors**

The building contains two different types of exterior doors:

1. Three aluminum type exterior doors. They are located throughout the building and were replaced over 10 years ago.

2. One glass with aluminum/steel frame type exterior doors. They are located throughout the building and were replaced over 10 years ago.

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 acceptable condition with some signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific door problem spots were identified:

Interior mold/water damage signs on areas around doors

Missing/worn weather-stripping

Damaged/warped/aged door frame

**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 593 Lincoln Ave Building has evidence of an integrated heating system, air system and supplemental cooling. The building has not been occupied since March 2009, and therefore all equipment has been drained and is not currently operating.

### Equipment

The 593 Lincoln Ave Building is heated by a Weil McLain natural gas steam boiler. The heat of combustion of natural gas heats water until it becomes steam, which serves steam coils and steam radiators throughout the building. A portion of the water returns to the boiler as condensate. The steam piping in the basement is un-insulated and severely corroded.

Weil McLain Natural Gas Steam Boiler; Rusted Piping and Flue, no insulation on piping

The steam coil is contained in an air handling unit for heating throughout the space. The steam radiators are throughout the perimeter of the building to compensate for envelope losses.

Steam Radiator Basement; Steam Fin tube Radiator Upper Floors

The Air Handling unit has no visible nameplate information and appears to be at least 30 years old and inoperable. There is an outside air damper in the mechanical space for the air handler which has been plugged.

Abandoned Air Handling Unit; Blocked Outside Air Damper

There does not appear to be a cooling system in place at the building. There are air conditioning units for cooling in a few offices.

Window AC Units

There were no visible exhaust fans on the roof or on the exterior of the building. The only ventilation evident was the outside air intake louver for the abandoned air handing unit. There are two large ducts leading to the roof which are likely to serve as an air shaft to carry

exhaust away from the building. There are no available building drawings to confirm the design.

**Distribution Systems**

In a typical air handler arrangement, the supply fan draws in outside air where it is combined with return air from the building. Using transfer grills and returns grills the air from the space is draw into the above-ceiling return air plenum and ducted back to the unit. The mixed air inside the air handler is sent through a filter before passing through the evaporator or direct expansion (DX) coil. The supply air fan then pushes the air through the furnace section. The conditioned air is then sent to the supply air distribution system. The furnace is only active in the heating season and the DX system is only active in the cooling season

**Controls**

There is no evidence of the source of controls for the heating system. The AC units have manual controls. There were no visible thermostats.

**Domestic Hot Water**

The domestic hot water (DHW) for the 593 Lincoln Ave Building is provided by a 34,000 Btu/hr natural gas heaters with 40 gallons storage.

Domestic Hot Water Heater

The heaters have 45% estimated useful operating life remaining and appear in good condition.

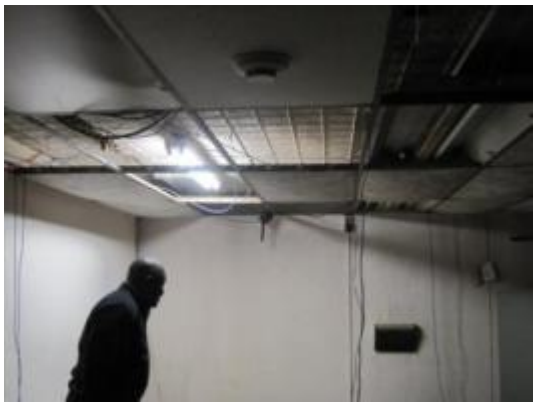
## Electrical systems

### 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 593 Lincoln Ave Building currently contains mostly T8 fixtures, chandeliers and wall sconces with self-ballast bulbs. Based on measurements of lighting levels for each space, there are no vastly over-illuminated areas. There are some concerns with both interior and exterior visibility in a few places.



Lobby lighting with photocells; lobby up-lighting


Standard office lighting; court room up-lighting

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

*Exterior Lighting* - The exterior lighting surveyed during the building audit was found to be a mix of Metal Halide lamp and CFL fixtures. Exterior lighting is controlled by timers.

Exterior Metal Halide lights

**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, printers, etc. 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.

**Elevators**

The 593 Lincoln Ave Building does not have an installed elevator.

**Other electrical systems**

There are not currently any other significant energy-impacting electrical systems installed at the 593 Lincoln Ave Building.

## 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 state and federal 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. Technology such as photovoltaic panels or wind turbines, use natural resources to generate electricity on the site. Geothermal systems offset the thermal loads in a building by using water stored in the ground as either a heat sink or heat source. Solar thermal collectors heat a specified volume of water, reducing the amount of energy required to heat water using building equipment. Cogeneration or CHP allows you to generate electricity locally, while also taking advantage of heat wasted during the generation process.

### Existing systems

There are no renewable energy systems 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.

Due to the limited and unknown future plan for use of the 593 Lincoln Ave building, there is not a consistent load in summer months to use the power generated from the solar panels. Once a master plan is established for the long term use of the building, this option can be reconsidered.

### 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.

### Geothermal

The 593 Lincoln Ave Building 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 56% and 76% remaining useful life.

## Combined Heat and Power

The 593 Lincoln Ave Building 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 | Lighting Upgrades: Replace Inc with CFL |
| 2 | Lighting Upgrades: Replace MH with PSMH |
| | **Description of Recommended 5-10 Year Payback ECMs** |
| 3 | Lighting Upgrades: Replace T12 with T8 |

## ECM#1: *Building Lighting Upgrades: Inc to CFL*

During the field audit, SWA completed a building lighting inventory (see Appendix B). The existing lighting also contains over 30 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 when compared to incandescent, halogen and Metal Halide fixtures. CFL bulbs produce the same lumen output with less wattage than incandescent bulbs and last up to five times longer. 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 from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

**Installation cost:**

Estimated installed cost: $1,056 (includes $250 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

| ECM # | est. installed cost, $ | est. incentives, $ | net est. ECM cost with incentives, $ | kWh, 1st yr savings | kW, demand reduction/mo | therms, 1st yr savings | kBtu/sq ft, 1st yr savings | est. operating cost, 1st yr savings, $ | total 1st yr savings, $ | life of measure, yrs | est. lifetime energy cost savings, $ | simple payback, yrs | annual return on investment, % | $CO_2$ reduced, lbs/yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1,056 | 0 | 1,056 | 3,546 | 1 | 0 | 1 | 1,051 | 1,651 | 5 | 8,255 | 0.6 | 682 | 6,349 |

**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 26 hrs/yr to replace aging burnt out lamps vs. newly installed.

**Rebates/financial incentives:**

- *None at this time*

Please see Appendix F for more information on Incentive Programs.

## ECM#2: *Building Lighting Upgrades: MH to PSMH*

During the field audit, SWA completed a building interior as well as exterior lighting inventory (see Appendix B). The existing lighting contains four standard probe start Metal Halide (MH) lamps. SWA recommends replacing the higher wattage MH fixtures with pulse start MH lamps which offer the advantages of standard probe start MH lamps, but minimize the disadvantages. They produce higher light output both initially and over time, operate more efficiently, produce whiter light, and turn on and re-strike faster. Due to these characteristics, energy savings can be realized via one-to-one substitution of lower-wattage systems, or by taking advantage of higher light output and reducing the number of fixtures required in the space. 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 from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

**Installation cost:**

Estimated installed cost: $1,905 (includes $500 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

| ECM # | est. installed cost, $ | est. incentives, $ | net est. ECM cost with incentives, $ | kWh, 1st yr savings | kW, demand reduction/mo | therms, 1st yr savings | kBtu/sq ft, 1st yr savings | est. operating cost, 1st yr savings, $ | total 1st yr savings, $ | life of measure, yrs | est. lifetime energy cost savings, $ | simple payback, yrs | annual return on investment, % | $CO_2$ reduced, lbs/yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 1,905 | 100 | 1,805 | 1,323 | 0 | 0 | 0 | 220 | 444 | 15 | 6,660 | 4.1 | 269 | 2,369 |

**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 5 hrs/yr to replace aging burnt out lamps vs. newly installed.

**Rebates/financial incentives:**

- *NJ Clean Energy - Metal Halide with pulse start ($25 per fixture) - Maximum incentive amount is $100.*

Please see Appendix F for more information on Incentive Programs.

## ECM#3: *Building Lighting Upgrades: T12 to T8*

During the field audit, SWA completed a building lighting inventory (see Appendix B). The existing lighting contains 134 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 T12 fixtures with magnetic ballasts. T8 fixtures also provide better lumens for less wattage when compared to incandescent, halogen and Metal Halide 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 from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

**Installation cost:**

Estimated installed cost: $16,544 (includes $4,900 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

| ECM # | est. installed cost, $ | est. incentives, $ | net est. ECM cost with incentives, $ | kWh, 1st yr savings | kW, demand reduction/mo | therms, 1st yr savings | kBtu/sq ft, 1st yr savings | est. operating cost, 1st yr savings, $ | total 1st yr savings, $ | life of measure, yrs | est. lifetime energy cost savings, $ | simple payback, yrs | annual return on investment, % | $CO_2$ reduced, lbs/yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 18,554 | 2,010 | 16,544 | 9,937 | 2 | 0 | 3 | 1,038 | 2,717 | 15 | 40,755 | 6.1 | 146 | 17,792 |

**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 25 hrs/yr to replace aging burnt out lamps vs. newly installed.

**Rebates/financial incentives:**

- *NJ Clean Energy - T12 to T8 ($15 per fixture) - Maximum incentive amount is $2,010.*

Please see Appendix F 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 593 Lincoln Ave Building:

- Install premium motors when replacements are required - Select NEMA Premium motors when replacing motors that have reached the end of their useful operating lives.
- Re-point deteriorated mortar joints soon to prevent possible water/moisture penetration into cavity walls.
- Replace Air Handling Unit with new premium efficiency type.
- Replace Air Compressor with new using premium efficiency motor.
- Replace all steam water piping and insulate as per code requirements.
- Insulate original and un-insulated roof/ceiling sections. SWA suggests applying spray-foam and/or rigid foam board insulation (R-30 min.)
- Due to significant base deterioration in the interior, SWA recommends abandoning the building until further action (repair/rebuilding) has been evaluated.
- Replace all original, single-glazed windows and frames with historically and architecturally accurate low-E, double glazed type.

### 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.
- Repair and maintain gutters, downspouts and downspout deflectors to minimize uncontrolled roof water run-off causing exterior wall damage.
- Maintain/ inspect all roof surfaces on a regular basis.
- Install/replace and maintain weather-stripping around all exterior doors and roof hatches.

- 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.

Note: The recommended ECMs and the list above are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for City of Orange Township. Based on the requirements of the LGEA program, City of Orange Township must commit to implementing some of these measures, and must submit paperwork to the Local Government Energy Audit program within one year of this report’s approval to demonstrate that they have spent, net of other NJCEP incentives, at least 25% of the cost of the audit (per building). The minimum amount to be spent, net of other NJCEP incentives, is $926.50.

## APPENDIX A: EQUIPMENT LIST

### Inventory

| Building System | Description | Location | Make/ Model | Fuel | Space Served | Date Installed | Estimated Remaining Useful Life % |
|---|---|---|---|---|---|---|---|
| Heating | Steam Boiler, 2,049 Mbh max, 1,245 MBH min, 3/4HP burner motor | Basement Boiler Rm | Weil McLain, Type CI, S#1987707, Cyclonetic Burner M#JB1C-07-R7795C-LL15, S#W024885 | Natural Gas | All Areas | 2001 | 60% |
| Air Compressor | Air Compressor | Basement Boiler Rm | Johnson System Type 3X3B, S#4988 | Electric | All Areas | 1950's | 0% |
| DHW | Hot water heater, 34,000 Btu/hr input, 40 gallon storage | Basement Boiler Rm | Ruud M#M40-7, S#RUNG 0798A30811 | Natural Gas | All Areas | 1998 | 40% |
| Cooling | Window AC units, 8,000 Btu/hr Cooling, 815 Watts 9.8 EER | Office | Air Temp, B6X08F2A-a, S# CS 130972 085Y | Electric | Office | 2005 | 80% |
| Cooling | Window AC units, 8,000 Btu/hr Cooling, 815 Watts 10.7 EER | Office | whirlpool, M# ACQ189XR1, S#QS1603874 | Electric | Office | 2005 | 80% |
| HVAC | Air Handling unit, No Nameplate. Outside air damper into closet, completely blocked with debris | Basement Closet | NA | Electric | All Areas | 1950's | 0% |

**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 | Bsmt | Hallway | Ceiling Mounted | S | Inc | 10 | 1 | 60 | Sw | 16 | 260 | 0 | 600 | 2,496 | CFL | Ceiling Mounted | CFL | S | Sw | 10 | 1 | 20 | 16 | 260 | 0 | 200 | 832 | 1664 | 0 | 1664 |
| 2 | Bsmt | Storage Rm | Ceiling Mounted | M | 4'T12 | 16 | 2 | 40 | Sw | 2 | 260 | 12 | 1,472 | 765 | T8 | Ceiling Mounted | 4'T8 | E | Sw | 16 | 2 | 32 | 2 | 260 | 5 | 1104 | 574 | 191 | 0 | 191 |
| 3 | Bsmt | Jail Cells | Ceiling Mounted | M | 4'T12 | 7 | 2 | 40 | Sw | 4 | 260 | 12 | 644 | 670 | T8 | Ceiling Mounted | 4'T8 | E | Sw | 7 | 2 | 32 | 4 | 260 | 5 | 483 | 502 | 167 | 0 | 167 |
| 4 | Bsmt | Staircase | Ceiling Mounted | M | 2'T12 | 2 | 2 | 20 | Sw | 16 | 260 | 6 | 92 | 383 | T8 | Ceiling Mounted | 2'T8 | E | Sw | 2 | 2 | 17 | 16 | 260 | 2 | 72 | 300 | 83 | 0 | 83 |
| 5 | Bsmt | Boiler Rm | Ceiling Mounted | S | Inc | 2 | 1 | 60 | Sw | 2 | 260 | 0 | 120 | 62 | CFL | Ceiling Mounted | CFL | S | Sw | 2 | 1 | 20 | 2 | 260 | 0 | 40 | 21 | 42 | 0 | 42 |
| 6 | Bsmt | Hallway | Exit Sign | S | LED | 3 | 1 | 5 | Sw | 24 | 365 | 1 | 17 | 145 | N/A | Exit Sign | LED | S | Sw | 3 | 1 | 5 | 24 | 365 | 1 | 17 | 145 | 0 | 0 | 0 |
| 7 | Bsmt | Storage Rm | Ceiling Mounted | M | 8'T12 | 1 | 2 | 80 | Sw | 2 | 260 | 20 | 180 | 94 | T8 | Ceiling Mounted | 8'T8 | E | Sw | 1 | 2 | 59 | 2 | 260 | 7 | 125 | 65 | 29 | 0 | 29 |
| 8 | Bsmt | Storage Rm 2 | Ceiling Mounted | M | 4'T12 | 6 | 2 | 40 | Sw | 2 | 260 | 12 | 552 | 287 | T8 | Ceiling Mounted | 4'T8 | E | Sw | 6 | 2 | 32 | 2 | 260 | 5 | 414 | 215 | 72 | 0 | 72 |
| 9 | Bsmt | Weight Room | Ceiling Mounted | M | 4'T12 | 2 | 2 | 40 | Sw | 2 | 260 | 12 | 184 | 96 | T8 | Ceiling Mounted | 4'T8 | E | Sw | 2 | 2 | 32 | 2 | 260 | 5 | 138 | 72 | 24 | 0 | 24 |
| 10 | Bsmt | Weight Room | Ceiling Mounted | M | 8'T12 | 2 | 2 | 80 | Sw | 2 | 260 | 20 | 360 | 187 | T8 | Ceiling Mounted | 8'T8 | E | Sw | 2 | 2 | 59 | 2 | 260 | 7 | 250 | 130 | 57 | 0 | 57 |
| 11 | Bsmt | Storage 3 | Ceiling Mounted | E | 4'T8 | 2 | 4 | 32 | Sw | 2 | 260 | 5 | 266 | 138 | N/A | Ceiling Mounted | 4'T8 | E | Sw | 2 | 4 | 32 | 2 | 260 | 5 | 266 | 138 | 0 | 0 | 0 |
| 12 | Bsmt | Staircase | Ceiling Mounted | E | 4'T8 | 1 | 4 | 32 | Sw | 16 | 260 | 5 | 133 | 553 | N/A | Ceiling Mounted | 4'T8 | E | Sw | 1 | 4 | 32 | 16 | 260 | 5 | 133 | 553 | 0 | 0 | 0 |
| 13 | Bsmt | Staircase | Exit Sign | S | LED | 2 | 1 | 5 | Sw | 24 | 365 | 1 | 11 | 96 | N/A | Exit Sign | LED | S | Sw | 2 | 1 | 5 | 24 | 365 | 1 | 11 | 96 | 0 | 0 | 0 |
| 14 | 1 | Staircase | Ceiling Mounted | E | 4'T8 | 1 | 4 | 32 | Sw | 16 | 260 | 5 | 133 | 553 | N/A | Ceiling Mounted | 4'T8 | E | Sw | 1 | 4 | 32 | 16 | 260 | 5 | 133 | 553 | 0 | 0 | 0 |
| 15 | 1 | Office | Ceiling Mounted | M | 4'T12 | 6 | 4 | 40 | Sw | 9 | 260 | 12 | 1,032 | 2,415 | T8 | Ceiling Mounted | 4'T8 | E | Sw | 6 | 4 | 32 | 9 | 260 | 5 | 798 | 1867 | 548 | 0 | 548 |
| 16 | 1 | Office | Ceiling Mounted | M | 4'T12 | 6 | 2 | 40 | Sw | 9 | 260 | 12 | 552 | 1,292 | T8 | Ceiling Mounted | 4'T8 | E | Sw | 6 | 2 | 32 | 9 | 260 | 5 | 414 | 969 | 323 | 0 | 323 |
| 17 | 1 | Hallway | Ceiling Mounted | M | 4'T12 | 8 | 4 | 40 | Sw | 16 | 260 | 12 | 1,376 | 5,724 | T8 | Ceiling Mounted | 4'T8 | E | Sw | 8 | 4 | 32 | 16 | 260 | 5 | 1064 | 4426 | 1298 | 0 | 1298 |
| 18 | 1 | Hallway | Exit Sign | S | LED | 3 | 1 | 5 | Sw | 24 | 365 | 1 | 17 | 145 | N/A | Exit Sign | LED | S | Sw | 3 | 1 | 5 | 24 | 365 | 1 | 17 | 145 | 0 | 0 | 0 |
| 19 | 1 | Office 2 | Ceiling Mounted | M | 4'T12 | 2 | 2 | 40 | Sw | 8 | 260 | 12 | 184 | 383 | T8 | Ceiling Mounted | 4'T8 | E | Sw | 2 | 2 | 32 | 8 | 260 | 5 | 138 | 287 | 96 | 0 | 96 |
| 20 | 1 | Office 2 | Ceiling Mounted | M | 4'T12 | 7 | 4 | 40 | Sw | 8 | 260 | 12 | 1,204 | 2,504 | T8 | Ceiling Mounted | 4'T8 | E | Sw | 7 | 4 | 32 | 8 | 260 | 5 | 931 | 1936 | 568 | 0 | 568 |
| 21 | 1 | Lobby | Ceiling Mounted | M | 4'T12 | 4 | 4 | 40 | Sw | 8 | 260 | 12 | 688 | 1,431 | T8 | Ceiling Mounted | 4'T8 | E | Sw | 4 | 4 | 32 | 8 | 260 | 5 | 532 | 1107 | 324 | 0 | 324 |
| 22 | 1 | Lobby | Ceiling Mounted | E | 4'T8 | 1 | 4 | 32 | Sw | 8 | 260 | 5 | 133 | 277 | N/A | Ceiling Mounted | 4'T8 | E | Sw | 1 | 4 | 32 | 8 | 260 | 5 | 133 | 277 | 0 | 0 | 0 |
| 23 | 1 | Lobby | Exit Sign | S | LED | 1 | 1 | 5 | Sw | 24 | 365 | 1 | 6 | 48 | N/A | Exit Sign | LED | S | Sw | 1 | 1 | 5 | 24 | 365 | 1 | 6 | 48 | 0 | 0 | 0 |
| 24 | 1 | Lobby back | Exit Sign | S | LED | 1 | 1 | 5 | Sw | 24 | 365 | 1 | 6 | 48 | N/A | Exit Sign | LED | S | Sw | 1 | 1 | 5 | 24 | 365 | 1 | 6 | 48 | 0 | 0 | 0 |
| 25 | 1 | Lobby back | Ceiling Mounted | M | 4'T12 | 1 | 4 | 40 | Sw | 8 | 260 | 12 | 172 | 358 | T8 | Ceiling Mounted | 4'T8 | E | Sw | 1 | 4 | 32 | 8 | 260 | 5 | 133 | 277 | 81 | 0 | 81 |
| 26 | 1 | Office 3 | Ceiling Mounted | M | 4'T12 | 6 | 4 | 40 | Sw | 9 | 260 | 12 | 1,032 | 2,415 | T8 | Ceiling Mounted | 4'T8 | E | Sw | 6 | 4 | 32 | 9 | 260 | 5 | 798 | 1867 | 548 | 0 | 548 |
| 27 | 1 | Bathroom | Ceiling Mounted | S | Inc | 1 | 1 | 60 | Sw | 9 | 260 | 0 | 60 | 140 | CFL | Ceiling Mounted | CFL | S | Sw | 1 | 1 | 20 | 9 | 260 | 0 | 20 | 47 | 94 | 0 | 94 |

| 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) |
| 28 | 1 | Office 4 | Ceiling Mounted | M | 4'T12 | 5 | 4 | 40 | Sw | 9 | 260 | 12 | 860 | 2,012 | T8 | Ceiling Mounted | 4'T8 | E | Sw | 5 | 4 | 32 | 9 | 260 | 5 | 665 | 1556 | 456 | 0 | 456 |
| 29 | 1 | Office 5 | Ceiling Mounted | M | 4'T12 | 4 | 4 | 40 | Sw | 9 | 260 | 12 | 688 | 1,610 | T8 | Ceiling Mounted | 4'T8 | E | Sw | 4 | 4 | 32 | 9 | 260 | 5 | 532 | 1245 | 365 | 0 | 365 |
| 30 | 1 | Bathroom | Ceiling Mounted | M | 4'T12 | 1 | 4 | 40 | Sw | 9 | 260 | 12 | 172 | 402 | T8 | Ceiling Mounted | 4'T8 | E | Sw | 1 | 4 | 32 | 9 | 260 | 5 | 133 | 311 | 91 | 0 | 91 |
| 31 | 1 | Bathroom | Ceiling Mounted | S | Inc | 1 | 1 | 60 | Sw | 9 | 260 | 0 | 60 | 140 | CFL | Ceiling Mounted | CFL | S | Sw | 1 | 1 | 20 | 9 | 260 | 0 | 20 | 47 | 94 | 0 | 94 |
| 32 | 1 | Office 6 | Ceiling Mounted | M | 4'T12 | 4 | 4 | 40 | Sw | 9 | 260 | 12 | 688 | 1,610 | T8 | Ceiling Mounted | 4'T8 | E | Sw | 4 | 4 | 32 | 9 | 260 | 5 | 532 | 1245 | 365 | 0 | 365 |
| 33 | 1 | Patrol | Ceiling Mounted | M | 4'T12 | 7 | 4 | 40 | Sw | 8 | 260 | 12 | 1,204 | 2,504 | T8 | Ceiling Mounted | 4'T8 | E | Sw | 7 | 4 | 32 | 8 | 260 | 5 | 931 | 1936 | 568 | 0 | 568 |
| 34 | 1 | Bathroom | Ceiling Mounted | S | Inc | 1 | 1 | 60 | Sw | 9 | 260 | 0 | 60 | 140 | CFL | Ceiling Mounted | CFL | S | Sw | 1 | 1 | 20 | 9 | 260 | 0 | 20 | 47 | 94 | 0 | 94 |
| 35 | 2 | Staircase 2 | Ceiling Mounted | M | 4'T12 | 2 | 4 | 40 | Sw | 16 | 260 | 12 | 344 | 1,431 | T8 | Ceiling Mounted | 4'T8 | E | Sw | 2 | 4 | 32 | 16 | 260 | 5 | 266 | 1107 | 324 | 0 | 324 |
| 36 | 2 | Staircase 2 | Ceiling Mounted | S | Inc | 2 | 1 | 60 | Sw | 16 | 260 | 0 | 120 | 499 | CFL | Ceiling Mounted | CFL | S | Sw | 2 | 1 | 20 | 16 | 260 | 0 | 40 | 166 | 333 | 0 | 333 |
| 37 | 2 | Hallway | Ceiling Mounted | M | 4'T12 | 8 | 4 | 40 | Sw | 16 | 260 | 12 | 1,376 | 5,724 | T8 | Ceiling Mounted | 4'T8 | E | Sw | 8 | 4 | 32 | 16 | 260 | 5 | 1064 | 4426 | 1298 | 0 | 1298 |
| 38 | 2 | Hallway | Exit Sign | S | LED | 2 | 1 | 5 | Sw | 24 | 365 | 1 | 11 | 96 | N/A | Exit Sign | LED | S | Sw | 2 | 1 | 5 | 24 | 365 | 1 | 11 | 96 | 0 | 0 | 0 |
| 39 | 2 | Office 1 | Ceiling Mounted | M | 4'T12 | 4 | 4 | 40 | Sw | 8 | 260 | 12 | 688 | 1,431 | T8 | Ceiling Mounted | 4'T8 | E | Sw | 4 | 4 | 32 | 8 | 260 | 5 | 532 | 1107 | 324 | 0 | 324 |
| 40 | 2 | Office 2 | Ceiling Mounted | M | 4'T12 | 12 | 4 | 40 | Sw | 8 | 260 | 12 | 2,064 | 4,293 | T8 | Ceiling Mounted | 4'T8 | E | Sw | 12 | 4 | 32 | 8 | 260 | 5 | 1596 | 3320 | 973 | 0 | 973 |
| 41 | 2 | Office 3 | Ceiling Mounted | M | 4'T12 | 9 | 4 | 40 | Sw | 8 | 260 | 12 | 1,548 | 3,220 | T8 | Ceiling Mounted | 4'T8 | E | Sw | 9 | 4 | 32 | 8 | 260 | 5 | 1197 | 2490 | 730 | 0 | 730 |
| 42 | 2 | Staircase 2A | Ceiling Mounted | E | 4'T8 | 1 | 4 | 32 | Sw | 16 | 260 | 5 | 133 | 553 | N/A | Ceiling Mounted | 4'T8 | E | Sw | 1 | 4 | 32 | 16 | 260 | 5 | 133 | 553 | 0 | 0 | 0 |
| 43 | 2 | Janitor's Closet | Ceiling Mounted | E | 4'T8 | 1 | 4 | 32 | Sw | 2 | 260 | 5 | 133 | 69 | N/A | Ceiling Mounted | 4'T8 | E | Sw | 1 | 4 | 32 | 2 | 260 | 5 | 133 | 69 | 0 | 0 | 0 |
| 44 | 2 | Bathroom | Ceiling Mounted | S | Inc | 2 | 1 | 60 | Sw | 9 | 260 | 0 | 120 | 281 | CFL | Ceiling Mounted | CFL | S | Sw | 2 | 1 | 20 | 9 | 260 | 0 | 40 | 94 | 187 | 0 | 187 |
| 45 | 2 | Kitchen | Ceiling Mounted | E | 4'T8 | 2 | 4 | 32 | Sw | 9 | 260 | 5 | 266 | 622 | N/A | Ceiling Mounted | 4'T8 | E | Sw | 2 | 4 | 32 | 9 | 260 | 5 | 266 | 622 | 0 | 0 | 0 |
| 46 | 2 | Office 4 | Ceiling Mounted | E | 4'T8 | 2 | 4 | 32 | Sw | 9 | 260 | 5 | 266 | 622 | N/A | Ceiling Mounted | 4'T8 | E | Sw | 2 | 4 | 32 | 9 | 260 | 5 | 266 | 622 | 0 | 0 | 0 |
| 47 | 2 | Office 4 BR | Ceiling Mounted | S | Inc | 1 | 1 | 60 | Sw | 9 | 260 | 0 | 60 | 140 | CFL | Ceiling Mounted | CFL | S | Sw | 1 | 1 | 20 | 9 | 260 | 0 | 20 | 47 | 94 | 0 | 94 |

| 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) |
| 48 | 2 | Lounge | Ceiling Mounted | E | 4'T8 | 6 | 4 | 32 | Sw | 8 | 260 | 5 | 798 | 1,660 | N/A | Ceiling Mounted | 4'T8 | E | Sw | 6 | 4 | 32 | 8 | 260 | 5 | 798 | 1660 | 0 | 0 | 0 |
| 49 | 2 | Office 5 | Ceiling Mounted | E | 4'T8 | 2 | 4 | 32 | Sw | 9 | 260 | 5 | 266 | 622 | N/A | Ceiling Mounted | 4'T8 | E | Sw | 2 | 4 | 32 | 9 | 260 | 5 | 266 | 622 | 0 | 0 | 0 |
| 50 | 2 | Office 6 | Ceiling Mounted | E | 4'T8 | 6 | 4 | 32 | Sw | 9 | 260 | 5 | 798 | 1,867 | N/A | Ceiling Mounted | 4'T8 | E | Sw | 6 | 4 | 32 | 9 | 260 | 5 | 798 | 1867 | 0 | 0 | 0 |
| 51 | 2 | Storage Closet | Ceiling Mounted | M | 4'T12 | 1 | 2 | 40 | Sw | 2 | 260 | 12 | 92 | 48 | T8 | Ceiling Mounted | 4'T8 | E | Sw | 1 | 2 | 32 | 2 | 260 | 5 | 69 | 36 | 12 | 0 | 12 |
| 52 | 2 | Bathroom | Ceiling Mounted | S | Inc | 1 | 1 | 60 | Sw | 9 | 260 | 0 | 60 | 140 | CFL | Ceiling Mounted | CFL | S | Sw | 1 | 1 | 20 | 9 | 260 | 0 | 20 | 47 | 94 | 0 | 94 |
| 53 | Attic | Storage | Ceiling Mounted | S | Inc | 5 | 1 | 60 | Sw | 2 | 260 | 0 | 300 | 156 | CFL | Ceiling Mounted | CFL | S | Sw | 5 | 1 | 20 | 2 | 260 | 0 | 100 | 52 | 104 | 0 | 104 |
| 54 | Attic | Storage | Ceiling Mounted | M | 4'T12 | 1 | 4 | 40 | Sw | 2 | 260 | 12 | 172 | 89 | T8 | Ceiling Mounted | 4'T8 | E | Sw | 1 | 4 | 32 | 2 | 260 | 5 | 133 | 69 | 20 | 0 | 20 |
| 55 | Ext | Exterior | Wall Mounted | S | MH | 4 | 1 | 200 | Sw | 12 | 260 | 56 | 1,024 | 3,195 | PSMH | Wall Mounted | PSMH | S | Sw | 4 | 1 | 125 | 12 | 260 | 25 | 600 | 1872 | 1323 | 0 | 1323 |
| 56 | Ext | Exterior | Wall Mounted | S | Inc | 6 | 1 | 60 | Sw | 12 | 260 | 0 | 360 | 1,123 | CFL | Wall Mounted | CFL | S | Sw | 6 | 1 | 20 | 12 | 260 | 0 | 120 | 374 | 749 | 0 | 749 |
| Totals: | | | | | | 207 | 150 | 2,382 | | | | 448 | 25,955 | 60,009 | | | | | | 207 | 150 | | | | 219 | 19,675 | 45,204 | 14,806 | 0 | 14,806 |
| Rows Highlighed Yellow Indicate an Energy Conservation Measure is recommended for that space | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Proposed Lighting Summary Table | | | |
|---|---|---|---|
| Total Gross Floor Area (SF) | 13,428 | | |
| Average Power Cost ($/kWh) | 0.1690 | | |
| **Exterior Lighting** | **Existing** | **Proposed** | **Savings** |
| Exterior Annual Consumption (kWh) | 4,318 | 2,246 | **2,072** |
| Exterior Power (watts) | 1,384 | 720 | **664** |
| **Total Interior Lighting** | **Existing** | **Proposed** | **Savings** |
| Annual Consumption (kWh) | 55,691 | 42,957 | **12,734** |
| Lighting Power (watts) | 24,571 | 18,955 | **5,616** |
| Lighting Power Density (watts/SF) | 1.83 | 1.41 | **0.42** |
| | | | |
| Estimated Cost of Fixture Replacement ($) | 19,405 | | |
| Estimated Cost of Controls Improvements ($) | 0 | | |
| **Total Consumption Cost Savings ($)** | **4,811** | | |

| 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: THIRD PARTY ENERGY SUPPLIERS

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

| Third Party Gas Suppliers for PSEG 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 |
| **Dominion Retail, Inc.**<br>395 Highway 170, Suite 125<br>Lakewood, NJ 08701 | (866) 275-4240<br>www.retail.dom.com |
| **Gateway Energy Services Corp.**<br>44 Whispering Pines Lane<br>Lakewood, NJ 08701 | (800) 805-8586<br>www.gesc.com |
| **UGI Energy Services, Inc.**<br>704 East Main Street, Suite 1<br>Moorestown, NJ 08057 | (856) 273-9995<br>www.ugienergyservices.com |
| **Great Eastern Energy**<br>116 Village Riva, Suite 200<br>Princeton, NJ 08540 | (888) 651-4121<br>www.greateastern.com |
| **Hess Corporation**<br>1 Hess Plaza<br>Woodbridge, NJ 07095 | (800) 437-7872<br>www.hess.com |
| **Hudson Energy Services, LLC**<br>545 Route 17 South<br>Ridgewood, NJ 07450 | (877) 483-7669<br>www.hudsonenergyservices.com |
| **Intelligent Energy**<br>2050 Center Avenue, Suite 500<br>Fort Lee, NJ 07024 | (800) 724-1880<br>www.intelligentenergy.org |
| **Keil & Sons**<br>1 Bergen Blvd.<br>Fairview, NJ 07002 | (877) 797-8786<br>www.systrumenergy.com |
| **Metro Energy Group, LLC**<br>14 Washington Place<br>Hackensack, NJ 07601 | (888) 536-3876<br>www.metroenergy.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 |

| Third Party Gas Suppliers for PSEG Service Territory | Telephone & Web Site |
|---|---|
| **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 |
| **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 |
| **Sprague Energy Corp.**<br>12 Ridge Road<br>Chatham Township, NJ 07928 | (800) 225-1560<br>www.spragueenergy.com |
| **Stuyvesant Energy LLC**<br>10 West Ivy Lane, Suite 4<br>Englewood, NJ 07631 | (800) 646-6457<br>www.stuyfuel.com |
| **Woodruff Energy**<br>73 Water Street<br>Bridgeton, NJ 08302 | (800) 557-1121<br>www.woodruffenergy.com |

| Third Party Electric Suppliers for PSEG Service Territory | Telephone & Web Site |
|---|---|
| **Hess Corporation**<br>1 Hess Plaza<br>Woodbridge, NJ 07095 | (800) 437-7872<br>www.hess.com |
| **American Powernet Management, LP**<br>437 North Grove St.<br>Berlin, NJ 08009 | (877) 977-2636<br>www.americanpowernet.com |
| **BOC Energy Services, Inc.**<br>575 Mountain Avenue<br>Murray Hill, NJ 07974 | (800) 247-2644<br>www.boc.com |
| **Commerce Energy, Inc.**<br>4400 Route 9 South, Suite 100<br>Freehold, NJ 07728 | (800) 556-8457<br>www.commerceenergy.com |
| **ConEdison Solutions**<br>535 State Highway 38<br>Cherry Hill, NJ 08002 | (888) 665-0955<br>www.conedsolutions.com |
| **Constellation NewEnergy, Inc.**<br>900A Lake Street, Suite 2<br>Ramsey, NJ 07446 | (888) 635-0827<br>www.newenergy.com |
| **Credit Suisse, (USA) Inc.**<br>700 College Road East<br>Princeton, NJ 08450 | (212) 538-3124<br>www.creditsuisse.com |

| Third Party Electric Suppliers for PSEG Service Territory | Telephone & Web Site |
|---|---|
| **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 |
| **Metro Energy Group, LLC**<br>14 Washington Place<br>Hackensack, NJ 07601 | (888) 536-3876<br>www.metroenergy.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 |
| **Sprague Energy Corp.**<br>12 Ridge Road<br>Chatham Township, NJ 07928 | (800) 225-1560<br>www.spragueenergy.com |
| **Strategic Energy, LLC**<br>55 Madison Avenue, Suite 400<br>Morristown, NJ 07960 | (888) 925-9115<br>www.sel.com |
| **Suez Energy Resources NA, Inc.**<br>333 Thornall Street, 6th Floor<br>Edison, NJ 08837 | (888) 644-1014<br>www.suezenergyresources.com |
| **UGI Energy Services, Inc.**<br>704 East Main Street, Suite 1<br>Moorestown, NJ 08057 | (856) 273-9995<br>www.ugienergyservices.com |

## APPENDIX D: 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 measure (such as LED lighting versus fluorescent) the operating savings will factor in the cost of replacing the units to match the lifetime of the ECM. In this case or in one where one-time repairs are made, the total replacement / repair sum is averaged over the lifetime of the ECM.

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

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

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

**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.

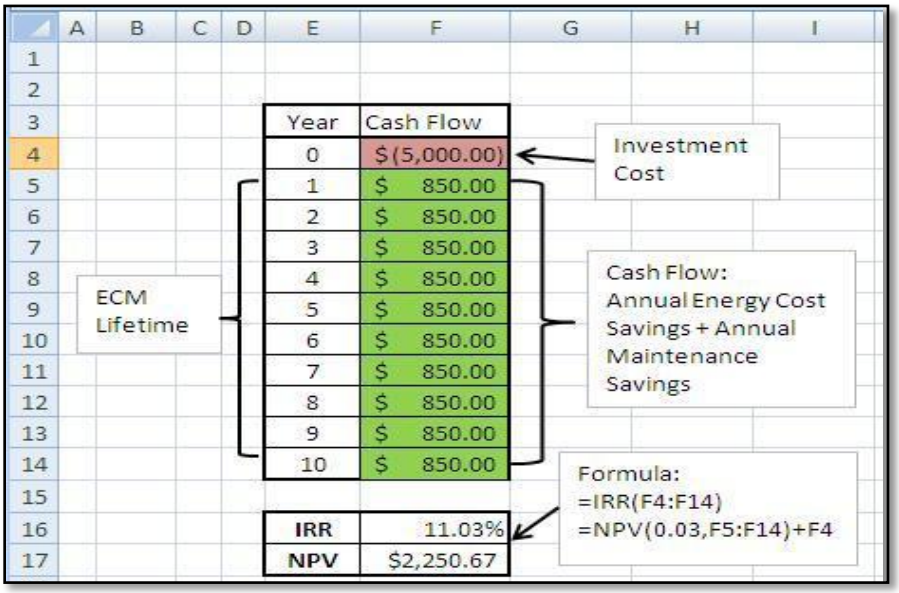
## Calculation References

| 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 |
| Incentive 1: | NJ Renewable Energy Incentive Program (REIP), for systems of size 50kW or less, $1/Watt incentive subtracted from installation cost |
| Incentive 2: | 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 & Industrial Lifetimes

| 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 E: STATEMENT OF ENERGY PERFORMANCE FROM ENERGY STAR®

OMB No. 2060-0347

# STATEMENT OF ENERGY PERFORMANCE
# City of Orange Township - 593 Lincoln Ave.

**Building ID:** 2337624
**For 12-month Period Ending:** February 28, 2010[1]
**Date SEP becomes ineligible:** N/A
**Date SEP Generated:** June 07, 2010

**Facility**
City of Orange Township - 593 Lincoln Ave.
593 Lincoln Ave
Orange, NJ 07050

**Facility Owner**
N/A

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

**Year Built:** 1890
**Gross Floor Area (ft²):** 13,428

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

**Site Energy Use Summary**[3]

| | |
|---|---|
| Electricity - Grid Purchase(kBtu) | 467,184 |
| Natural Gas (kBtu)[4] | 1,310,069 |
| Total Energy (kBtu) | 1,777,253 |

**Energy Intensity**[5]

| | |
|---|---|
| Site (kBtu/ft²/yr) | 132 |
| Source (kBtu/ft²/yr) | 218 |

**Emissions** (based on site energy use)

| | |
|---|---|
| Greenhouse Gas Emissions ($MtCO_2e$/year) | 141 |

**Electric Distribution Utility**
Public Service Elec & Gas Co

**National Average Comparison**

| | |
|---|---|
| National Average Site EUI | 104 |
| National Average Source EUI | 213 |
| % Difference from National Average Source EUI | 3% |
| Building Type | Other |

Stamp of Certifying Professional

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

**Certifying Professional**
N/A

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

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

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



EPA Form 5900-16

## APPENDIX F: 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. Theincentives for electricity and natural gas savings will be paid based on actual savings, provided that the minimum 15%performance threshold savings has been achieved.

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

### Direct Install 2010 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 200 kW** within 12 months of applying
- Must be located in New Jersey
- Must be served by one of the state's public, regulated or natural gas companies
    - Electric: Atlantic City Electric, Jersey Central Power & Light, Orange Rockland Electric, PSE&G
    - Natural Gas: Elizabethtown Gas, New Jersey Natural Gas, PSE&G, South Jersey Gas

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

### 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.

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 G: ENERGY CONSERVATION MEASURES

| | ECM # | ECM description | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0-5 Year Payback | 1 | 32 New CFL fixtures to be installed with incentives | 0 | 1,056 | 3,546 | 1 | 0 | 1 | 1,051 | 1,651 | 5 | 8,255 | 0.6 | 682 | 136 | 155 | 6,262 | 6,349 |
| 0-5 Year Payback | 2 | 4 New pulse start metal halide fixtures to be installed with incentives | 100 | 1,805 | 1,323 | 0 | 0 | 0 | 220 | 444 | 15 | 6,660 | 4.1 | 269 | 18 | 24 | 3,314 | 2,369 |
| 5-10 | 3 | 134 New T8 fixtures to be installed with incentives | 2,010 | 16,544 | 9,937 | 2 | 0 | 3 | 1,038 | 2,717 | 15 | 40,755 | 6.1 | 146 | 10 | 14 | 14,949 | 17,792 |

## APPENDIX H: 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.***